US Army Corps
of Engineers
Nashville District

Superfund Five Year Review Report
Benfield Industries Site, Waynesville, NC
EPA ID: NC981026479

Prepared for

USEPA Region 4

2003

FINAL SUPERFUND FIVE YEAR REVIEW REPORT
BENFIELD INDUSTRIES SITE
EPA ID: NC981025479

WAYNESVILLE, NORTH CAROLINA

Prepared for the
US Environmental Protection Agency
Region 4

Prepared By the
US Army Corps of Engineers
Nashville District

August 2003

USEPA Five-Year Review Signature Cover
Preliminary Information

Site name: **Benfield Industries Superfund Site**			EPA ID: **NC981026479**
Region: **4**	State: **North Carolina**	City County: **Waynesville, Haywood County**	
LTRA: **Yes**		Construction completion date: **April 2001**	
Fund PRP Lead: **USEPA**			NPL status: **Currently on final NPL**
Lead Agency: **USEPA, Region 4**			
Who conducted the review (EPA Region, state, Federal agencies or contractor): **US Army Cops of Engineers, Nashville District**			
Dates review conducted: **From: 1/1/03 To: 6/30/03**			Date(s) of site visit: **3/23/03**
Whether first or successive review: **First Review**			
Circle: **Statutory Policy**		Due date: **September 30, 2003**	
Trigger for this review (name and date): **Five Years from beginning of construction**			
Recycling, reuse, redevelopment site: **Yes**			

Deficiencies:
Deficiencies identified during this review include shortcomings in data quality control and reporting, unsecured extraction and monitoring wells, insufficient data to fully evaluate degradation of organics In the buried, treated soils, and improper placement of extraction well screens.

Recommendations:
Recommendations are identified in the review report. Some recommendations are relatively simple – such as securing all monitoring and extraction wells with a lock. Others, such as installing new wells screened closer to the plume are more intensive.

Protectiveness Statement(s):
Since all source material containing leachable contaminants has been removed from the site, it is expected that a re-designed groundwater extraction system will be capable of meeting the remedial action objectives.

The remedy is expected to be protective of human health and the environment upon attainment of the groundwater cleanup goals. In the Interim, exposure pathways that could result in unacceptable risks are being controlled, and institutional controls are preventing exposure to contaminated soils and groundwater. All threats at the Site have been addressed through removal and treatment of contaminated soils, burying and covering of soils not meeting the remediation levels, the installation of fencing, and the implementation of institutional controls.

Other Comments:
The deficiencies noted during this review are not immediate threats to the protectiveness of the remedy. Once these items are investigated and corrected, long-term protectiveness, operation, and site safety will be improved.

Signature of USEPA Division Director and Date

James S. Kutzman for

Winston A. Smith, Director, Waste Management Division

8/19/03

Date

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List of Acronyms

ARARs	Applicable or Relevant and Appropriate Requirements
AWQC	Ambient Water Quality Criteria
Ba	Barium
BaP	Benzo(a)pyrene
B & V	B & V Waste Science and Technology Group
CERCLA	Comprehensive Environmental Response Compensation and Liability Act
CFR	Code of Federal Regulations
COCs	Chemicals of Concern
COPCs	Contaminants of Potential Concern
Cr	Chromium
CWA	Clean Water Act
ESD	Explanation of Significant Difference
FEMA	Federal Emergency Management Agency
FS	Feasibility Study
gpm	gallons per minute
GTSC	Groundwater Technical Support Center
HI	Hazard Indices
HRS	Hazard Ranking Score
HVO	Haywood Vocational Opportunities, Inc.
lbs	pounds
IRIS	Integrated Risk Information System
LTM	Long Term Monitoring
LTRA	Long Term Remedial Action
LTU	Land Treatment Unit
MCL	Maximum Contaminant Level
MES	Mountain Environmental Services
mg/l	milligrams per liter
Mn	Manganese
MW	Monitoring Well
NC	North Carolina
NCDENR	North Carolina Department of Environment and Natural Resources
NCP	National Oil and Hazardous Substance Pollution Contingency Plan
ND	Non-detect
NOAA	National Oceanic and Atmospheric Administration
NPL	National Priority List
O & M	Operations and Maintenance
QC	Quality Control
PAH	Polynuclear Aromatic Hydrocarbons
PCP	Pentachlorophenol
ppb	parts per billion
ppm	parts per million

List of Acronyms (cont.)

POTW	Publicly Owned Treatment Works
PPA	Potential Purchaser Agreement
PRPs	Potential Responsible Parties
RA	Remedial Action
RL	Remediation Level
RAO	Remedial Action Objectives
RCRA	Resource Conservation and Recovery Act
RD	Remedial Design
RD/RA	Remedial Design/Remedial Action
RfD	Reference Dose
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
RL	Reporting Limit
ROD	Record of Decision
RPM	Remedial Project Manager
RSD	Risk Specific Dose
SD	Sediment
SDWA	Safe Drinking Water Act
SF	carcinogen
SOW	Scope of Work
SVOC	Semi-volatile Organic Compound
SW	Surface Water
TCLP	Toxicity Characteristic Leachate Procedure
U	Undetected
µg/L	micrograms per liter
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound

1.0 Introduction and Purpose

The purpose of conducting a Five Year Review is to evaluate the implementation and performance of the remedy in order to determine if it is, or will be protective of human health and the environment. Protectiveness is generally defined in the National Contingency Plan (NCP) by the risk range and hazard index (HI).

The US Army Corps of Engineers prepared this Five Year Review report pursuant to CERCLA 121 and the NCP.

CERCLA 121 states:

> *If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgement of the President that action is appropriate at such site in accordance with section (104) or (106), the President shall take or require such action. The President shall report to the congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such review.*

The United States Environmental Protection Agency (USEPA) interpreted this requirement further in *NCP, 40 CFR 300.430(f)(4)(ii) as:*

> *If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action.*

This is the first Five Year Review for the Benfield Site. The triggering action for this statutory review is the initiation of the soil phase of the remedial action on December 1, 1997. The Five Year review is required due to the fact that hazardous substances, pollutants, or contaminants remain at the site above levels that allow for unlimited use and unrestricted exposure. This Five Year Review was performed in a manner consistent with the latest USEPA guidance *(USEPA, 2002a)*.

2.0 Site Chronology

Table 1 gives the Site chronology. The site was owned and operated by Unagusta Furniture Company from 1904 to 1961. Unagusta manufactured wooden bed frames. Waynewood, Inc., a mattress manufacturer, also occupied the site for a portion of this time. Waynewood, Inc., went out of business sometime in the 1950s.

Guardian Investment Company operated from the site from April 1961 until February 1975, although there is little information regarding the company's activities.

Benfield Industries, Inc., (a bulk chemical mixing and repackaging facility) operated the site from 1976 until 1982 when a fire destroyed the plant. Physical features of the site included two storage buildings, a brick work building with a concrete storage area, and aboveground storage tanks ranging in capacity from 1,000 to 10,000 gallons. Some of the products handled and stored at the Benfield facility included paint thinners, solvents, sealants, cleaners, de-icing solutions, and wood preservatives. Solid products were packaged in 8 to 100 pound containers where liquid products were packaged in one-pint to five-gallon containers.

The North Carolina Department of Human Resources ordered Benfield Industries to remove all chemicals and debris from the site by September 1, 1982. After this was completed, the majority of the site was covered with anywhere from 6 to 18 inches of clean fill material.

The Benfield site was proposed for the National Priority List (NPL) in June 1988 and was finalized in October 1989 with a Hazardous Ranking System (HRS) score of 31.67. Mr. Thomas Benfield and Benfield Industries Inc. were identified as potential responsible parties (PRPs). At this time, Benfield Industries was no longer an active company and Mr. Benfield was not financially capable of financing a Remedial Investigation Feasibility Study (RI/FS). Consequently, the Superfund was used to finance the cleanup.

The County of Haywood sold the properly at auction to Haywood Vocational Opportunities, Inc. in December 2001 to collect back taxes for the property. The new owner has signed a prospective purchaser agreement (PPA) with the USEPA, and future development is expected onsite *(USEPA, 2002c).*

Table 1: Chronology of Site Events	
EVENT	**DATE**
Unagusta Furniture Co. and Waynewoad, Inc. operated at the site manufacturing wooden bed frames and sewed mattresses for the bed frames	1904 to 1961
Guardian Investment Company owns property	April 1961 – 1975
Through bankruptcy proceedings Clyde Savings and Loan Association became owner of the property	August 1975
Thomas G. Benfield purchased property	August 1975
Benfield Industries, Inc. began operations	1976
In response to complaints from citizens, site investigated by North Carolina Department of Natural Resources and Community Development	January 1981
Facility destroyed by fire	April 1982
North Carolina Water Resource Research Institute investigated surface water quality	April 1982
State orders Benfield to remove all chemicals and debris from site and cover with clean fill material	May – September 1982
Site investigated by North Carolina Department of Natural Resources, Solid and Hazardous Waste Management Branch	September 1985
Site proposed for National Priorities List	June 24, 1988
Site finalized for NPL	October 4, 1989
PRP Search document	October 24, 1989
EPA issued RI/FS notice letter to PRPs	March 1990
First fact sheet announced public meeting and provided public with site background information	February 1990
Public meeting held as a result of financial lending institutions encouraging buyers/seller to have Environmental Assessment on prospective properties	February 28, 1990
Issued RI/FS Scope of Work (SOW) to ARCS contractor	February 28, 1990
Follow-up site investigation by North Carolina Department of Environment, Health and Natural Resources	March 1990
Telephone conversation with PRPs lawyer to confirms PRP not financially capable of funding RI/FS	April 4, 1990

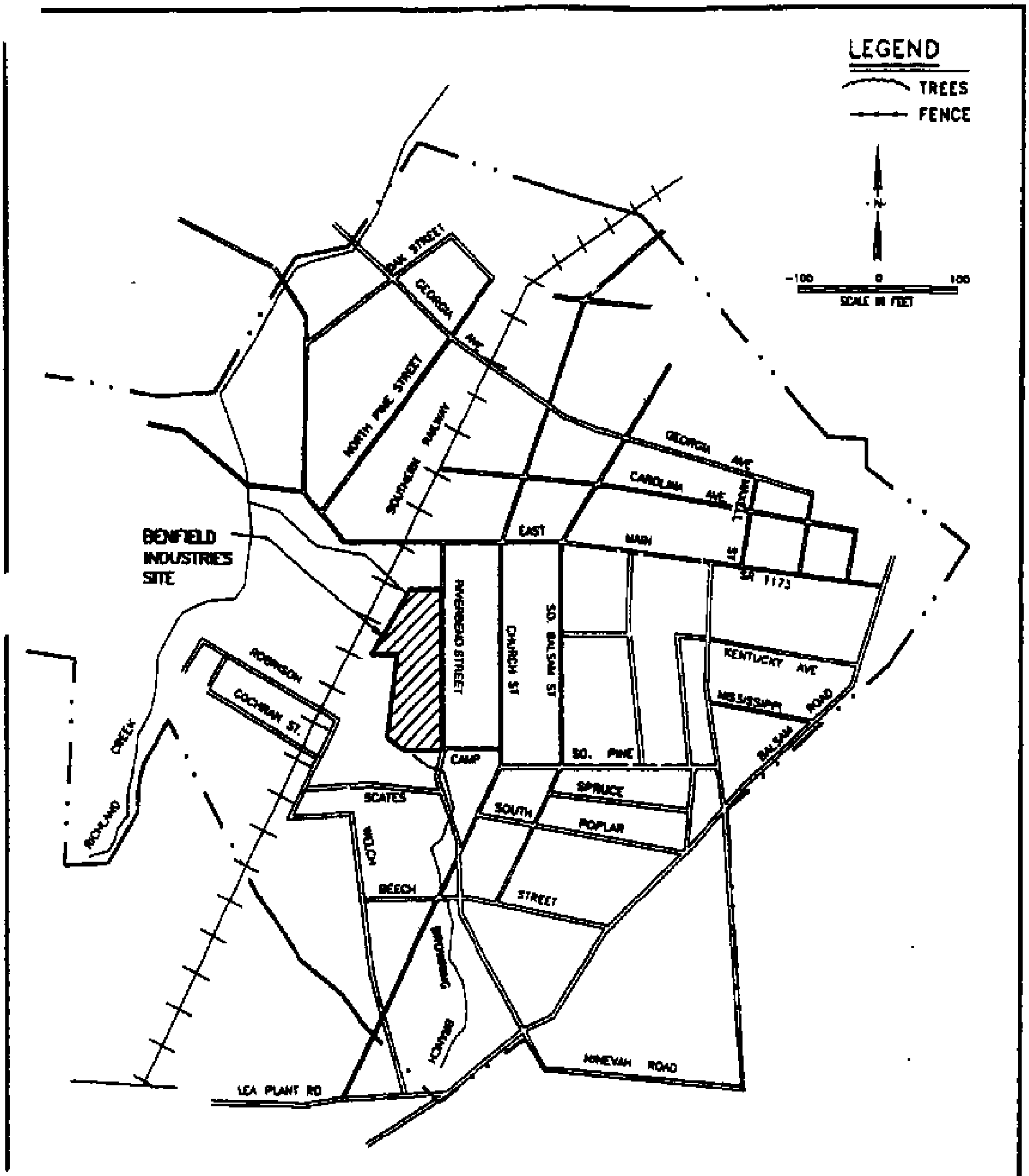
Table 1: Chronology of Site Events (continued)	
EVENT	**DATE**
Draft RI/FS Work Plan	September 21, 1990
Final Rl/FS Work Plan	November 14, 1990
Second fact sheet provided to public	December 1990
Kick-Off Meeting	January 7,1991
Draft RI Report	November 22,1991
Third fact sheet summarizing finding and conclusions of RI provided to public	January 1992
Draft FS document	March 20,1992
Final FS Report	April 3, 1992
Final Feasibility Study	July 16, 1992
Record of Decision issued (ROD)	July 31,1992
Conducted Treatability Study	October 1993 – February 1995
Final Treatabllity Study Report issued	July 10,1994
Preliminary Design Report	November 1994
90% Remedial Design (RD) Packages	March 3, 1995
Final RD	March 10, 1995
ROD Amended Issued	June 15, 1995
Remedial Action Soil Phase Initiation	December 1,1997
Remedial Action Soil Phase Completion	October 2000
Initiate construction of ground water extraction system	February 2001
Complete construction of groundwater extraction system	April 2001
Pre-final inspection	June 20, 2001
Preliminary Close-Out Report	September 19, 2001
Explanation of Significant Difference (ESD) Issued	November 6, 2001
Haywood Vocational Opportunities, Inc. purchased property	December 2001

3.0 Site Location and History

3.1 Site Description

The Benfield Site is located in Hazelwood (now part of Waynesville), Haywood County, North Carolina, and occupies approximately 3.5 acres of the six-acre parcel at 112 through 124 Riverbend Street *(USEPA, 1995)*. **Figure 1** shows the Site location.

The terrain of the Site slopes gently toward the north-northwest, with an average gradient of 0.013 lateral foot/vertical feet, with the exception of the area surrounding the Browning Branch with drops abruptly by approximately five (5) feet at the Branch *(USEPA, 1995)*.



SITE VICINITY MAP

FIGURE NO. 1

The Site is currently vacant. The Site is moderately vegetated, with more dense vegetation along the banks of Browning Branch *(USEPA, 1995)*. The Site is surrounded by a 6 ft chain-link fence. The property was sold in December 2001, and future site development is expected *(USEPA, 2002c)*. **Figure 2** shows the Site features.

3.2 Land and Water Use

The Site is surrounded by light industrial, commercial, and residential areas, and is In the Browning Branch 100-yr floodplain *(USEPA, 1995)*. The Site is bordered to the north by a house and an antique shop, by Riverbend Street to the east, a residence to the south, and the Southern Railway and Browning Branch to the west. Riverbend Street is a divide between residential use to the east, and industrial/commercial use to the west *(USEPA, 1995)*. At the time of the Risk Assessment Report (1992), the house onsite and the houses on the east side of Richland Street were occupied *(B&V, 1992)*.

Materials on site include 6 to 18 inches of clayey-silt fill and native silty soil. The groundwater table ranges from 3.5 to 6 ft below surface *(USEPA, 1995)*. The upper zone is referred to as the alluvium (water table interface), followed by the saprolite (top of bedrock, 34 to 52 ft below surface), and then fractured metamorphic bedrock. These units are typically hydraulically connected. Groundwater from both the alluvium and the saprolite zones flow to the north. Groundwater flow parallels the direction of stream flow in Browning Branch and follows surface topography. Horizontal velocity estimates for the alluvium and saprolite are 558 ft/yr and 43 ft/yr, respectively *(USEPA, 1995)*.

The State of North Carolina (NC) has classified groundwater (15A NCAC 2L) as “GA”, indicating it is a potable source of water *(B&V, 1992)*. Potable water for the Town of Hazelwood at the time of the Risk Assessment report was supplied by a well located 1.5 mi west of the Benfield Site. Waynesville’s water supply was the Allen Creek Reservoir located 4 mi south of the Hazelwood water supply. Some private wells were also present in the area. However, there were no private potable wells in use in the vicinity of the site or downgradient *(USEPA, 1992a)*. In addition, all of the known potable wells were screened in bedrock (bedrock was not sampled during the Rl) *(B&V, 1992).*

The Site is in the Browning Branch 100-yr floodplain. Browning Branch flows north-northwest into Richland Creek about 1,600 ft downstream of the Site. Richland Creek flows into Lake Junaluska, about 4 mi to the northeast. Richland Creek continues from Lake Junaluska until its confluence with the Pigeon River, approximately 2.5 mi downstream of Lake Junaluska *(USEPA, 1992a)*. Browning Branch and Richland Creek

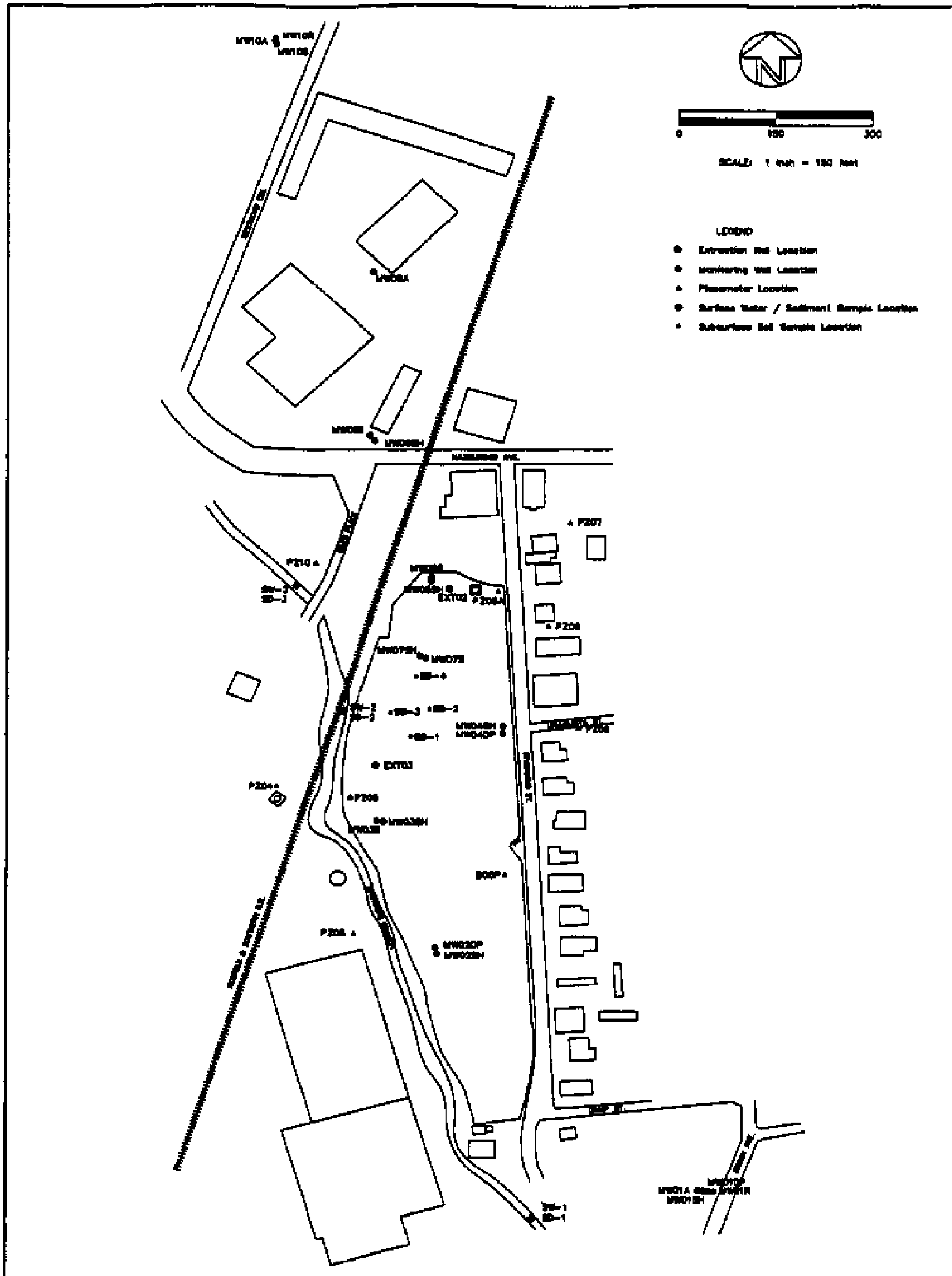


Figure 2
Site Map
Benfield Industries Site - Waynesville, NC

are classified by the state of NC as “Class C” surface waters (NCAC T15A:02B), suitable for “secondary recreation” and “propagation of natural trout and maintenance of trout” *(USEPA, 1995)*. However, neither sport or commercial fish species were observed during the RI *(USEPA, 1995)*, and fishing was not noted to occur at the time of the Risk Assessment Report *(B&V, 1992)*. At the time of the ROD Amendment, Browning Branch was not thought to be impacted by the Benfield Site *(USEPA, 1995)*.

3.3 Site Investigations

The Remedial Investigation (RI) was finalized on April 3, 1992. During the RI a total of 47 soil samples were collected including those from borings that were subsequently converted to groundwater monitoring wells. These samples included five (5) surface soil samples, 22 subsurface samples collected from immediately below the surface soil, and 20 soil samples collected from the water table interface. In addition, two soil samples were collected from the test pits.

During the RI groundwater samples were collected from the five (5) shallow monitoring wells (designated “S”) and six (6) deep monitoring wells (designated “D”). The shallow wells were screened at the water table interface, and the deep wells were screened at the base of the saprolite (top of bedrock). No wells were located within the bedrock zone.

Six (6) sediment and five (5) surface water samples were collected during the RI. These samples were located upgradient of, adjacent to, and downgradiant from the Site/offsite.

The following sections discuss the significant results of the sampling effort.

3.3.1 Soil Results

The RI listed the following chemicals of concern (COCs) for soil: benzo(a)anthracene, benzo(a)pyrene, benzo(b and k)fluroanthene, chrysene, indeno(1,2,3-cd)pyrene, naphthalene, and pentachlorophenol. The greatest concentrations of contaminants in soil were found, during the RI, in the top 5 ft of soil at three areas at the Site. The west central portion of the Site, in the vicinity of the former packaging building; north/north central portion of the Site in the vicinity of a former warehouse; and the south central portion of the Site where dumping of chemicals was reported to have occurred *(USEPA, 1995)*.

3.3.2 Groundwater Results

The COCs for groundwater were identified as benzene, chlorobenzene, 1,2-dichloropropane, vinyl chloride, total xylenes, carbazole, benzo(a)anthracene, benzo(a)pyrene, benzo (b and k) fluroanthene, chrysene, indeno (1,2,3-cd)pyrene, 1,4-dichlorobenzene, naphthalene, pentachlorophenol, antimony, barium, beryllium, chromium, lead, manganese, nickel, and vanadium. The plume of groundwater contamination contained Volatile Organic Compounds (VOCs), Semivolatile Organic Compounds (SVOCs), and metals, and was found to extend approximately 550 ft downgradient of the property boundary. At the time of the ROD Amendment, the bedrock groundwater zone was not thought to be impacted, nor was Browning Branch *(USEPA, 1995)*.

3.3.3 Surface Water & Sediment Results

Six (6) sediment and five (5) surface water samples were collected during the RI. These samples were located from upgradient of (SD1), adjacent to (SD2 and SD3), and downgradient from the Site/offsite (SD4 and SD5). SD4 was located offsite, to the northwest of the railroad tracks, and SD5 was located immediately adjacent to railroad tracks, due east of the corner of the former AC Lawrence Leather building. Contaminants, mainly PAHs, were found in the sediments collected at two sampling locations, One of these locations (SD1) was upgradient of the Site, thus the contamination is not attributable to the Site. The elevated contaminant levels found at the other location (SD5) was not thought to have been caused by Site activities because it was located on the opposite side of Browning Branch and near an active railroad line and railroad bridge, both of which were composed of creosote-treated wood.

3.3.4 Risk Assessment

The baseline risk assessment for the Site was prepared by B & V Waste Science and Technology Group (B & V) as part of the RI and presented in a separate report entitled, *Risk Assessment Report* (May 29, 1992). It was comprised of a human health assessment and a qualitative ecological risk assessment.

The risk assessment showed that site soils and sediment in the Browning Branch did not pose an unacceptable risk to human health under current or future scenarios. However, site soils would be expected to adversely affect the quality of site groundwater for the next 200 years. Groundwater was found not to pose an unacceptable risk under the current scenario, but unacceptable risks to potential future residents were predicted if groundwater was used as a drinking water source *(USEPA, 1995)*. Offsite (outside the property boundary) groundwater was also evaluated. The results of the risk assessment indicated that the only migration pathway of concern was the leaching of contaminants from soils to groundwater.

The results of the risk assessment are discussed in further detail below.

Human Health

The following *current* exposure populations and media were evaluated in the baseline risk assessment:

- Trespasser--exposure to onsite surface soil (0–2 ft), onsite surface water and sediment

- Adult offsite resident--exposure to offsite sediment and surface water

- Child offsite resident--exposure to offsite sediment and surface water

The following potential *future* exposure populations were evaluated in the baseline risk assessment:

- Adult offsite resident--exposure to offsite sediment and surface water; offsite shallow (alluvial) and deep (saprolite) groundwater

- Child offsite resident--exposure to offsite sediment and surface water; offsite shallow (alluvial) and deep (saprolite) groundwater

- Adult onsite resident--exposure to onsite surface, shallow (2–3.5 ft), and deep (3.5--5 ft) subsurface soil, onsite sediment and surface water; onsite shallow (alluvial) and deep (saprolite) groundwater

- Child onsite resident--exposure to onsite surface, shallow, and deep subsurface soil, onsite sediment and surface water; onsite shallow (alluvial) and deep (saprolite) groundwater

- Onsite construction worker--exposure to onsite surface shallow and deep subsurface soil, onsite sediment and surface water; onsite shallow (alluvial) groundwater

The air pathway was not considered to be of concern, and thus was not quantitatively evaluated as an exposure pathway for surface soils *(USEPA, 1995).*

Background concentrations were considered for all media in the determination of contaminants of potential concern (COPCs) to carry through in the risk assessment.

“Deep” groundwater, is the saprolite zone, not bedrock. As noted previously, there were no private potable wells in use in the vicinity of the site or downgradient *(USEPA, 1992a).* In addition, all of the known potable wells in the area were screened in bedrock, and since bedrock was not sampled during the RI, there is no evaluation performed in the potable water zone *(B&V, 1992).*

Onsite sediment exposure was represented by SD2 and SD3, collected adjacent to the Site. Sediment exposure to offsite sediments was represented separately by SD4 and SD5 because SD5 was not thought to be representative.

Table 2 is a summary of the risk assessment results. **Table 2** shows all of the pathways evaluated, as well as the total noncarcinogenic hazard indices and carcinogenic risk estimates, and the chemical drivers for those pathways outside of USEPA's acceptable risk criteria. As shown in **Table 2**, none of the *current* exposure scenarios exceeded the acceptable noncarcinogenic hazard index (1.0), and none exceeded the acceptable carcinogenic risk range (10^{-4} to 10^{-6}), For the *future* exposure scenarios, however, many exceeded USEPA's risk criteria, primarily due to the potential ingestion of, and dermal contact with, groundwater. Shallow groundwater risk estimates were worse than deep groundwater, and onsite groundwater estimates were worse than offsite groundwater, at the time of the risk assessment.

The highest estimated hazard index (100) was for the future onsite residential child, and the chemical drivers were: naphthalene, vanadium, antimony, chromium, barium, manganese, and phenanthrene, primarily in shallow groundwater.

The highest estimated cancer risk (3.1E-03) was also for the future onsite residential child, and the chemical drivers were: benzo(a)pyrene, benzo(a)anthracene, pentachlorophenol, benzo(b and k)fluaranthene, beryllium, vinyl chloride, and dibenzo(a,h)anthracene,

<u>Ecological Risk</u>

A qualitative ecological risk assessment was conducted as part of the Baseline Risk Assessment. No comparisons to ecological benchmarks were made to site media concentrations. The ecological risk assessment concluded that surface and subsurface soils would potentially pose the greatest risk to flora and fauna *(B &V, 1992)*. The ROD indicated that surface water and sediment did not appear impacted, but would continue to be monitored in the future *(USEPA, 1992a)*. Groundwater was not expected to pose any environmental risk since it was not thought to discharge to Browning Branch *(B &V, 1992).*

Endangered species were identified in Haywood County, but a survey was not conducted to specifically evaluate the area of the Site. It was concluded, however, that habitats were limited due to commercial and residential development.

The information generated during the Remedial Design (RD) or presented in the ROD Amendment did not alter conclusions about potential risks posed by the Site *(USEPA, 1995).*

3.4 Remediation Levels

Section 9.1 of the ROD described all applicable or relevant and appropriate requirements (ARARs) for the Benfield Site. Section 11.1 of the ROD described the remediation levels and remediation goals for the Site *(USEPA, 1992a)*. Section 5.1.2 of the ROD Amendment also discussed compliance with ARARs. Most of the remediation standards were not risk-based, but rather, were based on ARARs.

Table 3 presents the Soil Remediation Levels for the Benfield Site, as specified in the ROD *(USEPA, 1995).* There are remediation levels for 7 contaminants, all polynuclear aromatic compounds (PAHs). Only benzo(a)pyrene (BaP) had a soil risk-based clean-up goal (based on a 1 E-06 cancer risk); the other contaminants are based on protecting groundwater as a potential source of drinking water. These groundwater protection based levels were derived using “Multimedia Leaching” groundwater model *(USEPA, 1995).*

Table 4 presents the Groundwater Remediation Levels for the Site, as specified in the ROD *(USEPA, 1995)*. Since groundwater was a potential drinking water source, groundwater levels were set at the Safe Drinking Water Act (SDWA) Maximum Contaminant Levels (MCLs). Where an MCL did not exist, risk-based remediation goals were calculated *(USEPA, 1995)*. Only three groundwater contaminants had risk-based levels: carbazole, naphthalene, and vanadium.

Because the RI determined that the Site was not adversely affecting Browning Branch, no surface water remediation levels were developed, and surface waters were not considered in violation of federal ambient water quality criteria or NC water quality standards *(USEPA, 1995)*. However, screening criteria for surface water (based on NC freshwater AWQC) were given in the ROD to which additional monitoring data would be compared. If screening values were exceeded, additional investigation of Browning Branch would be warranted. **Table 5** gives the screening criteria for surface water.

Table 2: SUMMARY OF ESTIMATED RISKS TO HUMAN HEALTH, BENFIELD SITE, HAZELWOOD, NORTH CAROLINA [(a)]

Receptor	Medium [(b)]	Exposure Route	Estimated Hazard Index	Noncarcinogenic Risk Drivers	Estimated Carcinogenic Risk	Carcinogenic Risk Drivers
Current Onsite Trespasser (adolescents)	Onsite Surface Soil	Dermal Contact, Incidental Ingestion		✓		
	Onsite Surface Soil	Dermal Contact				
	Onsite Sediment	Dermal Contact				
		TOTAL:	**0.02**		**8.1 E-07**	
Current Offsite Resident (adults)	Offsite Sediment (SD4) (c)	Dermal Contact				
	Offsite Sediment (SD5) (c)	Dermal Contact, Incidental Ingestion		✓		
	Offsite Surface Water (SW4) (c)	Dermal Contact				
		TOTAL:	**0.01**		**3.9 E-06**	
Current Offsite Resident (children)	Offsite Sediment (SD4) (c)	Dermal Contact				
	Offsite Sediment (SD5) (c)	Dermal Contact Incidental Ingestion		✓		

Table 2: SUMMARY OF ESTIMATED RISKS TO HUMAN HEALTH, BENFIELD SITE, HAZELWOOD, NORTH CAROLINA [(a)] (Continued)

Receptor	Medium [(b)]	Exposure Route	Estimated Hazard Index	Noncarcinogenic Risk Drivers	Estimated Carcinogenic Risk	Carcinogenic Risk Drivers
	Offsite Surface Water (SW4) (c)	Dermal Contact				
		TOTAL:	**0.08**		**3.8 E-06**	
Future Offsite Resident (adults)	Offsite Shallow Groundwater (MW-6S) (c)	Dermal Contact, Ingestion		✓		
		TOTAL:	**2.0**	**Mn, Ba, Cr**	**NA**	**NA**
Future Offsite Resident (adults)	Offsite Shallow Groundwater (MW-6D) (c)	Dermal Contact, Ingestion, Inhalation		✓		
		TOTAL:	**0.5**		**8.2 E-07**	
Future Onsite Resident (adults)	Onsite Shallow Groundwater	Dermal Contact, Ingestion, Inhalation		✓		
	Onsite Sediment	Dermal Contact				
	Onsite Surface Water	Dermal Contact				
	Onsite Surface Soil	Dermal Contact, Incidental Ingestion				
	Onsite Shallow Subsurface Soil	Dermal Contact, Incidental Ingestion				

Table 2: SUMMARY OF ESTIMATED RISKS TO HUMAN HEALTH, BENFIELD SITE, HAZELWOOD, NORTH CAROLINA [(a)] (Continued)

Receptor	Medium [(b)]	Exposure Route	Estimated Hazard Index	Noncarcinogenic Risk Drivers	Estimated Carcinogenic Risk	Carcinogenic Risk Drivers
Future Onsite Resident (adults)		**TOTAL:**	**40**	**Naphthalene; Cr, V, Mn**	**4.1E-03**	**B(a)P, B(a)anthracene, pentachlorophenol, B(bk)fluoranthene Be, vinyl chloride, dibenzo(ah)anthracene**
Future Onsite Resident (adults)	Onsite Deep Groundwater	Dermal Contact, Ingestion, Inhalation		✓		✓
	Onsite Sediment	Dermal Contact				
	Onsite Surface Water	Dermal Contact				
	Onsite Surface Soil	Dermal Contact, Incidental Ingestion				
	Onsite Deep Subsurface Soil	Dermal Contact, Incidental Ingestion				
		TOTAL:	**3.0**	**Naphthalene, Cr**	**9.8E-04**	**Vinyl Chloride**
Future Offsite Resident (children)	Offsite Shallow Groundwater	Dermal Contact, Ingestion		✓		
		TOTAL:	**6.0**	**Ba, Mn, Cr**	**NA**	**NA**

Table 2: SUMMARY OF ESTIMATED RISKS TO HUMAN HEALTH, BENFIELD SITE, HAZELWOOD, NORTH CAROLINA [(a)] (Continued)

Receptor	Medium [(b)]	Exposure Route	Estimated Hazard Index	Noncarcinogenic Risk Drivers	Estimated Carcinogenic Risk	Carcinogenic Risk Drivers
Future Offsite Resident (children)	Offsite Deep Groundwater	Dermal Contact, Ingestion, Inhalation		✓		
		TOTAL:	**1.0**	**Ba, Mn, Cr**	**8.5E-07**	
Future Onsite Resident (children)	Onsite Shallow Groundwater	Dermal Contact, Ingestion Inhalation		✓		✓
	Onsite Sediment	Dermal Contact				
	Onsite Surface Water	Dermal Contact				
	Onsite Surface Soil	Dermal Contact, Incidental Ingestion				
	Onsite Shallow Subsurface Soil	Incidental Ingestion				
		TOTAL:	**100**	**Naphthalene, V, Sb, Cr, Ba, Mn, phenanthrene**	**3.1 E-03**	**B(a)P, B(a)anthracene, pentachlorophenol, B(bk)fluoranthene Be, vinyl chloride, dibenzo(ah)anthracene**
Future Onsite Resident (children)	Onsite Deep Groundwater	Dermal Contact, Ingestion, Inhalation		✓		✓
	Onsite Sediment	Dermal Contact				

Table 2: SUMMARY OF ESTIMATED RISKS TO HUMAN HEALTH, BENFIELD SITE, HAZELWOOD, NORTH CAROLINA [(a)] (Continued)

Receptor	Medium [(b)]	Exposure Route	Estimated Hazard Index	Noncarcinogenic Risk Drivers	Estimated Carcinogenic Risk	Carcinogenic Risk Drivers
	Onsite Surface Water	Dermal Contact				
	Onsite Surface Soil	Dermal Contact, Incidental Ingestion				
	Onsite Shallow Subsurface Soil	Dermal Contact, Incidental Ingestion				
	Onsite Deep Subsurface Soil	Incidental Ingestion				
		TOTAL:	**10**	**Naphthalene, Cr, chlorobenzene, Mn, xylenes, 1,2,4-trichlorobenzene, phenenenthene**	**7.5 E-04**	**Vinyl chloride**
Future Onsite Construction Workers (adults)	Onsite Shallow Groundwater	Dermal Contact		✓		
	Onsite Sediment	Dermal Contact				
	Onsite Surface Water	Dermal Contact				
	Onsite Surface Soil	Dermal Contact, Incidental Ingestion				
	Onsite Shallow Subsurface Soil	Dermal Contact, Incidental Ingestion				

Table 2: SUMMARY OF ESTIMATED RISKS TO HUMAN HEALTH, BENFIELD SITE, HAZELWOOD, NORTH CAROLINA [(a)] (Continued)

Receptor	Medium [(b)]	Exposure Route	Estimated Hazard Index	Noncarcinogenic Risk Drivers	Estimated Carcinogenic Risk	Carcinogenic Risk Drivers
	Onsite Deep Subsurface Soil	Dermal Contact, Incidental Ingestion				
		Total:	**5.0**	**Naphthalene, V, Sb, Mn**	**1.3 E-05**	

Notes:
(a) Estimates as reported in the *Risk Assessment Report for the Benfield Industries Site. Hazelwood, NC. Volume I,* B & V Waste Science & Technology Group. May 29, 1992.
(b) Surface soil defined as (0-2'), shallow subsurface (2-3.5') and deep subsurface (3.5-5')
(c) These media were represented by one sample in the risk assessment. Offsite sediments were represented separately by SD4 and SD5 because SD5 did not appear to be representative of Browning Branch.

Shaded , values exceed USEPA's carcinogenic risk level of 1E-04 or noncarcinogenic risk level of 1.0. Check marks are dominant exposure routes, and chemical drivers for the total risk estimates and given,

Table 3. Soil Remediation Levels [a]	
Contaminant	**Soil Remediation Level (mg/kg)**
Benzo(b or k) fluoranthene	1.6
Benzo(a)anthracene	0.8
Benzo (a)pyrene	0.3 [b]
Chrysene	1.6
Indeno(1,2,3-cd)pyrene	2.8
Naphthalene	10.0
Pentachlorophenol	1.0

[a] Source: USEPA (1992a), Paint of compliance Is all property soils except B(a)P, which is only far the top 12 inches.
[b] Only the level for BaP is risk-based (at 10^{-6} cancer risk); other soil remediation levels are based on modeling of predicted concentrations of groundwater from soil concentrations to result in concentrations above groundwater ARARs.

Table 4. Groundwater Remediation Levels [a]		
Contaminant	**Groundwater Remediation Level (ug/l)**	**Basis [b]**
Organics		
Benzene	5	*A*
Benzo(a)anthracene	0.1	*B*
Benzo(a)pyrene	0.2	*B*
Benzo(b or k)fuoranthene	0.2	*B*
Carbonzole	5	*D*
Chlorobenzene	100	*A*
Chrysene	0.2	*B*
1,4-Dichlorobenzene	1.8	*C*
1,2-Dichloropropane	0.56	*C*
Indeno(1,2,3-cd)pyrene	0.4	*B*
Naphtalene	100	*D*
Pentachlorophenol	1	*A*
Vinyl Chloride	0.0015	*C*
Total Xylenes	400	*C*
Inorganics		
Antimony	6	*A*
Barium	1000	*C*
Berillium	4	*A*
Chromium	50	*C*
Lead	15	*E*
Manganese	50	*C*
Nickel	100	*A*
Vanadium	200	*D*

[a] Source: USEPA (1992a). Point of compliance is the entire plume.
[b] Basis (at the time of the ROD): A= MCL, B= proposed MCL, Phase V rule, C= NC groundwater quality standard (NCAC 15-2L,002), D= risk-based (at 10^{-6} cancer risk), E= USEPA action level

Likewise for sediment, no sediment remediation levels were developed because Site sediments were not found to be of concern. However, screening criteria for sediments (based on the National Oceanic and Atmospheric Administration (NOAA) Effects Levels -Low and -Median) were given

Table 5. Surface Water Screening Criteria [(a)]

Contaminant	Screening Level (ug/L) [(b)]
Organics	
Benzene	71.4
PAHs	0.0311
Vinyl chloride	525
Inorganics	
Barium	1,000
Beryllium	6.5
Chromium (total)	50
Lead	25
Manganese	50
Nickel	88

[(a)] Source: USEPA (1992a).

[(b)] Basis was the NC freshwater AWOC (NCAC T15A:02B).

Table 6. Sediment Screening Criteria [(a)]

Contaminant	Screening Level (mg/kg) [(b)]
Organics	
Phenanathrene	0.225 / 1.38
Anthracane	0.085 / 0.96
Fluoranthene	0.6 / 3.6
Pyrene	0.35 / 2.2
Benzo(a)anthracene	0.23 / 1.6
Chrysene	0.4 / 2.8
Benzo(a)pyrene	0.4 / 2.5
Dibenzo(a,h,)anthracene	0.06 / 0.26
Inorganics	
Copper	70 / 390
Lead	35 / 110
Nickel	30 / 50
Zinc	120 / 270

[(a)] Source: USEPA (1992a).

[(b)] Basis were the NOAA Effects Range-Low / Range-Median values.

in the ROD to which additional monitoring data would be compared. If screening values were exceeded, additional investigation of Browning Branch would be warranted. **Table 6** gives the screening criteria for sediments.

The information generated during the Remedial Design (RD) or presented in the ROD Amendment did not alter any Site remediation levels *(USEPA, 1995)*.

4.0 Remedial Actions

4.1 Remedy Selection

The ROD for the Benfield Industries Site was signed on July 31, 1992. Remedial Action Objectives (RAOs) were developed as a result of data collected during the RI. The RAOs for Benfield Industries Site are *(USEPA, 1992b)*:

- Prevent ingestion of groundwater having carcinogen(s) concentrations in excess of Federal/State Applicable, Appropriate and Relevant Requirements (ARARs) and a total excess cancer risk greater than 10^{-6}.

- Prevent ingestion of groundwater having noncarcinogen(s) in excess of Federal/State ARARs and risk assessment criteria.

- Restoration of groundwater system by cleanup to the above stated health-based standards, and by preventing the migration of the pollutants beyond the existing limits of the known contaminant plume.

- Prevent discharge of groundwater contaminants to surface water bodies that would exceed state surface water quality ARARs.

- Prevent ingestion or direct contact with contaminated soil having greater than 10^{-6} excess cancer risk or exceeding public health assessment criteria for noncarcinogens.

- Prevent migration of contaminants in the soil that could result in groundwater contamination in excess of Federal/State ARARs on an excess cancer risk of greater than 10^{-6}.

The ROD *(USEPA, 1992a)* specified the following remedial actions (RA) for the entire Site:

- Soil washing and biotreatment of the resulting slurry;

- Extraction and on-site treatment and discharge of contaminated groundwater. Treatment was to consist of pretreatment through aeration, ion exchange to remove heavy metals, primary organic treatment using submerged fixed film bioreactors, and polishing through granulated activated carbon filters;

- Addition of nutrients to the treated groundwater prior to reintroducing the water back into the aquifer through infiltration galleries to promote in-situ biodegradation;

- Review of existing groundwater monitoring system to insure proper monitoring of groundwater; with the addition of monitoring wells to mitigate any deficiencies in the monitoring network; and

- Monitoring of groundwater and Browning Branch.

The primary goal of the remedy was to reduce the future risks posed by the contaminants in both soils and groundwater at the Site to within USEPA's acceptable risk ranges. The remedial activities required by the 1992 ROD were modified in the 1995 ROD Amendment. The 1992 ROD required a treatability study be performed using the specified technologies to confirm that those technologies would achieve the desired results. The treatability study was performed in three sequential phases. Phase 1 was initiated in October 1993, and Phase 3 was completed in 1995.

The results of the treatability study compelled USEPA to reconsider the soil remedy specified in the 1992 ROD. The treatability study demonstrated that the soil washing and the slurry bioreactor would not achieve the desired RAOs. At the same time, data from the solid phase bioremediation portion of the treatability study indicated that this technology should be able to achieve the cleanup objectives.

During the early part of the remedial design (RD), contact was re-established with the City of Waynesville with regard to obtaining a permit to discharge effluent from the Site to the City of Waynesville publicly owned treatment works (POTW). The possibility of discharging the entire effluent from the Site without pretreatment emerged from these discussions. Based upon the complexity of the groundwater treatment system envisioned in the 1992 ROD, USEPA opted to pursue the least cumbersome approach of discharging the entire effluent of extracted groundwater to the POTW instead of building, operating, and maintaining groundwater treatment and discharge systems onsite.

These changes to ROD were formalized in the 1995 ROD Amendment. The necessity to make this modification to the ROD arose from not obtaining the remediation level for benzo(a)pyrene in all of the treated soils during the soil phase of the RA. The amended remedy included these changes:

<u>Soil Remediation</u>

- Steam cleaning material/debris removed during mechanical screening of excavated soil (primarily cobbles and gravel larger than one to four inches).

- Analyses of steam-cleaned material to insure remediation levels have been achieved.

- Soils passing through the screen were to be transported to on-site, preconstructed land treatment beds for biological treatment.

- During the treatment period (approximately two months), nutrients and moisture would be added to the soils, as needed, and the soils would be tilled. After two months, verification samples from the treated soil would be collected and analyzed.

- Upon successful verification, the cleaned soils (approximately 12 to 18 inches of aerated soil) would be removed from the surface of the treatment bed, leaving the bottom 1 to 3 inches of the cleaned soil in place to insure none of the underlying contaminated soil is removed. These 1 to 3 inches of cleaned soil also would provide an established microbial population for the next layer of soil to be treated.

- During the next two months, nutrients and moisture would be monitored and adjusted, as needed, in the next 9 to 12 inch layer of soil. This layer also would be tilled to maintain a suitable quantity of air. After two months, soil samples verification soil sampling would be performed to ensure cleanup goals were achieved. Upon successful verification, this layer of clean soil would be removed, again leaving a 1 to 3 inch buffer zone.

- This sequence would continue until all the contaminated soil was treated. Upon completion, the clean, treated soil would be placed in the excavated areas, and the Site graded and reseeded.

- As part of the soil remediation effort, appropriate air monitoring of the air emissions from the excavation areas and the land farming beds would be performed. If necessary, emission controls would be instituted to control unacceptable air emissions.

- In the event that the concentration of benzo(a)pyrene remained greater than 300 ug/Kg of treated soil, the following actions would

> be taken. These soils would be segregated and buried together under at least one foot of clean soil to eliminate direct human contact. This area of the property would have a deed restriction placed on it to prevent digging into this particular area in the future. This deed restriction would remain until the concentration of benzo(a)pyrene decreased to the cleanup goal concentration. These soils would be sampled and analyzed, at a minimum, every five years in accordance with Section 121(c) of CERCLA.

An Explanation of Significant Differences (ESD) *(USEPA, 2001)* was issued on November 6, 2001. The ESD provided the Institutional Control for the Site via restrictive covenant language to be placed on the deed for this property with the Haywood County Register of Deeds (**see Appendix A**). This covenant was necessary to restrict future groundwater use, because some treated soils remaining onsite did not meet the treatment performance standard identified in the ROD.

The actual restrictive covenant language to be included on the property deed as the Institutional Control was provided in the ESD. Such language was developed by NCDENR. The ESD finalized the institutional Control language referred to in the 1995 ROD Amendment. The following language was taken out of Section 4.3, "Summary of Fundamental Changes" of the 1995 ROD Amendment *(USEPA, 1995)*.

> *In the event this condition {i.e., cleaned [meaning treated] soils with a concentration of benzo(a)pyrene greater than 300 micrograms per kilogram (µg/kg) or 300 parts per billion (ppb) [the soil clean-up goal for benzo(a)pyrene]} is encountered, the following actions will be taken. Because this soil cleanup goal is based on direct contact to humans, this soil will be covered with at least one foot of clean soil to prevent any direct human contact with this soil. These soils will be segregated and buried together and this particular portion of the property will have a restrictive covenant placed on it to prevent digging into this particular area in the future. This restrictive covenant will remain until the concentration of benzo(a)pyrene decreases to the clean-up goal concentration. This sequence of events will greatly reduce the likelihood of humans coming into direct contact with soils containing benzo(a)pyrene above the 300 micrograms/kilogram concentration. These soils will be sampled and analyzed, at a minimum, every five years in accordance with Section 121(c) of CERCLA, which requires long-term effectiveness and permanence reviews every five years when hazardous materials are left at a site.*

Prior to allowing for the placement of soils back into the excavations, USEPA evaluated whether or not the remaining levels of contaminants in the treated soil would adversely impact the underlying groundwater as precipitation percolates through the ground. USEPA conducted toxicity characteristic leachate procedure (TCLP) analyses on numerous samples of treated soils. All TCLP results showed that the remaining levels of contaminants in the treated soils would not adversely impact the quality of the underlying groundwater.

To eliminate the unacceptable risk from direct contact, all the treated soils with levels of benzo(a)pyrene above the 300 µg/kg were buried with a minimum of 1 foot of clean soil placed on top. As both USEPA and North Carolina Department of Environment and Natural Resources (NCDENR) wants this property to be reused in the future, the restrictive covenant language, specified in Section 9.0 of the ESD, was developed to protect human health from any unnecessary exposures. In essence, the only use of this property prohibited by the restrictive covenant language is the construction of a residential community, homes, condominiums, or apartments. This limitation dovetails with the County of Haywood's zoning for the property as this property lies within the 100-year flood zone of Browning Branch.

Groundwater Remediation

The amended remedy for addressing contaminated groundwater included:

- Installation of at least three extraction wells, one off-site and at the periphery of the contaminated groundwater plume and two on-site and within the boundaries of the plume. Installation of approximately 10 piezometers and at least one monitoring well cluster.

- Groundwater extracted via the off-site extraction well would be discharged directly into the POTW.

- Groundwater extracted via the two on-site extraction wells would be piped to an Effluent Discharge Tank prior to being discharged to the POTW.

- The discharges to the POTW would be governed by a POTW discharge permit issued by the City of Waynesville Department of Public Works & Utilities.

4.2 Remedy Implementation

The remedial action (RA), which was funded through Superfund, began in November 1997. The first phase consisted of flush mounting a number of monitoring wells/piezometers that would be covered by the on-site Land Treatment Unit (LTU); construction of the on-site LTU; excavation and sizing of contaminated soils; air monitoring during the excavation; land-farming the contaminated soils in the LTU; cleaning the removed cobble, backfilling the cleaned cobble and treated soils back into the excavations, dismantling the LTU following treatment of all soils, and grading, resurveying and reseeding the site. During construction of the LTU, soils in two areas of the Site were found to contain levels of pentachlorophenol (PCP) above the ROD cleanup goal. Since PCP does not readily degrade, approximately 5,230 yd^3 of PCP contaminated soil was excavated and disposed of off-site at the BF1 landfill in Buford, Georgia. Excavation for PCP contaminated soil was to a maximum depth of 2 feet below ground surface.

In addition to the construction of the LTU, two above ground 50,000-gallon temporary holding/settling ponds were constructed on the northern end of the Site. Water from both the LTU and excavation dewatering efforts were pumped to these two holding ponds. After allowing some time for settling, the contents of these ponds were periodically discharged to the City of Waynesville POTW under Permit No. 008.

Construction of the land treatment unit (LTU) in the southern portion of the Site began in the late Fall of 1997. Excavation of the soils began in the Spring of 1998. The RD anticipated excavating a total of 18,000 cubic yards or 21,600 tons of contaminated soil. During the summer of 1998, approximately 13,500 tons of material was treated. This material consisted of 13,200 tons of soil, 270 tons of hay, and 27 tons of manure. Active aeration of the soils began in May 1998 and was discontinued in October 1998. During March-April 1999, the treated soils were removed from the LTU and stockpiled. These stock piled soils were eventually placed in the excavation. After the LTU was emptied, the remaining contaminated soils (approximately 14,800 tons) were excavated, screened, transported to the LTU, mixed with the soil amendments, and aerated. The soil amendments included over 110 tons of hay and over 40 tons of manure. As done previously, the soils were arranged in windrows. Treatment of soils was terminated in September 2000 and the soils/cobble were backfilled into the excavations. During September/October 2000, the LTU was dismantled and the Site was graded and hydro-seeded

During soil excavation, air monitoring was performed to ensure that no unacceptable releases of airborne contaminants occurred. The results from this monitoring indicated that no unacceptable releases were occurring. Therefore no air pollution control actions were required.

During excavation efforts, two unknown underground storage tanks were encountered in the northwest corner of the Site. One tank had a 500-gallon capacity, while the other had a 1000-gallon capacity. The tanks had numerous pit holes and contained predominantly groundwater. Sampling indicated the presence of benzene, toluene, ethylbenzene, and xylene. In all likelihood these tanks had contained fuel products, although this is not indicated in the records. The tanks were removed, cut-up, and disposed of off-site.

The following activities were associated with the second phase of the remedy implementation: install two temporary wells in the general vicinity of the extraction well locations; run pump tests on these two temporary wells; size actual extraction wells and pumps based on these two pump tests; install two on-site extraction wells and well heads; install equalization tank and the necessary connections between the equalization tanks and the well heads; install control system; connect the equalization tank to the POTW; erect a shelter over equalization tank to protect it from heavy snows; reattach standup pipes to previously modified monitoring wells/piezometers; and install additional monitoring wells and piezometers.

Construction of the groundwater extraction system began in February 2001 and was completed in April 2001. The system involves 2 eight-inch diameter extraction wells (EXT02 and EXT03) installed through the alluvium and saprolite beneath the site to the top of competent bedrock. EXT02 is pictured in Photograph 1. EXT02 was installed to a total depth of 36 feet, and EXT03 was installed to a total depth of 31.5 feet. The design flow rate for EXT02 was 4 gallons per minute (gpm) and EXT03 was 12 gpm. The actual average flow rates for EXT02 is 3.9 gpm and for EXT03 is 5.7 gpm. After pumping from the well, extracted groundwater is sent to a 5,200-gallon polyethylene tank. This tank has secondary containment constructed of reinforced concrete and a 2 foot by 2 foot sump located in the northwest corner of the containment structure. The tank and containment structure are pictured in Photograph 2. The entire structure is covered with a wood and sheet metal roof. After extraction groundwater is discharged directly into the City of Waynesville sewer system, which transport the extracted water to the city's Wastewater Treatment Plant for treatment. As of November 2001, over 3 million gallons of groundwater has been extracted and discharged to the local POTW.

4.3 System Operations/Operations and Maintenance (O&M)

An Operation and Maintenance (O&M) Plan was developed and finalized for the groundwater extraction system on October 17, 2001 *(USEPA, 2001)*. This O&M Plan governed the following site activities. For the first year of O&M, running from April 29, 2001 through April 29, 2002, the following activities were to be done on a daily basis:

1. check and record extraction flow rates, pressures, and accumulative amount extracted from each extraction well;
2. check and record the effluent flow rate and accumulative gallons discharged from the effluent tank;

3. check and record accumulative hours of operation for the extraction well pumps and the effluent pump;
4. inspect the conveyance piping for leaks;
5. measure and record the water levels in the extraction wells;
6. check and record information displayed on the pump control panel screen; and
7. document any other maintenance activities performed.

All of this information/data is included in each monthly O&M Progress Report that the O&M subcontractor is required to generate. In addition, the O&M Plan required:

- On a quarterly basis, measure and record groundwater levels in 27 wells/piezometers. The following wells/piezometers are included in this effort: EXT02, MW02SH, MW02DP, EXT03, MW03SH, MW03S, MW04SH, MW04DP, MW05SH, MW05S, MW07SH, MW07S, MW08SH, MW08S, MW09A, MW10A, MW10R, MW10S, PZ04, PZ05, PZ05A, B05P, PZ06, PZ07, PZ08, PZ09, and PZ10. These water levels are used to generate a potentiometric surface map, which will allow USEPA to evaluate the groundwater extraction system and ensure that the plume is being captured.

- On a semi-annual basis, for at least the first two years of O&M, the following 15 monitoring wells are to be sampled: EXT02, MW02SH, MW02DP, EXT03, MW03SH, MW03S, MW04SH, MW04DP, MW05SH, MW05S, MW07SH, MW07S, MW08SH, MW08S, and PZ05A. All samples are analyzed for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), and metals. After collecting groundwater quality data for a year, USEPA will evaluate whether or not to eliminate any of these analyses. The surface water and sediment in Browning Branch will be sampled, by the operating contractor, as part of the Five Year Review process.

- Periodic sampling of groundwater effluent to be conducted to satisfy the requirements of the discharge permit. One composite sample to be collected from the effluent discharge monthly for the first three months of system operation. Thereafter, one composite sample will be collected from the effluent discharge every six months. Effluent samples will be analyzed for volatile organic compounds, semivolatile organic compounds, and total metals.

An Addendum to the *O&M Manual for the Groundwater Extraction System at the Benfield Industries Site* was finalized on September 4, 2002

(USEPA, 2002b). The purpose of the Addendum was to document changes to O&M activities and present a detailed schedule of known upcoming events for the next five years. Information in this Addendum supercedes that found in the original O&M manual.

On May 1, 2002, the frequency of scheduled O&M site visits was changed to three times per week (typically Monday, Wednesday, and Friday). The operations performed during these site visits remains as identified in the original O&M plan.

The frequency of groundwater monitoring events at the site was modified to the following:

- Quarterly sampling during the second year of system operation (May 2002 - April 2003)
- Semi-annual sampling during the third and fourth years of system operation (May 2003 - April 2005)
- Annual sampling during the fifth year of operation and thereafter (May 2005 and beyond).

The list of 15 wells sampled during each event and the analytical requirements for each event remained the same as identified in the original O&M Plan.

The Operating contractor, Mountain Environmental Services (MES), maintains the extraction system to remove ten gallons of groundwater per minute. Forty-percent of this flow rate is from EXT02, with the remainder being provided by EXT03. In order to balance the system, ten gpm of extracted water must be discharged to the POTW. A review of maintenance logs shows that these flowrates and ratios are, for the most part, maintained within a variance of 5%.

<u>Costs</u>

The average operation and maintenance cost for 2002 was $2,488.00/month. This includes the cost for discharge to the POTW and sampling of the monitoring wells. The highest monthly O&M cost, $4,218, occurred during the first month of operation.

5.0 Five Year Review Process

5.1 Administrative Components

Personnel of the US Army Corps of Engineers (USACE), Nashville District, performed the Five Year Review. This team consisted of Rebecca Terry (Chemist), Laura Benneyworth (Risk Assessor), and Douglas Mullendore (Process Engineer).

This Five Year Review consisted of the following activities: document review, data review, site inspection, local interviews, and Five Year Review Report preparation. The document review and data review commenced in February 2003, with the site visit occurring on March 19, 2003. Local interviews were conducted during the site visit and included the operating contractor.

5.2 Document Review

This Five Year Review consisted of a review of relevant documents including the ROD, ROD Amendment, ESD, O&M records and monitoring data reports. The remediation levels identified in the ROD were also reviewed in detail, and ARARs and toxicity factors were checked for updates.

5.3 Data Review

The data review consisted of evaluation of pre-remediation, quarterly groundwater O&M data collected from June 2001 to October 2002, subsurface soil, surface water, and sediment data collected in October 2002 in support of the Five Year Review, and extraction well and effluent monitoring data collected since the extraction system has been operational. These data are discussed in more detail below, and summarized in **Appendix B.**

5.3.1 Data Assessment

In order to determine the quality of data produced for this project an assessment of data generated during long-term monitoring (LTM) was performed. This assessment includes a review of the analytical data and an evaluation. It should be noted that the required level of data validation or verification for data generated during the LTM is not identified in project documents.

Upon review of the LTM data it was discovered that

- The laboratory for this project reported some of the organic constituents as not detected. However, the reporting limit concentration for some constituents exceeds the remediation level.

Based on the review of historical data an evaluation of the data quality for this project cannot be determined at this time.

5.3.2 Groundwater Monitoring

Quarterly groundwater data are collected by MES. **Appendix B1** summarizes the groundwater data collected from 1991 to October 2002. Where there were exceedances of the ROD remediation levels, the cell values are boxed. In cases where the detection limit exceeded the remediation level, the cell values are given in bold type.

For this Five Year Review, four monitoring reports (August 2001, February 2002, July 2002, and October 2002) were available. The data provided in the monitoring reports indicate that the main contaminant mass occurs near the groundwater/soil interface down to a depth of 20 feet or less, and is associated with the shallow alluvium beneath the Site. Although the alluvium and saprolite units are reported to be hydraulically connected, the saprolite unit has displayed relatively low concentrations of organic contaminants.

Table 7 presents all the groundwater O & M data (1991--October 2002) for three wells that were evaluated in further detail:

- MW3SH, an alluvium well in the center of the plume, in the most impacted groundwater zone. This well provides an illustration of contaminant concentration reductions over time.

- MW5S, a saprolite well, was selected for evaluation because it is the closest well in the direction of the nearest residence downgradient, and in the deeper groundwater where potable wells may be screened

- MWBS, an alluvial well, was selected for evaluation because it is the closest downgradient well in the direction of Browning Branch Creek. Any contaminants reaching this well might eventually discharge into the creek.

Also highlighted in **Table 7** are Site contaminants that were “risk drivers”, i.e., those that contributed most significantly to risks estimated in the risk assessment (see also **Table 2**). Six Site contaminants that were “risk drivers” in groundwater were selected for further evaluation: total xylenes, naphthalene, benzo(a)pyrene (BaP), barium (Ba), total chromium (Cr), and manganese (Mn).

Data from **Table 7** were used to generate plots of concentrations of these “risk drivers” from 1991 to October 2002 for the three wells identified in the above paragraph. These plats are given as **Figures 3 through 8** for total xylenes, naphthalene, BaP, Ba, total Cr, and Mn, respectively. It should be noted that not all three wells were sampled for all sampling dates, and that the three wells represent two different groundwater zones/depths.

In general, **Figures 3 through 8** show that concentrations of these “risk drivers” has decreased in all wells since Site remediation in 1994. However, BaP concentrations (**Figure 5**) appear to have increased above the remediation level (0.2 ug/L) between 1994 and July 2002 before decreasing again in October 2002. In addition, Mn (**Figure 8**) appears to be on the increase in all three of these wells since August 2002. In the most recent sampling event (October 2002), concentrations of these contaminants were below remediation levels (“RL” on plots), with the exception of Mn in all three wells. The reduction of metal concentrations could be a direct result in a change in sampling technique. A bailer was utilized to collect samples prior to October 2002. For the October 2002 and for all subsequent sampling events a low flow sampling technique was used. This technique usually produces samples with lower turbidity and thus could be responsible for the lower metals concentrations.

5.3.3 Soil Monitoring

Subsurface soil data were collected in October 2002 by MES *(MES, 2003)* for USEPA in support of the Five Year Review. These data are summarized in **Appendix B2**, and locations are shown in **Figure 2**. Four samples and one duplicate were collected at depths from 4 to 4.5 ft from the area where soil not meeting soil treatment performance standards was buried.

As shown in **Appendix B2**, elevated concentrations of SVOCs remain at all four subsurface soil locations, Contaminant concentrations that were detected at highest concentrations included benzo(a)pyrene, benzo(b)fluoranthene, bis(2-ethylhexyl)phthalate, fluoranthene, and pyrene *(MES, 2003).* Three of the four locations had exceedances of the benzo(a)pyrene remediation level. The results indicate that very little biological degradation has occurred since the soils were buried during remediation activities.

TABLE 7
GROUNDWATER RESULTS FOR SELECTED WELLS
Benfield Industries Site - Waynesville, North Carolina

Well Number	GW Remediation		MW03SH (Alluvial) - In Plume											MW05S (Samprollite) – Nearest Residence												
Sample Date	Level (ug/L)	1991	1994		May-99	Aug-01		Feb-02		Jul-02		Oct-02		1991		1994		May-99	Aug-01		Feb-02		Jul-02		Oct-02	
Volatile Organic (ug/L)																										
1,1,1-Trichloroethane		NA			NA									22	J	13		NA	10	U	10	U	10	U	10	U
1,1-Dichlorobenzene		NA			NA													NA								
1,1-Dichloroethane		NA			NA									60		ND		NA	10	U	10	U	10	U	10	U
1,2,4-Trichlorobenzene		NA	ND		NA	21		23		16		8	J					NA								
1,2,4-Trimethylbenzene		NA			NA													NA								
1,2-Dichlorobenzene		NA			NA									51		160		NA	2	J	2	J	10	U	1	J
1,2-Dichloroethane		NA	9	J	NA	10		10	U	10	U	10	U	29	J	6	J	NA	10	U	10	U	10	U	10	U
1,2-Dichloropropane	0.56	NA			NA													NA								
1,3,5-Trimethylbenzene		NA			NA													NA								
1,3-Dichlorobenzene		NA	5	J	NA	10	U	10	U	10	U	10	U	3	J	3	J	NA	10	U	10	U	10	U	10	U
1,4-Dichlorobenzene	1.6	NA	ND		NA	6	J	8	J	10	U	7	J	6	J	10		NA	3	J	1	J	10	U	1	J
2-Butanone		NA			NA													NA								
2-Chlorotoluene		NA			NA													NA								
4-Isopropyltoluene		NA			NA													NA								
Acetone		NA			NA													NA								
Benzene	5	NA	1	J	NA	10	U	10	U	10	U	10	U	2	J	11		NA	10	U	10	U	10	U	10	U
Carbon disulfide		NA			NA													NA								
Chlorobenzene	**100**	**NA**			**NA**									**ND**		**21**		**NA**	**2**	**J**	**2**	**J**	**10**	**U**	**1**	**J**
Chloroethane		NA			NA									ND		7	J	NA	10	U	10	U	10	U	10	U
Chloroform		NA			NA													NA								
cis-1,2-Dichloroethene		NA			NA													NA								
Ethyl benzene		NA	180		NA	4	J	3	J	4	J	1	J	440		18		NA	10	U	10	U	10	U	10	U
Isopropylbenzene		NA			NA													NA								
Methylcyclohezene		NA	ND		NA	130		140		160		58						NA								
Naphtalene		NA			NA													NA								
n-Propylbenzene		NA			NA													NA								
sec-Butylbenzene		NA			NA													NA								
t-Butylbenzene		NA			NA													NA								
Tetrachloroethene		NA			NA													NA								
Toluene		NA	190		NA	10	U	10	U	10	U	10	U	190		6	J	NA	10	U	10	U	10	U	10	U
Total xylenes	**400**	**NA**	**850**		**NA**	**25**		**19**		**16**		**7**	**J**	**600**		**27**		**NA**	**10**	**U**	**10**	**U**	**10**	**U**	**10**	**U**
Trichloroethane		NA			NA													NA								
Vynil chloride	**0.0015**	**NA**			**NA**									**33**	**J**	**26**		**NA**	**10**	**U**	**10**	**U**	**10**	**U**	**10**	**U**

Notes:

Source: MES (2003)

– Shaded cell = risk driver

– ND = Not detected, detection limit unknown, NA = not analyzed.

– U = Not detected. Value listed is minimum quantification limit.

– J = Estimated value

TABLE 7
GROUNDWATER RESULTS FOR SELECTED WELLS
Benfield Industries Site - Waynesville, North Carolina

Well Number	GW Remediation	MW03SH (Alluvial) - In Plume											
Sample Date	Level (ug/L)	1991	1994		May-99	Aug-01		Feb-02		Jul-02		Oct-02	
Semivolatile Organics (ug/L)													
1,1-Biphenyl		NA	ND		NA	360	J	450	J	81	J	10	U
2-Chloronaphthalene		NA			NA								
2-Methylnaphthalene		NA	40	J	NA	1200		1300		220		10	U
2-Methylphenol		NA			NA								
Acenaphthalene		NA	520	J	NA	1600		2100		560		10	U
Acenaphthylene		NA	58	J	NA	110	J	130	J	23	J	10	U
Anthracene		NA	23	J	NA	740	J	720	J	91	J	10	U
Benzo(a)anthracene	**0.1**	**NA**	**11**	**J**	**NA**	**470**	**J**	**490**	**J**	**50**	**J**	**10**	**U**
Benzo(a)pyrene	**0.2**	**NA**	**4**	**J**	**NA**	**220**	**J**	**210**	**J**	**21**	**J**	**10**	**U**
Benzo(b or k)fluorethane	**0.2**	**NA**	**9**	**J**	**NA**	**NA**		**NA**		**NA**		**NA**	
Benzo(b)fluorethane		NA	NA		NA	150	J	280	J	25	J	10	U
Benzo(g,h,i)perylene		NA	ND		NA	38		1000	U	100	U	10	U
Benzo(k)fluoranthene		NA	NA		NA	300	J	130	J	24	J	10	U
Benzyl butyl phthalate		NA	ND		NA	43		1000	U	100	U	10	U
Bis (2-ethylexyl) phthalate		NA	ND		NA	330	J	1000	U	100	U	10	U
Caprolactan		NA			NA								
Carbonzole	5	NA	150	J	NA	56		1000	U	10	J	10	U
Chysene	0.2	NA	6	J	NA	400	J	360	J	41	J	10	U
Dibenzo(a,h)anthracene		**NA**	**ND**		**NA**	**20**		**1000**	**U**	**100**	**U**	**10**	**U**
Dibenzofuran		NA	370	J	NA	1300		1800		430		10	U
Di-n-buthylphthalate		NA	ND		NA	51		1000	U	100	U	10	U
Di-n-octylphthalate		NA	ND		NA	11		1000	U	100	U	10	U
Fluoranthene		NA	71	J	NA	2100		2400		450		10	U
Fluorene		NA	360	J	NA	1500		2100		470		10	U
Indeno (1,2,3-cd)pyrene	0.4	NA	ND		NA	52		1000	U	100	U	10	U
Naphthalene	**100**	**NA**	**1300**	**J**	**NA**	**240**	**J**	**260**	**J**	**65**	**J**	**10**	**U**
Pentachlorophenol	**1**	**NA**			**NA**								
Pentananthrene		**NA**	**410**	**J**	**NA**	**5200**		**5100**		**1100**		**10**	**U**
Pyrene		NA	45	J	NA	1500	J	1600		250		10	U

Well Number	MW05S (Samprollite) – Nearest Residence												
Sample Date	1991		1994		May-99	Aug-01		Feb-02		Jul-02		Oct-02	
Semivolatile Organics (ug/L)													
1,1-Biphenyl	ND		ND		NA	10	U	5 J		10	U	10	UJ
2-Chloronaphthalene	4		ND		NA	10	U	10	U	10	U	10	UJ
2-Methylnaphthalene	390	J	68		NA	10	U	10	U	10	U	10	UJ
2-Methylphenol	8	J	ND		NA	10	U	10	U	10	U	10	UJ
Acenaphthalene	220	J	64		NA	16		3	J	10	U	10	UJ
Acenaphthylene	38		2	J	NA	10	U	10	U	10	U	10	UJ
Anthracene	26		ND		NA	10	U	10	U	10	U	10	UJ
Benzo(a)anthracene	**14**	**J**	**ND**		**NA**	**10**	**U**	**10**	**U**	**10**	**U**	**10**	**UJ**
Benzo(a)pyrene	**5**	**J**	**ND**		**NA**	**10**	**U**	**10**	**U**	**10**	**U**	**10**	**UJ**
Benzo(b or k)fluorethane	**11**		**NA**		**NA**	**NA**		**NA**		**NA**			
Benzo(b)fluorethane					NA								
Benzo(g,h,i)perylene	1	J	ND		NA	10	U	10	U	10	U	10	U
Benzo(k)fluoranthene					NA								
Benzyl butyl phthalate					NA								
Bis (2-ethylexyl) phthalate					NA								
Caprolactan					NA								
Carbonzole	210	J	210		NA	10	U	6	J	10	U	10	UJ
Chysene	12	J	ND		NA	10	U	10	U	10	U	10	UJ
Dibenzo(a,h)anthracene					**NA**								
Dibenzofuran	200	J	150		NA	2	J	2	J	10	U	10	
Di-n-buthylphthalate					NA								
Di-n-octylphthalate					NA				U				
Fluoranthene	64		12		NA	10	U	10	U	1	J	2	J
Fluorene	160	J	46		NA	10	U	10	U	10	U	10	UJ
Indeno (1,2,3-cd)pyrene	2	J	ND		NA	10	U	10	U	10	U	10	UJ
Naphthalene	**2400**	**J**	**1400**		**NA**	**10**	**U**	**10**	**U**	**10**	**U**	**10**	**UJ**
Pentachlorophenol					**NA**								
Pentananthrene	**250**	**J**	**46**		**NA**	**10**	**U**	**10**	**U**	**10**	**U**	**10**	**UJ**
Pyrene	41		7	J	NA	10	U	10	U	10	U	1	J

Notes:

Source: MES (2003)

– J = Estimated value

– Shaded cell = risk driver

– ND = Not detected, detection limit unknown, NA = not analyzed.

– U = Not detected. Value listed is minimum quantification limit.

TABLE 7
GROUNDWATER RESULTS FOR SELECTED WELLS
Benfield Industries Site - Waynesville, North Carolina

Well Number	GW Remediation		MW03SH (Alluvial) - In Plume												MW05S (Samprollite) – Nearest Residence												
Sample Date	Level (ug/L)	1991	1994		May-99	Aug-01		Feb-02		Jul-02		Oct-02		1991		1994		May-99	Aug-01		Feb-02		Jul-02		Oct-02	
Total Metal (ug/L)												100	U													
Aluminum		NA	NA		NA	NA		24,000	J	4100				NA		NA		NA	NA		3000	J	2400		16	U
Antimony	**6**	NA			NA													NA								
Arsenic		NA			NA													NA								
Barium	**1000**	NA	**ND**		NA	NA		**230**										NA	NA							
Beryllium	**4**	NA	**ND**		NA	NA		**111**		**0.2**								NA	NA							
Cadmium		NA			NA													NA								
Calcium		NA	NA		NA	NA		5300		4400		4800		NA		NA		NA	NA		29000		26000		26000	
Chromium	**50**	NA	**ND**		NA	NA		**45**										NA	NA		**12**					
Cobalt		NA	ND		NA	NA		14		2.3	U	1	U	220		ND		NA	NA		8		6.8	U	2.3	
Copper		NA	NA		NA	NA		42		10U		1	U	NA		NA		NA	NA		6.3		9.2	U	1	U
Iron		NA	NA		NA	NA		33000		9500		5000		NA		NA		NA	NA		4200		4600		180	
Lead	15	NA	33		NA	NA		16		6		2	U	8		ND		NA	NA		2		1.3	U	2	U
Magnesium		NA	NA		NA	NA		6600		2100		1500		NA		NA		NA	NA		11000		9600		9300	
Manganese	**50**	NA	**ND**		NA	NA		**4150**		**280**		**10**		**1300**				NA	NA				**100**			
Mercury		NA			NA													NA								
Nickel	100	NA	ND		NA	NA		27		7.2		1	U	360		ND		NA	NA		1900		16		2.2	
Potassium		NA	NA		NA	NA		4800		2000		1600		NA		NA		NA	NA		1600		1600		1200	
Selenium		NA			NA													NA								
Silver		NA			NA													NA								
Sodium		NA	NA		NA	NA		3300	J	3600		3,200	J	NA		NA		NA	NA		6200	J	6500		6000	J
Thallium		NA			NA													NA								
Vanadium	**200**	NA	**ND**		NA	NA		**52**		**12**								NA	NA		**11**					
Zinc		NA	NA		NA	NA		110		18		3.6	J	NA		NA		NA	NA		10		5.9		2	J

Notes:

Source: MES (2003)

– Shaded cell = risk driver

– ND = Not detected, detection limit unknown, NA = not analyzed.

– U = Not detected. Value listed is minimum quantification limit.

– J = Estimated value

TABLE 7
GROUNDWATER RESULTS FOR SELECTED WELLS
Benfield Industries Site - Waynesville

Well Number		MW06A / MW08SH (Alluvial) – Downgradient, Near Creek											
Sample Date	1991	1994		May-99		Aug-01		Feb-02		Jul-02		Oct-02	
Volatile Organic (ug/L)													
1,1,1-Trichloroethane	NA												
1,1-Dichlorobenzene	NA	ND		4		10	U	10	U	10	U	10	U
1,1-Dichloroethane	NA	21		ND		10	U	10	U	10	U	10	U
1,2,4-Trichlorobenzene	NA												
1,2,4-Trimethylbenzene	NA												
1,2-Dichlorobenzene	NA	ND		4		10	U	10	U	10	U	1	J
1,2-Dichloroethane	NA												
1,2-Dichloropropane	NA	2	J	ND		10	U	10	U	10	U	10	U
1,3,5-Trimethylbenzene	NA												
1,3-Dichlorobenzene	NA	1	J	ND		10	U	10	U	10	U	10	U
1,4-Dichlorobenzene	NA	3	J	2		10	U	10	U	10	U	10	U
2-Butanone	NA												
2-Chlorotoluene	NA												
4-Isopropyltoluene	NA												
Acetone	NA												
Benzene	NA	4	J	ND		10	U	10	U	10	U	10	U
Carbon disulfide	NA												
Chlorobenzene	**NA**	**37**		**11**		**1**	**J**	**2**	**J**	**10**	**U**	**1**	**J**
Chloroethane	NA												
Chloroform	NA												
cis-1,2-Dichloroethene	NA												
Ethyl benzene	NA												
Isopropylbenzene	NA												
Methylcyclohezene	NA												
Naphtalene	NA												
n-Propylbenzene	NA												
sec-Butylbenzene	NA												
t-Butylbenzene	NA												
Tetrachloroethene	NA												
Toluene	NA												
Total xylenes	**NA**												
Trichloroethane	NA	ND		ND		10	U	10	U	10	U	1	J
Vynil chloride	**NA**												

Notes:

Source: MES (2003)

– Shaded cell = risk driver

– ND = Not detected, detection limit unknown, NA = not analyzed.

– U = Not detected. Value listed is minimum quantification limit.

– J = Estimated value

TABLE 7
GROUNDWATER RESULTS FOR SELECTED WELLS
Benfield Industries Site - Waynesville

Well Number		MW06A / MW08SH (Alluvial) – Downgradient, Near Creek											
Sample Date	1991	1994		May-99		Aug-01		Feb-02		Jul-02		Oct-02	
Semivolatile Organics (ug/L)													
1,1-Biphenyl	NA												
2-Chloronaphthalene	NA												
2-Methylnaphthalene	NA												
2-Methylphenol	NA												
Acenaphthalene	NA	37		ND		6	J	10	U	10		3	J
Acenaphthylene	NA	2	J	ND		10	U	10	U	10	U	10	U
Anthracene	NA												
Benzo(a)anthracene	**NA**												
Benzo(a)pyrene	**NA**												
Benzo(b or k)fluorethane	**NA**												
Benzo(b)fluorethane	NA												
Benzo(g,h,i)perylene	NA												
Benzo(k)fluoranthene	NA												
Benzyl butyl phthalate	NA												
Bis (2-ethylexyl) phthalate	NA												
Caprolactan	NA												
Carbonzole	NA	27		ND		10	U	10	U	10	U	10	U
Chysene	NA												
Dibenzo(a,h)anthracene	**NA**												
Dibenzofuran	NA	18		ND		10	U	10	U	10	U	10	U
Di-n-buthylphthalate	NA												
Di-n-octylphthalate	NA												
Fluoranthene	NA	ND		ND		2	J	10	U	3	J	10	U
Fluorene	NA	27		ND		2	J	10	U	4	J	10	U
Indeno (1,2,3-cd)pyrene	NA												
Naphthalene	**NA**												
Pentachlorophenol	**NA**												
Pentananthrene	**NA**												
Pyrene	NA	ND		ND		10	U	10	U	2	J	2	J

Notes:

Source: MES (2003)

– Shaded cell = risk driver

– ND = Not detected, detection limit unknown, NA = not analyzed.

– U = Not detected. Value listed is minimum quantification limit.

– J = Estimated value

TABLE 7
GROUNDWATER RESULTS FOR SELECTED WELLS
Benfield Industries Site - Waynesville

Well Number		MW06A / MW08SH (Alluvial) – Downgradient, Near Creek												
Sample Date	**1991**	**1994**		**May-99**		**Aug-01**		**Feb-02**		**Jul-02**		**Oct-02**		
Total Metal (ug/L)														
Aluminum	NA	NA		NA		NA		12000	J	2900		18	U	
Antimony	**NA**													
Arsenic	NA													
Barium	**NA**	**2500**		**94**		**NA**		**220**		**140**	**J**	**96**		
Beryllium	**NA**													
Cadmium	NA													
Calcium	NA	NA		NA		NA		29000		24000		29000		
Chromium	**NA**	**250**		**ND**		**NA**		**18**		**5.3**		**1**	**J**	
Cobalt	NA	ND		ND		NA		10		3.6	U	2.5	R	
Copper	NA	NA		NA		NA		14		5.6	U	1	U	
Iron	NA	NA		NA		NA		27000		14000		7600		
Lead	NA	69		ND		2	U	2	U	2	U	2.3		
Magnesium	NA	NA		NA		NA		8600		5100		5000		
Manganese	**NA**	**NA**		**310**		**NA**		**2100**		**2100**		**2200**		
Mercury	NA													
Nickel	NA	ND		ND		NA		10		2.9		1	U	
Potassium	NA	NA		NA		NA		5400		3700		3800		
Selenium	NA													
Silver	NA													
Sodium	NA	NA		NA		NA		5000	J	5800		5900	J	
Thallium	NA													
Vanadium	**NA**	**NA**		**NA**		**NA**		**25**		**6.3**	**J**	**1**	**J**	
Zinc	NA	NA		NA		NA		39		6.3		1.5	J	

Notes:

Source: MES (2003)

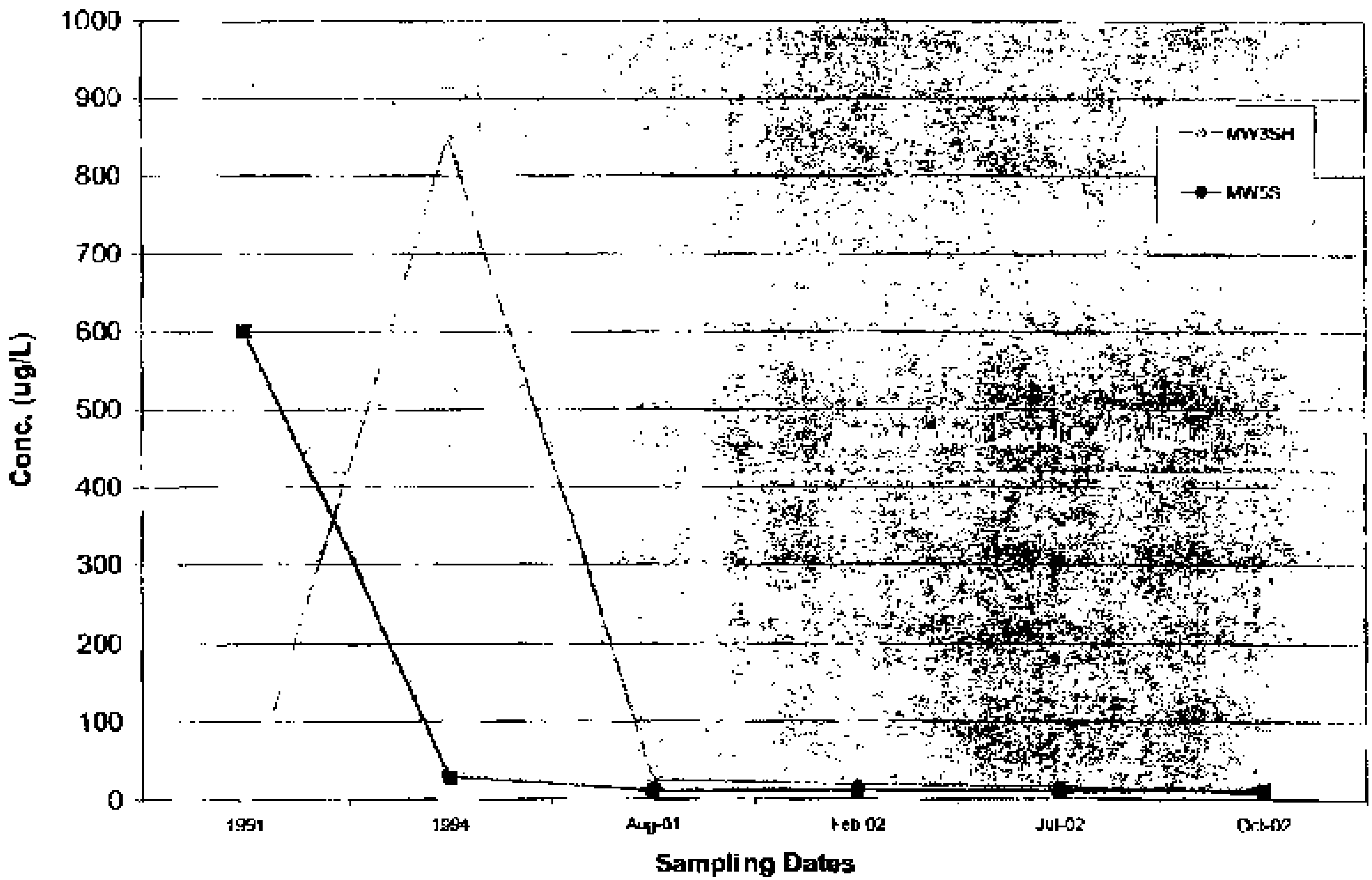
– Shaded cell = risk driver

– ND = Not detected, detection limit unknown, NA = not analyzed.

– U = Not detected. Value listed is minimum quantification limit.

– J = Estimated value

Figure 3. Groundwater Conc.-Xylenes



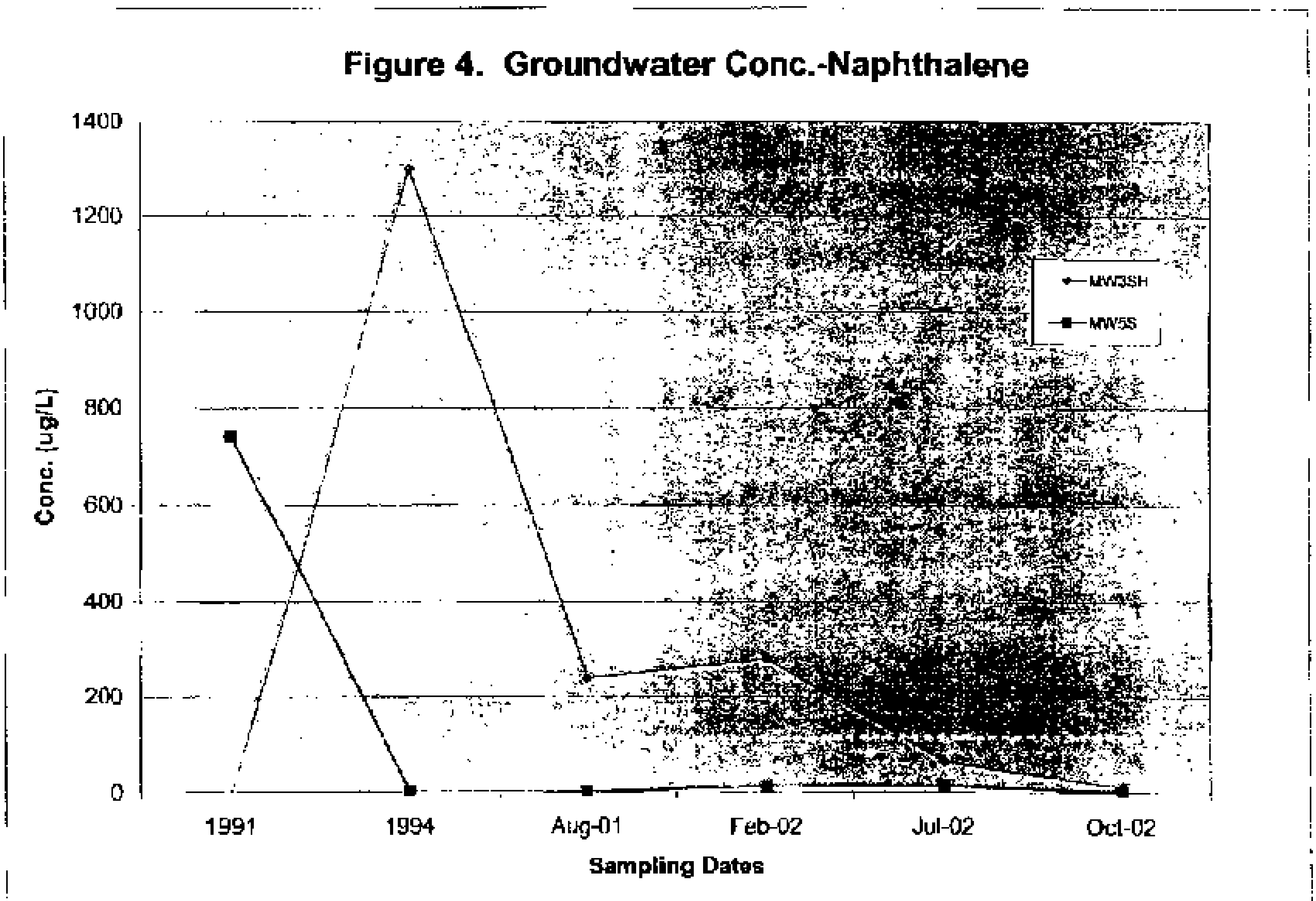
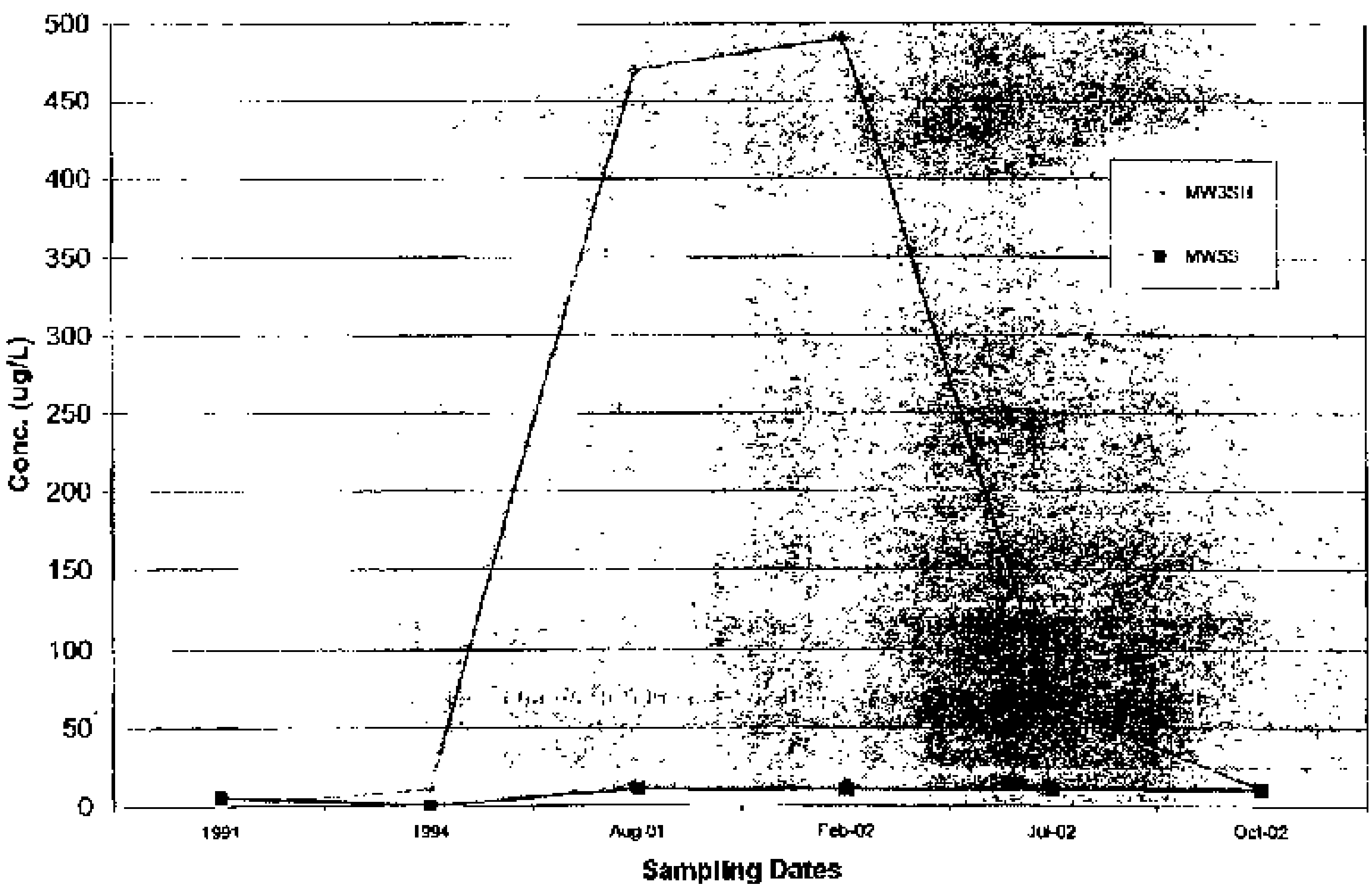


Figure 4. Groundwater Conc.-Naphthalene
1400
1200
1000
800
600
400
200
0
Conc. (ug/L)
1991
1994
Aug-01
Feb-02
Jul-02
Oct-02
Sampling Dates
MW5S

Figure 5. Groundwater Conc.-BaP



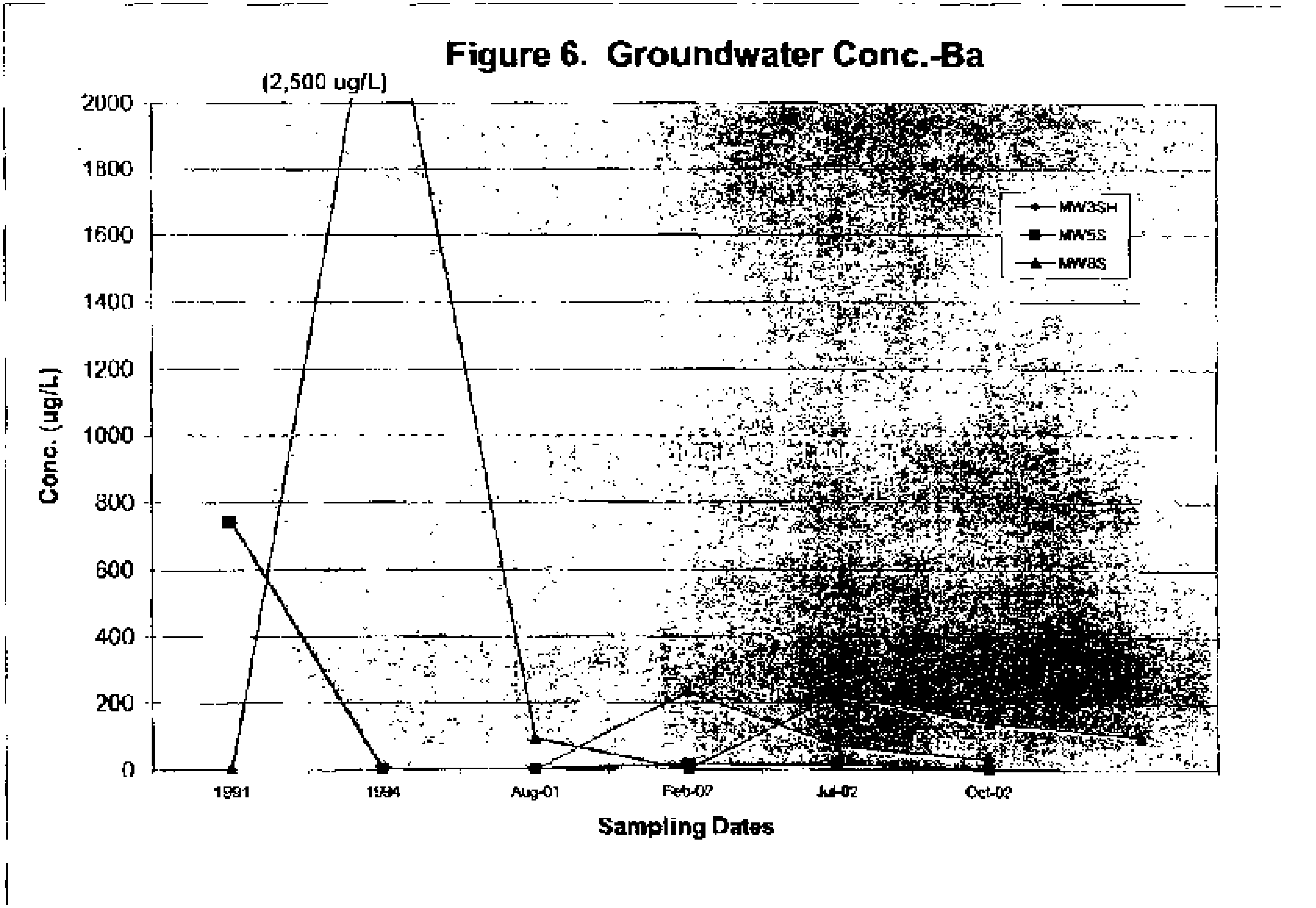


Figure 6. Groundwater Conc.-Ba
(2,500 ug/L)
2000
1800
1600
1400
1200
1000
800
600
400
200
0
Conc. (ug/L)
MW3SH
MW5S
MW8S
1991
1994
Aug-01
Feb-02
Jul-02
Oct-02
Sampling Dates

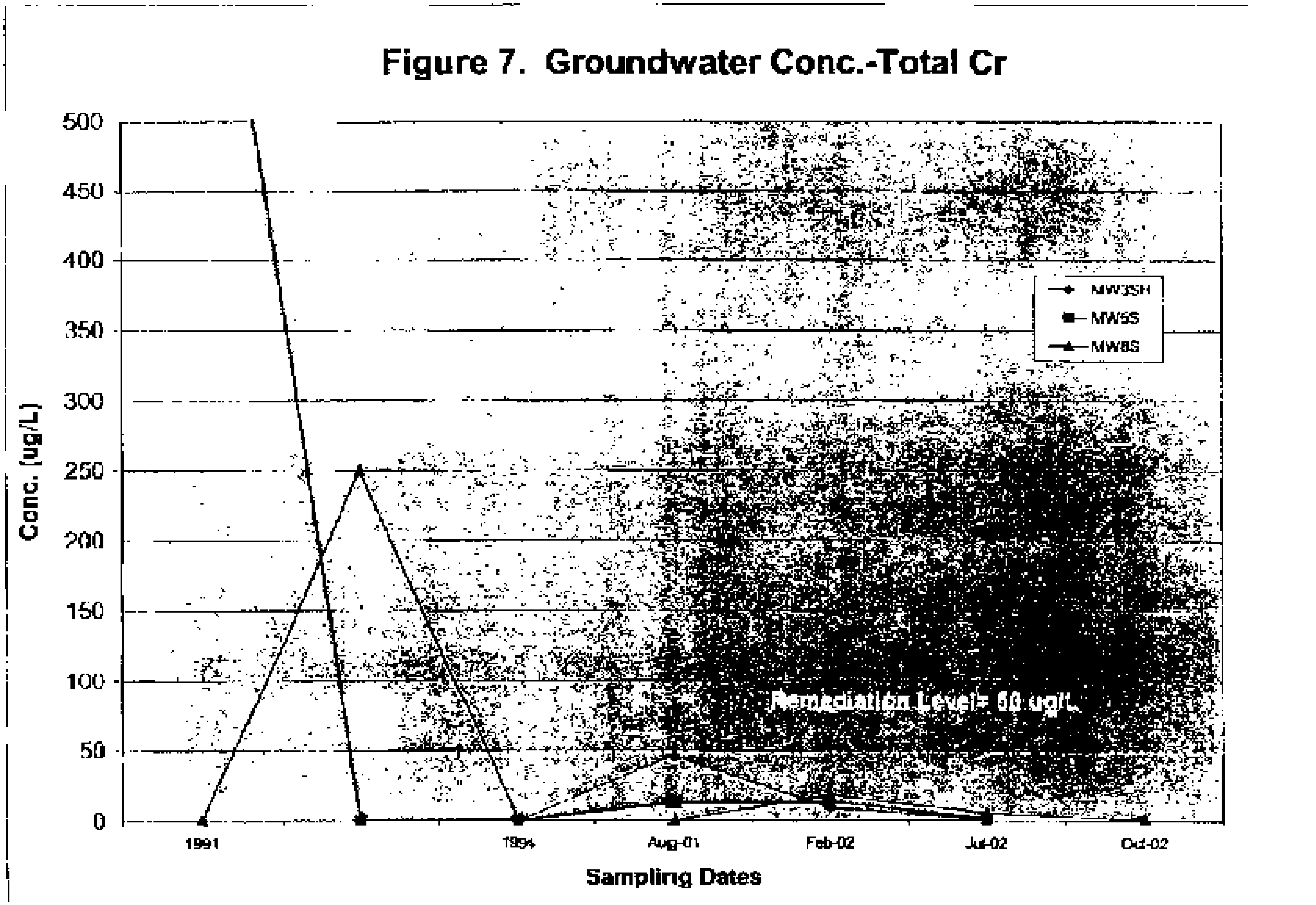
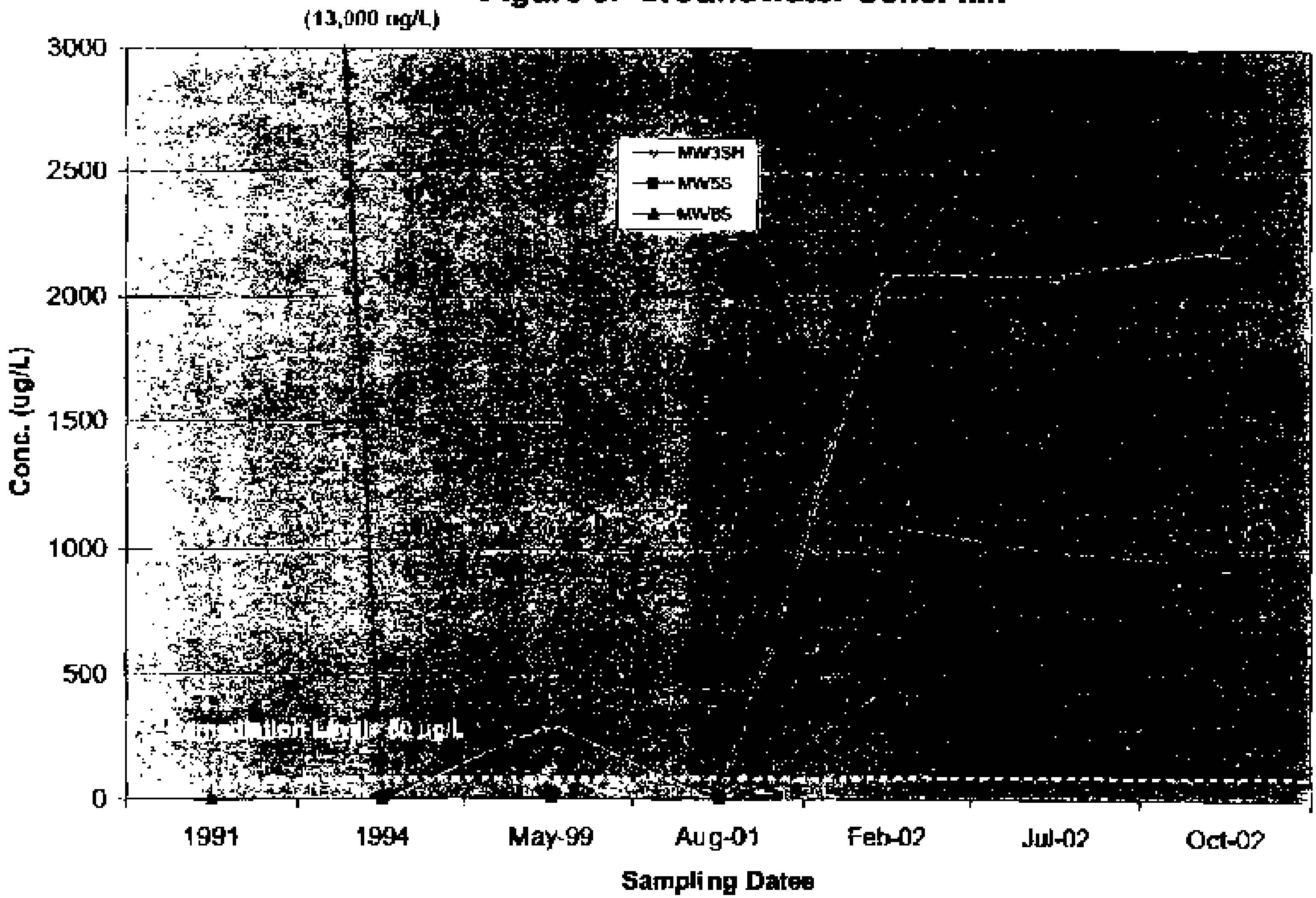


Figure 7. Groundwater Conc.-Total Cr
500
450
400
350
300
250
200
150
100
50
0
Conc. (ug/L)
MW3SH
MW5S
MW8S
Remediation Level= 50 ug/L
1991
1994
Aug-01
Feb-02
Jul-02
Oct-02
Sampling Dates

Figure 8. Groundwater Conc.-Mn



5.3.4 Surface Water and Sediment Monitoring

Surface water and sediment data from Browning Branch were collected from three locations in October 2002 by MES (*MES, 2003*). These data were collected for USEPA to support the Five Year Review, and are summarized in **Appendices B3 and B4**: locations are shown in **Figure 2**. Locations were chosen so that one was upstream (SW/SD-1), one adjacent to the Site (SW/SD-2), and one downstream (SW/SD-3) (*MES, 2003*).

Results indicate that no VOCs or SVOCs were detected in surface water. Similar concentrations of metals were found upstream, adjacent, and downstream, indicating that there is no impact from the Site to surface water quality in Browning Branch (*MES, 2003*). The surface water data were also compared to the screening levels for surface water given in the ROD (*USEPA, 1992*). There were no exceedances of the screening criteria for surface water (see **Appendix B3**).

Sediment sampling results showed that toluene was the only VOC detected in sediments, at relatively low concentrations. Toluene was not detected in the upstream sample. SVOCs and metals were detected in sediment samples. However, similar concentrations were found upstream, adjacent, and downstream, indicating that there is no impact from the Site to sediment quality in Browning Branch *(MES, 2003)*.

The sediment data were also compared to the screening levels given in the ROD (*USEPA, 1992*). There were exceedances (or concentrations equal to) the sediment screening criteria for anthracene, phenanthrene, pyrene, and zinc (see **Appendix B4**). Phenanthrene was also detected in the upstream sample, at higher concentrations than the other locations.

Surface water and sediment concentrations from the October 2002 event do not appear to be substantially different from the surface water and sediment concentrations from the RI given in the 1992 ROD (*USEPA, 1992*). Due to the conservatism inherent in the sediment screening criteria, and the low levels detected in sediment, these exceedances do not suggest that additional evaluation of Browning Branch is warranted.

5.3.5 Extraction Weil/Effluent Discharge Monitoring

For the most part, only low concentrations of contaminants have been detected in extraction wells EXT02 and EXT03. It would be expected, if the system was operating in the most efficient manner, the extraction wells would have levels of contamination near or higher than the groundwater remediation levels. The low contaminant concentrations found in the extraction wells are an indication that the plume is not being captured or a significant amount of clean groundwater is being pumped and is diluting the contaminated groundwater; or a combination of the two is occurring.

5.3.6 Groundwater Capture Zone and Extraction System Monitoring

USEPA's Groundwater Technical Support Center (GTSC) performed a review of the groundwater capture zone and extraction system in 2002 (see **Appendix C**). Based on this review, the current groundwater system appears to be providing limited hydraulic containment for the portion of the plume(s) remaining onsite. Further information summarized from the GTSC report (USEPA, 2003a) is summarized in the following paragraphs.

The potentiometric data do not indicate that the plume is being substantially contained or captured. The February 2002 monitoring report states that the closed contours on the potentiometric map indicate "some measure" of containment of the plume. While GTSC agreed that limited containment of the plumes might be occurring within the vicinity of the extraction wells, total plume containment is probably not occurring as a result of the extraction system's operation.

GTSC identified several problems with the presentation of the water level data used to determine whether the extraction system is capturing the plume. First, the only water level measurements, which show any substantial depression in the potentiometric surface, are the measurements in the extraction wells themselves. However, extraction wells should be avoided for creating water levels maps. If the hydraulic head from an extraction well is used, the assumptions are that the flow is horizontal and the efficiency of the well is known for the given pumping rate. In some cases, assumptions and estimates can be used to make corrections of water levels in extraction wells – this was not done in this case. In general, the potentiometric surface should be measured in wells and piezometers surrounding, and in close proximity to, the extraction wells, but not from the extraction wells themselves.

If the two extraction well data points are eliminated from the potentiometric surface, the other measuring points show little or no depression of the potentiometric surface. For instance, the pre-remediation water level presented for well MW-03SH (the most contaminated well, near EXT03) in the *Preliminary Design Report* is about 2,719 feet. The data point for the same well in February 2002, after almost a full year of operation of the system was 2,715.5 feet. This represents a reduction of about 3.5 feet that may be due to a cone of depression surrounding EXT03. However, the reduction of 3.5 feet is well within the natural variation reported for the area, and could easily have been caused by natural seasonal variations or drought conditions. Even if the reduction in this well is entirely due to a cone of depression around EXTO3, it is a relatively small reduction for a well located within 100 feet of the extraction well, showing a very limited area of depression.

Review of the provided data also indicated the current extraction well configuration are not adequate for the efficient and expeditious removal of the remaining on-site contaminant plume mass. It was noted that the alluvium has a much higher hydraulic conductivity than the saprolite, so it is much easier for the shallow, contaminated groundwater to flow horizontally within the alluvium than vertically into the saprolite. The extraction wells are screened deeper than the main plume mass, which allows the removal of a relatively large volume of "clean" ground water from the deeper saprolite unit, versus a concentrated effort to remove the remaining main plume mass identified in the shallow alluvium at the site, namely in the vicinity of monitoring wells MW03SH and MW07SH. Therefore, the extraction system is not capturing the shallow groundwater in the most efficient manner.

GTSC reached to conclusion that due to the design of the extraction system, it will be difficult, if not impossible, to substantially enhance the removal of some contaminants remaining in the shallow alluvium aquifer simply through operating the current extraction system at the current or increased pumping rates. The easy adsorption of PAHs by aquifer solid materials, as well as the differences in hydraulic conductivities between the alluvium and saprolite, may limit the transport of these contaminants to the extraction wells.

5.4 Update of ARARs and Toxicity Information

Question B of the Five Year Review Process asks, *"Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy still valid?"*. In order to answer that question, the toxicity factors and exposure assumptions used in the risk assessment *(B&V, 1992)* were evaluated, and ARARs for the Site were updated. As noted above in Section 3.5, most of the remediation levels for the Site were not risk-based; they were based on ARARs (drinking water standards), or based on modeling to protect groundwater as a drinking water resource.

Table 8 shows the oral (and calculated dermal) toxicity factors for noncarcinagens (RfD) and carcinogens (SF) that were used in the 1992 risk assessment (noted as "risk") for the contaminants for which there are remediation levels, and the current values, as cited in USEPA's online integrated risk information system *(IRIS, 2003)*. As shown in **Table 8**, many of the toxicity factors have changed since 1992, including all four of the site contaminants for which the remediation levels are risk-based (BaP, naphthalene, carbazole, and vanadium). In two cases (naphthalene and vanadium), the RfD was increased, which means that the subsequent noncarcinogenic risk would be decreased; in the case of BaP, the SF is higher, which means estimated carcinogenic risks would be increased; and, in the case of carbazole, a SF is not available in IRIS.

Therefore, because of changes to toxicity factors for the “risk drivers”, risk estimates would be expected to be different than that which was presented in the 1992 risk assessment, but only these four contaminants would affect the remediation levels for groundwater and soil.

ARARs have changed since the ROD was prepared. Most significant are the North Carolina groundwater standards that are much lower than MCLs or the ROD performance standards. The fact that groundwater treatment is necessary precludes unrestricted or residential groundwater use at this time.

Table 9 presents the groundwater remediation levels from the ROD (USEPA, 1992), the updated NC groundwater standards (15A NCAC 2L.0202, as amended August 1, 2002), and the updated National Primary Drinking Water Standards (40CFR141) Maximum Contaminant Levels (MCLs). Values which have changed since the 1992 ROD are boxed, and values which are lower than the groundwater remediation levels are shaded.

As shown in **Table 9**, many values have changed since 1992, but the only MCL that is lower (0.0002 mg/L instead of 0.0004 mg/L) than the corresponding remediation level is for indeno(1,2,3-cd)pyrene. The NC groundwater standards are lower than groundwater remediation levels for about half of the list of contaminants. It does not appear that the original exposure scenarios relevant to the Site have changed to any degree, except that there are now deed restrictions to preclude certain types of future site development (specifically, residential).

The state-of-the art of risk assessment has changed substantially since the risk assessment was prepared, and many new guidance documents have been developed since the ROD, including the USEPA’s ecological risk assessment guidance, and supplemental guidance regarding default exposure parameters, and methods for assessing exposure concentrations, and dermal pathways. It is unknown how these sources would affect the conclusions of the original risk assessment.

If a baseline risk assessment were to be re-done for the Site, it would surely be a different evaluation than that performed for the RI. The

COMPARISON OF UPDATED TEXICITY FACTORS

Benfield Industries Site, Waynesville, NC

Contaminant	Risk (a) Oral RfD Chronic (mg/kg-d)	Current (b) Oral RfD Chronic (mg/kg-d)	Changed?	Risk (a) (b) Dermal RfD Chronic (mg/kg-d)	Dermal Ab. Factor	Risk (a) Oral SF Chronic $(mg/kg\text{-}d)^{-1}$	Current (b) Oral SF Chronic $(mg/kg\text{-}d)^{-1}$	Changed?	Risk (a) Dermal SF Chronic $(mg/kg\text{-}d)^{-1}$
Organics									
Bezene	0.02	NA	Y	0.02	0.8	0.029	0.015 – 0.055	Y	0.04
Chlorobenzene	0.02	0.02		0.02	0.6	NA	NA		NA
1,2-Dichloropropane	NA	NA		NA	0.6	0.068	NA	Y	0.09
Vinyl Chloride	NA	0.003	Y	NA	0.6	1.9	0.072 – 1.5	Y	2.4
Total Xylenes	2	0.2	Y	2	0.6	NA	NA		NA
Benzo(a)anthracene	NA	NA		NA	0.5	5.8	NA	Y	12
Benzo(a)pyrene (c)	NA	NA		NA	0.5	5.8	7.3	Y	12
Benzo(b or k)fluoranthene	NA	NA		NA	0.5	5.8	NA	Y	12
Carbanzole (c)	NA	NA		NA	0.5	0.02	NA	Y	0.04
Chysene	NA	NA		NA	0.5	5.8	NA	Y	12
1-4 Dichlorobenzene	NA	NA		NA	0.5	0.024	NA	Y	0.05
Indeno(1,2,3-cd)Pyrene	NA	NA		NA	0.5	5.8	NA	Y	12
Naphthalene (c)	0.004	0.02	Y	0.002	0.5	NA	NA		
Pentachlorophenol	0.03	0.03		0.02	0.5	0.12	0.12		0.24
Inorganics									
Antimony	0.004	0.004		0.0008	0.2	NA	NA		
Barium	0.005	0.07	Y	0.001	0.2	NA	NA		
Barillium	0.005	0002	Y	0.001	0.2	4.3	NA	Y	22
Chromium (d)	0.005	1.5 – 0.003	Y	0.001	0.2	NA	NA		
Lead	NA	NA		NA	0.2	NA	NA		
Manganese	0.1	0.14	Y	0.020	0.2	NA	NA		
Nickel (c)	0.02	0.02		0.004	0.2	NA	NA		
Vanadium (c)	0.007	0.009	Y	0.001	0.2	NA	NA		

NA = not available in document cited. For RfDs, the lower the value, the worse the effect; for SFs, the higher the value, the worse the effect.

(a) Per the Risk Assessment Report (1992). Table 4-1.
(b) Per the Risk Assessment Report (1992). Table 4-2. For carcinogens is SF/absorption factor for noncarcinogens, is RfD x absorption factor. Absorption factors; VOCs (0.6), SOVCs (0.5) inorganics (0.2).
(c) Only these contaminants had risk-based remediation levels for soil and groundwater (see tables 3 and 4).
(d) In the risk assessment, the toxicity information for Cr was reported for Cr+6, in the update, both Cr+3 and Cr+6 are given respectively.
(e) In the risk assessment, the toxicity information for Ni was reported as “soluble salts”.

TABLE 9
COMPARISON OF GROUNDWATER REMEDLATION LEVELS AND UPDATED ARABS

Benfield Industries Site
Waynesville, NC

Chemical of Concern	Remediation Level (a) (mg/L)		NC State Groundwater Standard (2L Standard) Class GA (b) (mg/L)		USEPA Maximum Contaminant Level (MCL) (mg/L)	(c)
VOLATILE ORGANICS						
Benzene	*0.005*		0.004		0.005	
Chlorobenzene	*0.1*		0.05		0.1	
Vinyl chloride	*0.0000015*		0.00001		0.002	
Total xylenes	*0.4*		0.053		10	
SEMIVOLATILE ORGANICS						
Benzo(a)anthracene	*0.0001*		0.0000479		0.0002	(e)
Benzo(a)pyrene	*0.0002*		0.00000479		0.0002	(e)
Benzo(b or k)fluoranthene	*0.0002*		0.0000479	(d)	0.0002	(e)
1,4-Dichlorobenzene(para-)	*0.0018*		NA		0.075	
1,2-Dichloropropane	*0.00056*		0.00056		0.005	
Carbazole *	*0.005*		NA		NA	
Chrysene	*0.0002*		0.00479		0.0002	(e)
Indeno(1,2,3-cd)pyrene	*0.0004*		0.0000479		0.0002	(e)
Naphthalene *	*0.1*		6.024		NA	
Pentachlorophenol	*0.001*		0.0003		0.001	
TOTAL METALS						
Antimony	*0.006*		NA		0.006	
Barium	*1.0*		2.0		2.0	
Beryllium	*0.004*		NA		0.004	
Chromium	*0.05*	(f)	0.05		0.1	(f)
Lead	*0.015*		0.015		0.015	
Manganese	*0.05*		0.05		0.05	(g)
Nickel	*0.1*		0.01		NA	
Vanadium *	*0.2*		NA		NA	

* Remediation standard was risk-based, not ARAR-based.
NA = Not available in source cited

Shaded values are lower than remediation level.
Boxed values are changed from the remediation level.

(a) As cited in the ROD *(USEPA, 1992)*.
(b) Per 15A NCAC 2L .0202, as amended 8/1/2002. Class "GA" is existing or potential source of drinking water for humans.
(c) National Primary Drinking Water Standards, Maximum Contamination Levels(MCLs) *(USEPA, 2003)*.
(d) Standard for benzo(b) is 4.79E-05, for benzo(k) is 4.79E-04 mg/L.
(e) MCL for BaP (PAHs).
(f) Value is for total chromium.
(g) National Secondary Drinking Water Standards *(USEPA, 2003).*

ecological risk assessment would most likely not qualify as a screening level risk assessment under CERCLA. However, commercial development of the Site is planned, and there is nothing present at the Site that would indicate that an in-depth ecological risk assessment is warranted.

Since the baseline risk assessment process does not allow for institutional controls, a new risk assessment would likely result in the same human exposure pathways being of primary concern, i.e., the potential ingestion of groundwater and dermal contact by future residents. Also, even though some of the toxicity factors have changed, few of the remediation levels were risk-based, and many of the COCs would be expected to be the same.

5.5 Community Involvement

During the RI/FS, there was considerable community interest in the site. The property was sold at a property tax auction in 2002. The Remedial Project Manager (RPM) was present during the auction to answer questions from perspective bidders. The purchaser of the property was Haywood Vocational Opportunities, Incorporated (HVO). HVO maintains a vocational training center on property adjacent to the site. They intend to expand this operation to include building a new facility on the Site During the five-year review process a meeting between the inspection team and Mr. George Marshall, President of HVO, was held to discuss HVO's plans for the property.

5.6 Site Inspection

The site inspection was performed on March 19, 2003. Participants included Ms Rebecca Terry (Chemist - USACE), Mr. Doug Mullendore (Engineer - USACE), and Mr. David Traylor (Engineer - Mountain Environmental Services). Ms Terry and Mr. Mullendore arrived onsite at approximately 0830 and inspected extraction wells, the equalization tank, and many of the monitoring wells. During the investigation it was noted a gap existed in the Site's perimeter fencing. This gap was the result of the property owner removing an old water tower that was deemed a safety hazard. In the current condition the site was freely accessible to anyone desiring to enter it. The property owner had installed a fence and gate to protect the equalization tank from trespassers. The gate was secured by lock and chain, but neither extraction wells' protective housing was secured by a lock and some of the monitoring wells were unlocked. With this exception the site appeared to be well kept.

Freeze protection (insulation) had been added to the above ground piping of both extraction wells and at the POTW discharge point of the equalization tank. Additionally, the concrete pad around each extraction well had been repaired. Both actions had been taken as a result of the above ground water lines freezing and bursting during the winter.

After the site walkover the USACE team reviewed operation and maintenance information provided by Mr. Traylor. It appears that sufficient spare parts are kept onsite to minimize system downtime. Preventive maintenance is not performed on the extraction system. However, no significant operational shortcomings resulting from poor maintenance were identified.

There were no areas on site where an accidental public exposure to soil not meeting the performance standard could occur.

See **Appendix D** for photos taken of the Site during the site inspection.

See **Appendix E** for the Site Inspection Checklist.

5.7 Interviews

During the site visit the team interviewed two individuals. The first Mr. David Traylor is a Civil Engineer working for MES, the site's O&M contractor. Mr. Traylor supplied the team with operation and maintenance information.

The other interview was with Mr. George M. Marshall, the President of Haywood Vocational Opportunities, Inc. (HVO). HVO is the current owner of the property. Mr. Marshall provided insight on his company's development plans for the property. He also provided a copy of the deed, which can be found in **Appendix A**. It was evident during the interview that Mr. Marshall was aware of the deed restriction and all of its components. He stated that at the present time HVO had submitted a "fill plan" to the Federal Emergency Management Agency (FEMA). The purpose of this plan was to gain FEMA's approval of raising the property out of the 100-year flood plain. Mr. Marshall did not have any idea when FEMA's approval would be forthcoming.

USEPA performed other interviews with citizens of the surrounding area during May 2003. In general, these interviews revealed no public concerns with the remedial action. The interview questionnaires are included in **Appendix F** of this report.

6.0 Technical Assessment

6.1 Question A: *Is the remedy functioning as intended by the decision documents?*

While levels of groundwater contamination have dropped in many of the monitoring wells since the beginning of the remedial action, it is questionable as whether or not the groundwater extraction system is functioning as intended by the decision documents. The groundwater system is not operating as efficiently as it could. Based on observations discussed earlier, it is unlikely groundwater will be restored to concentrations less than the remediation levels, or that the plume will be contained using the current extraction system configuration. This inefficiency is not caused by physical limitations of the aquifer, but instead by the designed depths of extraction wells relative to the depth of the contaminant plume and the small volume of water being removed.

Although soil with contaminant concentrations above the soil remediation levels identified in the ROD are still present onsite, the remedy can be considered to be functioning as intended, since the ESD allowed such material to be present as long as it was not leachable, was buried to prevent direct exposure, and was monitored. The purpose of the monitoring was to determine if any significant biological degradation was occurring. Such contamination is limited to areas where treated soils not meeting the treatment standards were buried onsite. Since only a limited amount of analytical data is available it is difficult to determine whether any biodegradation has occurred.

6.2 Question B: *Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy still valid?*

As discussed above in Section 5.4, ARARs have changed since the ROD was prepared. Most significant are the North Carolina groundwater standards; these are much lower than MCLs or the ROD performance standards. Many toxicity factors have also changed since 1992. It does not appear that the original exposure scenarios relevant to the Site have changed to any degree, except that there are now deed restrictions to preclude certain types of future site development (specifically, residential).

The sediment data collected for the Five Year Review (October 2002) indicated exceedances of some of the screening levels given in the ROD However, as discussed in Section 5.3.4, due to the conservatism inherent in the sediment screening criteria, and the low levels detected in sediment, these exceedances do not suggest that additional evaluation of Browning Branch is necessary.

Ecological risks would probably be evaluated differently under current USEPA guidance. However, commercial development of the Site is planned, and there is nothing present at the Site that would indicate that an in-depth ecological risk assessment is warranted.

Even though changes have occurred in ARARs, toxicity factors, and risk guidance, the RAOs and cleanup levels appear to be appropriate to the Site, and sufficient for the protection of human health and the environment.

6.3 Question C: *Has any other information come to light that could call into question the protectiveness of the remedy?*

No additional information has come to light that could call into question the protectiveness of the remedy.

6.4 Technical Assessment Summary

The most significant issue regarding the protectiveness of the remedy is whether the groundwater extraction system is containing and capturing the contaminant plume in the most efficient manner. Regardless of whether the system is capturing the plume, the location of the extraction well screens causes for a large amount of clean water to be extracted with the contaminated groundwater, lowering the efficiency of the extraction system.

7.0 Issues

The most significant operational Issues that should be addressed are the inability of the groundwater extraction, as it is currently designed, to contain the contaminant plume and restore the ground water quality in the shortest possible time and the locking of all monitoring and extraction well cases. An additional issue, related to the monitoring of the system, is the ability of the analytical program to meet Data Quality Objectives on many levels. The comparability through approved methods, reporting limits, standardized data verification/validation should be addressed for future monitoring events.

8.0 Recommendations and Follow-up Actions

Recommended and follow-up actions are included in Table 10.

9.0 Protectiveness Statement

Since all source material containing leachable contaminants has been removed from the site, it is expected that a re-designed groundwater extraction system will be capable of meeting the remedial action objectives.

The remedy is expected to be protective of human health and the environment upon attainment of the groundwater cleanup goals. In the interim, exposure pathways that could result in unacceptable risks are being controlled, and institutional controls are preventing exposure to contaminated soils and groundwater. All threats at the Site have been addressed through removal and treatment of contaminated soils, burying and covering of soils not meeting the remediation levels, the installation of fencing, and the implementation of institutional controls.

10.0 Next Review

The next Five Year Review for the Benfield Industries Superfund Site is scheduled for August 2008, five years from the date of this review.

Table 10. Summary of Recommendations and Follow-Up Actions				
Recommendations			**Follow-up Actions: Affects Protectiveness? (Y/N)**	
	Responsible Party/Agency	**Milestone Date**	**Current**	**Future**
Improve Monitoring Data Results and Reporting by: • Show actually Reporting Limits instead of "ND" or "<" and ensure those limits are less than the ground water performance standards. • Data submittals in the future should provide all QC results for associated data.	USEPA	2003	N	N
Increase rate of groundwater extraction, by the installation of new wells or trenches screened nearer the zone of contamination, to ensure plume containment and groundwater remediation	USEPA	2004	N	Y
Evaluate the effectiveness of monitored natural attenuation as a remediation technology for this site	USEPA	2008 (next Five-Year Review Report)	N	N
Secure all monitoring and extraction wells	USEPA	2003	Y	Y

11.0 References

B & V Waste Science & Technology Group (B&V), 1992. *Risk Assessment Report for the Benfield Industries Site, Hazelwood, NC, Volume I*, May 29, 1992.

Mountain Environmental Services (MES), 2003. *October 2002 Sampling Report.*

USEPA, 2003a. Memorandum from David S. Burden, Ph, D, Director, Groundwater Technical Support Center to Jon Bornholm, RPM, USEPA 4, January 16, 2003.

USEPA, 2003. Online integrated risk information system (IRIS), http://www.epa.gov/iriswebp/iris/index.html, March 2003.

USEPA, 2002a. *Comprehensive Five-Year Review Guidance*, EPA 540-R-01.007, June 2001.

USEPA, 2002b. *Addendum to Operation and Maintenance (O&M) Manual, Groundwater Extraction System,* September 2002,

USEPA, 2002c. *Interim Remedial Action Report*, May 2002.

USEPA, 2001a. *Operation and Maintenance (O&M) Manual for the Groundwater Extraction System*, October 2001.

USEPA, 2001b. *Explanation of Significant Differences*, October 2001.

USEPA, 1995. *Amendment to the Record of Decision Remedial Alternative Selection, the Benfield industries Site, Hazelwood, Maywood County, North Carolina*, June 1995.

USEPA, 1992a. *Record of Decision Remedial Alternative Selection, the Benfield industries Site, Hazelwood, Haywood County, North Carolina,* July 31, 1992.

USEPA, 1992b. *Feasibility Study Report for The Benfield industries Site,* July 18, 1992.

Appendix A – Copy of Property Deed

BK 0516 PG 2051

8605-82-2326

TRANSFER MADE ON RECORD
Date 3/19/02
By SMM

Haywood County--Register of Deeds
Amy R. Murray
Inst #562692 Book 516 Page 2051
03/19/2002 04:03:01pm

STATE OF NORTH CAROLINA
COUNTY OF HAYWOOD

SHERIFF'S DEED

This deed, made this 19th day of March, 2002, by and between R. T. Alexander, Sheriff of Haywood County, North Carolina, party of the first part, and HVO Properties, LLC, parties of the second part, 56 Scates St. Waynesville, NC 28786

WITNESSETH

That whereas the party of the first part, being duly authorized by an execution issued upon a certain judgment docketed in the office of the Clerk of the Superior Court for Haywood County in a proceeding entitled "Haywood County a body politic and corporate vs. T. G. Benfield," (File #1999M216), and after due advertisement in accordance with law, did offer for sale and did sell, at public auction for cash to the highest bidder, at the courthouse door in Haywood County, on the 21 day of December, 2001, real property herein described, when and where HVO Properties, LLC became the last and highest bidder for the same at the price of $130,000.00; and

Whereas more than ten days have elapsed since the report of the sale was filed with the clerk of the superior court and no increased bid has been filed, and the sale having been confirmed by order of the superior court, and HVO Properties, LLC, party of the second part, has fully paid the amount of the bid to the party of the first part;

Now, therefore, in consideration of the premises and in further consideration of the sum of One Hundred Thirty Thousand Dollars ($130,000.00) in hand paid to the party of the first part by the party of the second part, receipt of which is hereby fully acknowledged, the party of the first part does hereby give, grant, bargain, sell, and convey unto the party of the second part, its heirs and assigns, all of the lot, tract, or parcel of real estate in Waynesville Township, Haywood County, North Carolina, and being more particularly bounded and described as follows:

SEE ATTACHED SCHEDULE "A"

For more particular description, see deed from Clyde Savings and Loan Association to T. G. Benfield, recorded in Deed Book 276, page 601, less out conveyances Deed Book 277, page 304 and Deed Book 410, page 82 in the Office of the Register of Deeds of Haywood County. Parcel Number 8605-82-2326, 6.020 acres, Waynesville Township.

SUBJECT TO the Declaration of Perpetual Land Use Restrictions attached hereto as Exhibit "B".

To have and to hold the above-described premises and all privileges and appurtenances thereunto appertaining, to the party of the second part, his heirs and assigns, to their only use and behoof forever free and clear of all encumbrances except all outstanding city and county taxes and all local improvement assessments against the above-described property not included in the judgment in the above-entitled cause in as full and ample manner as the party of the first part is authorized and empowered to convey the same;

In witness whereof, the party of the first part has hereunto set his hand and seal, the day and year first above written.

R. T. [signature] (SEAL)
Sheriff

State of North Carolina
County of Haywood

I, Janice Corn, notary public in and for the county of Haywood, do hereby certify that R. T. Alexander, Sheriff of Haywood County personally appeared before me this day and acknowledged the due execution of the foregoing deed as his or her own act and deed.

Witness my hand and official seal, this 19th day of March, 2002.

Janice Corn
Notary Public

My commission expires: 10/19/03

JANICE CORN NOTARY PUBLIC HAYWOOD CO. N.C.

State of North Carolina, Haywood County
The Foregoing Certificate(s) of JANICE CORN /NP
is (are) Certified to be Correct
This Instrument was filed for Registration on the 19th Day of March, 2002 in the Book and Page shown on the First Page hereof
Amy R. Murray By [signature] Asst.
Amy R. Murray

Inst # 562602 Book 516 Page: 2053

SCHEDULE "A"

BEGINNING on a stake in the Westerly margin of Richland Avenue ire the Town of Hazelwood, said stake being at the Southeasterly corner of the Allen Silver lot and formerly corner of the J.P. Scates lot, and runs thence South 7 deg. 30 min. East with the margin of Richland Avenue 913 feet to a stake; thence South 8 deg. 45 min. West, 38 feet to a stake; thence South 24 deg. West, 53 feet to a stake, McKay's corner; thence South 80 deg. West, 80 feet to a stake; McKay corner in Winchester old line; thence South 34 deg. East, 128 feet to a box elder; thence South 43 deg. East, 164 feet to a sycamore, corner of lot formerly owned by L Scates; thence with the L. Scates line, South 88 deg. 30 min. West, 650 feet to the Easterly rail of spur track of the Southern Railroad; thence with said Easterly rail in a Northerly direction to the intersection of the main line of said railroad, and with said Easterly rail of the main line of said railroad a total distance of 1275 feet to a stake at the Southwesterly corner of the Allen-Siler lot; thence with the line of said lot in art Easterly direction 170 feet to the BEGINNING, containing Twelve (12) acres, more or less.

SAVE AND EXCEPT the parcel of land granted and conveyed from T. G. Benfield to J. H. Sawyer by that certain deed dated October 7, 1975, and recorded in Book 277, page 304, in the Haywood County Public Registry, end more particularly described as follows:

BEGINNING at a stake in the northerly margin of Scates Street where it intersects with the eastern rail of the spur line of the Southern Railway tracks and runs thence with the easternmost rail of the spur line and of the main line of the Southern Railway three (3) calls as follows: North 5 deg. 02 min. East, 95.19 feet, North 8 deg. 49 min. East, 119.17 feet, and North 13 deg. 15 min. East, 426.82 feet; thence leaving the railway South 76 deg. 45 min. East, 181.40 feet (passing through iron posts at 80.00 feet and 160.00 feet respectively) to the center of a creek; thence with the center of the creek seven (7) calls as follows: South 21 deg. 25 min. East, 141.33 feet to a point (which is offset North 54 deg. 32 min. East, 12.40 feet from an iron stake), South 23 deg. 40 min. East, 107.82 feet to a point (which is offset North 25 deg. 24 min. East, 13.70 feet from an iron stake), South 35 deg. 13 min. East, 79.26 feet to a point directly beneath the center wire of the Carolina Power & Light Company high voltage line (which point is offset North 82 deg. 40 min. East, 13.70 feet from an iron stake), South 1 deg. 57 min. East, 73.59 feet to a point (which point is offset South 53 deg. 07 min. East, 15.00 feet from an iron stake), South 31 deg. 47 min. East, 67.18 feet to a point (which is offset North 27 deg. 32 min. East, 12.00 feet from an iron stake), South 53 deg. 53 min. East, 88.24 feet to a point (which is offset North 73 deg. 00 min. East, 10.00 feet from an iron stake), and South 39 deg. 59 min. East, 120.55 feet to a point on the bridge where Scates Street crosses said creek; thence with the northern margin of Scates Street South 88 deg. 30 min. West, 628.45 feet to the BEGINNING and containing 5.257 acres as per survey and plat of Gordon K. Stebbins & Assos., dated September, 1975, entitled "Property of Tom Benfield, Waynesville Township, Haywood County."

Inst # 562602 Book 516 Page: 2054

EXHIBIT “B”

DECLARATION OF PERPETUAL LAND USE RESTRICTIONS

Benfield Industries Superfund Site,
Haywood County, North Carolina

This Declaration is part of a Remedial Action Plan for the Benfield Industries Superfund Site (hereinafter referred to as the “Site”) that has been approved by the Secretary of the North Carolina Department of Environment and Natural resources (or its successor in function), or his/her delegate, as authorized by NCGS Section 130A-310.3 (f). The North Carolina Department of Environment and Natural resources shall hereinafter be referred to as “NCDENR.” The authority to place this Declaration on this property is provided through North Carolina General Statutes, Section 130A-310 through Section 130A-310.19.

For the purpose of protecting public health and the environment, it is declared that all of the real property described on Schedule “A” be held, sold and conveyed subject to the following perpetual land use restrictions, which shall run with the land; shall be binding on all parties having any right, title or interest in the above-described property or any part thereof, their heirs, successors and assigns; and shall, as provided in NCGS Section 130A-314.3 (f), be enforceable without regard to lack of privity of estate or contract, lack of benefit to particular land, or lack of any property ingest in particular land. These restrictions shall continue in perpetuity and cannot be amended or canceled unless and until the Haywood County Register of Deeds receives and records the written concurrence of the Secretary of NCDENR (or its successor in function), or his/her delegate.

PERPETUAL LAND USE RESTRICTION

- The Site may be maintained as open space. "Open space" for purposes of this restriction means an undeveloped, natural area where the sole human use shall be non-dermal recreational activities such as biking, running, hunting, fishing, and bird watching. The real property shall not be developed or utilized for residential purposes, although this property can be developed either for commercial or industrial purposes.

- The Site may be used for any above-ground construction or other improvements (including, but not limited to, utilities, roads, and sidewalks). No alteration, disturbance, or removal of the existing soil, landscape and contours shall occur other than erosion control measures approved by NCDENR, except that additional construction backfill maybe brought to the site without a restriction to fill height. If any Site activities require excavating more than a foot below the existing surface, approval from the Superfund Section of NCDENR shall be obtained. No on-site activities shall occur that will result in exposing the people to either contaminants in the soil or the ground water.

- Any surface or underground water located at the Site within the open space area shall not be used for swimming or as a source of potable water.

- The Site shall not be used for mining, extraction of coal, oil, gas or any other minerals or non-mineral substances.

- Mowing of vegetation and tree cutting is allowed on the Site.

ENFORCEMENT

The above land use restrictions shall be enforced by any owner, operator, or other party responsible for the Site. The above land use restrictions may also be enforced by NCDENR through the remedies provided in NCGS Chapter 130A, Article 1, Part 2 or by means of a civil action, and may also be enforced by any unit of local government having jurisdiction over any part of the Site. Any attempt to cancel this Declaration without the approval of NCDENR or its successor in function shall constitute noncompliance with the Remedial Action approved by NCDENR for the Site, and shall be subject to enforcement by NCDENR to the full extent of law. Failure by any party required or authorized to enforce any of the above restrictions shall in no event be deemed a waiver of the right to do so thereafter as to the same violation or as to one occurring prior or subsequent thereto.

NOTICE

Hazardous substances were stored, released and/or disposed of it the Site. Following is a description of remedial action taken, or to be taken, at the Site in order to protect public health and the environment.

The Remedial Action conducted at this Superfund site occurred under the authority of vested the President of the United States in the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended ("CERCLA"), 42 U.S.C. § 9606(a). This authority was delegated to the Administrator of U. S. Environmental Protection Agency (hereinafter "EPA") on January 23, 1981, by Executive Order 12580 (52 Fed. Reg. 2926, January 29, 1987), and was further delegated to EPA Regional Administrators on September 13, 1987, by EPA Delegation No. 14-14-B and re-delegated to the Director, Waste Management Division, EPA Region 4 on January 5, 1989, by Regional Delegation No. 8-14-A.

The objectives of the Remedial Action were specified in a July 30, 1992 Record of Decision, as amended by a June 15,1995 Record of Decision Amendment. Specifically, the Remedial Action consisted of:

- Construction of an on-site land treatment unit (hereinafter "LTU") on which to treat the contaminated soils. The LTU was bermed and lined to protect the underlying soil from being contaminated during treatment. Following treatment of the soils and during the dismantling of the LTU, the soils beneath the liner of the LTU will be tested to confirm that these soils have not been adversely impacted.

- Soils encountered during the construction of the LTU that were contaminated with pentachlorophenol above the performance standard were removed and disposed of off-site.

- An underground storage tank was uncovered and removed.

- All known contaminated soils (approximately 27,800 tons or 23,170 cubic yards) were excavated, screened to remove the cobble, and transported to the LTU. The screened soil was mixed with hay and manure and arranged in windrows in the LTU. This mixture was aerated via a track-hoe and kept moist. The cobbles were steamed cleaned and returned to the excavation. The treated soils were also returned to the excavation. Those soils that achieved all the performance standard were segregated out and used as the top cover for the excavation. The rest of the soil was replaced in the excavation.

- A groundwater extraction system was installed to address contaminated groundwater. The groundwater extraction system includes two on-site extraction wells, the necessary piping and electrical connections, a 10,000 gallon above ground storage/equalization tank, and a discharge line to the City of Waynesville sewer system. Groundwater samples and groundwater levels will be collected from up to 33 monitoring well/piezometers. These monitoring wells/piezometers are located on and off site. Groundwater samples are being collected to track the quality of the groundwater and groundwater levels are being measured to evaluate the effectiveness of hydraulic control established by the groundwater extraction system.

- As required by Section 121(c) of the CERCLA, as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986, Five-Year reviews of the Remedial Action will occur until the levels of contamination in the groundwater drop to or below the performance standards specified in the 1992 Record of Decision.

HAZARDOUS SUBSTANCES REMAIN ON THE SITE, BUT ARE NOT A DANGER TO PUBLIC HEALTH AND THE ENVIRONMENT, PROVIDED THAT THE ABOVE

RESTRICTIONS, AND ANY OTHER MEASURES REQUIRED BY NCDENR, ARE STRICTLY COMPLIED WITH. In addition to this Declaration, a Notice of Inactive Hazardous Substances or Waste Disposal Site, constituting a survey plat identifying the type, location and quantity of hazardous substances remaining on the Site and approved by NCDENR pursuant to NCGS Section 130-A-310.8 shall be recorded at the Haywood Register of Deeds Office.

FUTURE SALES, LEASES, CONVEYANCES AND TRANSFERS

When any portion of the Site is sold, leased, conveyed or transferred, pursuant to NCGS Section 130-A-310.8 (c) the deed or other instrument of transfer shall contain in the description section, in no smaller type than that used into body of the deed or instrument, a statement that the above-described real property has been used as a hazardous substance or waste disposal site and a reference by book and page to the recordation of the Notice of Inactive Hazardous Substance or Waste Disposal Site referenced in the preceding paragraph above.

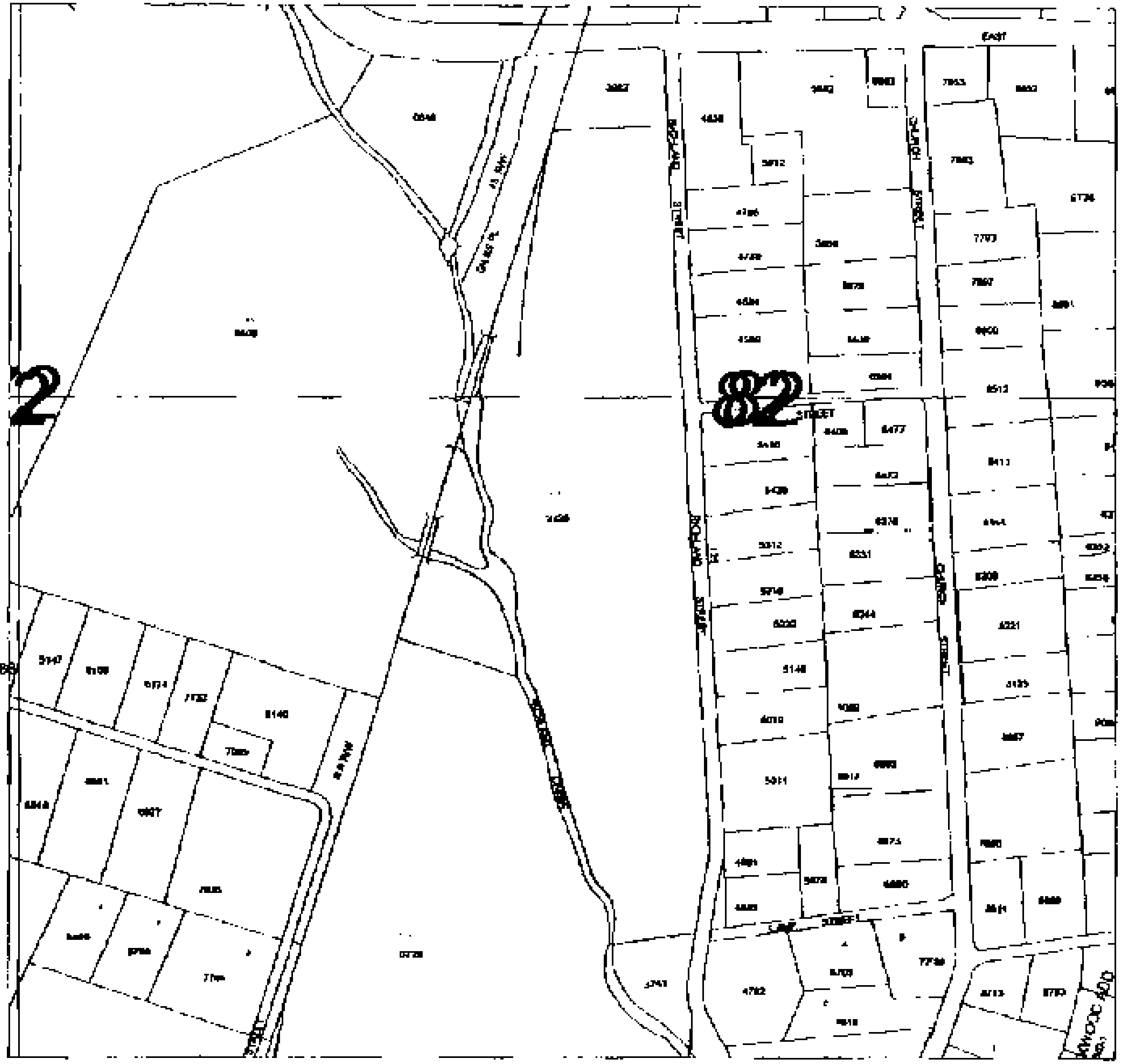
Haywood County

Land Records / GIS

Version September 2002

1 Inch = 192.8788 Feet.

Date : 11/18/2002



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PIN=8605822326
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NAME2=No data
ADDRESS1=58 SCATE ST
ADDRESS2=No data
CTY_ST_ZIP=WAYNESVILLE, NC 28786
MAPSHEET=8605.20
LEGAL_REF1=516/2051
LEGAL_REF2=No data
ADD_REF1=No data
ADD_REF2=No data
CALC_ACRES=6.0178
STREET_ADD=30 RIVERBEND ST
SALE_DATE=03/19/2002
SALE_PRICE=130000
PROP_DESC=30 RIVERBEND ST
SUBDIV_COD=No data
SUBDIV_NAM=No data
TOT_MKT_VA=104258
TOT_BLD_VA=13958
MAIN_AREA=0
YR_BUILT=0
LAND_VALUE=90300
DEFER_VAL=0
TO_ASSD_VA=104258
ACCT_NO=145295
TOWNSHIP=15
SALE_DATE2=No data
SALE_P[illegible]

Appendix B - O&M Monitoring Data (1991 - October 2002)

APPENDIX B1
GROUNDWATER RESULTS (1991-2002)

Benfield Industries Site – Waynesville, North Carolina

Well Number	Remediation	MW02SH						MW02DP					
	Level												
Sample Date	**(ug/L)**	**1991**	**1994**	**Aug-01**	**Feb-02**	**Jul-02**	**Oct-02**	**1991**	**1994**	**Aug-01**	**Feb-02**	**Jul-02**	**Oct-02**
Volatile Organic (ug/L)													
1,1,1-Trichloroethane	NA												
1,1-Dichlorobenzene	NA												
1,1-Dichloroethane	NA												
1,2,4-Trichlorobenzene	NA												
1,2,4-Trimethylbenzene	NA												
1,2-Dichlorobenzene	NA												
1,2-Dichloroethane	NA												
1,2-Dichloropropane	0.56												
1,3,5-Trimethylbenzene	NA												
1,3-Dichlorobenzene	NA												
1,4-Dichlorobenzene	1.8	1.8	ND	10U	10U	10U	10U						
2-Butanone	NA												
2-Chlorotoluene	NA												
4-Isopropyltoluene	NA												
Acetone	NA												
Benzene	5												
Carbon disulfide	NA												
Chlorobenzene	100												
Chloroethane	NA												
Chloroform	NA							2J	ND	10U	10U	10U	10U
cis-1,2-Dichloroethene	NA												
Ethyl benzene	NA												
Isopropylbenzene	NA												
Methylcyclohezene	NA												
Naphthalene	NA												
n-Propylbenzene	NA												
sec-Butylbenzene	NA												
t-Butylbenzene	NA												
Tetrachloroethene	NA												
Toluene	NA							3J	ND	10U	10U	10U	10U
Total xylenes	400												
Trichloroethane	NA												
Vinyl chloride	0.0015												

1. Blank = not historically detected.
2. Boxed = or exceeds RL Bold; DLs = or exceed RL
3. ND – Not detected. DL unknown.
3. U = Not detected at premium quantization limit.

4. J – Est. value; NA – Not analyzed.
5. Source: Mountain Env. (2003)

APPENDIX B1
GROUNDWATER RESULTS (1991-2002)

Benfield Industries Site – Waynesville, North Carolina

B-2

Well Number	Remediation	MW02SH						MW02DP					
	Level												
Sample Date	(ug/L)	1991	1994	Aug-01	Feb-02	Jul-02	Oct-02	1991	1994	Aug-01	Feb-02	Jul-02	Oct-02
Semivolatile Organics (ug/L)													
1,1-Biphenyl	NA												
2-Chloronaphthalene	NA												
2-Methylnaphthalene	NA												
2-Methylphenol	NA												
Acenaphthalene	NA												
Acenaphthylene	NA												
Anthracene	NA												
Benzo(a)anthracene	0.1	0.1	ND	10U	10U	10U	10U						
Benzo(a)pyrene	0.2	0.2	ND	10U	10U	10U	10U						
Benzo(b or k)fluorethane	0.2	0.2	ND	10U	10U	NA	NA						
Benzo(b)fluorethane	NA												
Benzo(g,h,i)perylene	NA												
Benzo(k)fluoranthene	NA												
Benzyl butyl phthalate	NA												
Bis (2-ethylexyl) phthalate	NA												
Caprolactan	NA	ND	ND	2J	10U	10U	10U						
Carbonzole	5	5	ND	10U	10U	10U	10U						
Chysene	0.2	0.2	ND	10U	10U	10U	10U						
Dibenzo(a,h)anthracene	NA												
Dibenzofuran	NA												
Di-n-buthylphthalate	NA												
Di-n-octylphthalate	NA												
Fluoranthene	NA												
Fluorene	NA												
Indeno (1,2,3-cd)pyrene	0.4												
Naphthalene	100	100	ND	10U	10U	10U	10U						
Pentachlorophenol	1												
Pentananthrene	NA												
Pyrene	NA												

1. Blank = not historically detected.
2. Boxed = or exceeds RL Bold; DLs = or exceed RL
3. ND – Not detected. DL unknown.
3. U = Not detected at premium quantization limit.
4. J – Est. value; NA – Not analyzed.
5. Source: Mountain Env. (2003)

APPENDIX B1
GROUNDWATER RESULTS (1991-2002)

Benfield Industries Site – Waynesville, North Carolina

Well Number	Remediation	MW02SH						MW02DP					
	Level												
Sample Date	**(ug/L)**	**1991**	**1994**	**Aug-01**	**Feb-02**	**Jul-02**	**Oct-02**	**1991**	**1994**	**Aug-01**	**Feb-02**	**Jul-02**	**Oct-02**
Total Metal (ug/L)													
Aluminum	NA	NA	NA	NA	2,000 J	1200	100 U	NA	NA	NA	2,000 J	2200	290
Antimony	6	ND	83	NA	4.0U	1.6 U	1.0 U						
Arsenic	NA												
Barium	1000	1000	8100	NA	59	66J	47	30	ND	NA	82	120J	74
Beryllium	4	ND	15	NA	1.0U	0.20U	1.0U						
Cadmium	NA							ND	ND	NA	2.6	1.7U	1.0U
Calcium	NA	NA	NA	NA	7200	6700	7500	NA	NA	NA	7200	8900	9900
Chromium	50	50	600	NA	4.2	3.3R	1.0 U	19	ND	NA	7.5	9.7	1.0 U
Cobalt	NA	ND	240	NA	3.0 R	1.3U	1.0 U	ND	ND	NA	3.6 R	3.4U	1.0 U
Copper	NA	NA	NA	NA	3.9	4.1U	1.0 U	NA	NA	NA	9.2	7.6U	1.0 U
Iron	NA	NA	NA	NA	3300	2300	700	NA	NA	NA	2900	5000	1200
Lead	15	15	380	NA	2.0U	1.0U	2.0 U	4	ND	NA	2.5	5.6	2.0 U
Magnesium	NA	NA	NA	NA	2300	2000	2000	NA	NA	NA	1400	1900	1500
Manganese	50	NA	8200J	NA	540	500	580	19J	ND	NA	130	400	310
Mercury	NA	ND	0.88	NA	0.10U	0.10U	0.10U						
Nickel	100	NA	250	NA	2.0U	2.1R	1.0 U	NA	ND	NA	4.1	4.9	1.4 R
Potassium	NA	NA	NA	NA	1700	1800	1600	NA	NA	NA	2700	3000	2600
Selenium	NA												
Silver	NA												
Sodium	NA	NA	NA	NA	3000J	3700	3300 J	NA	NA	NA	3,500 J	3700	3,300
Thallium	NA												
Vanadium	200	ND	1100	NA	5.5	4.0U	1.0 U	NA	ND	NA	5.7	6.7 U	1.0U
Zinc	NA	NA	NA	NA	33	13	9.2 J	NA	NA	NA	60	34	8.8 J

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2. Boxed = or exceeds RL Bold; DLs = or exceed RL
3. ND – Not detected. DL unknown.
3. U = Not detected at premium quantization limit.
4. J –Est. value; NA – Not analyzed.
5. Source: Mountain Env. (2003)

APPENDIX B1
GROUNDWATER RESULTS (1991-2002)

Benfield Industries Site – Waynesville, North Carolina

Well Number	Remediation Level (ug/L)	MW03SH					MW03S					
Sample Date		1994	Aug-01	Feb-02	Jul-02	Oct-02	1991	1994	Aug-01	Feb-02	Jul-02	Oct-02
Volatile Organic (ug/L)												
1,1,1-Trichloroethane	NA											
1,1-Dichlorobenzene	NA											
1,1-Dichloroethane	NA											
1,2,4-Trichlorobenzene	NA	ND	21	23	18	8 J						
1,2,4-Trimethylbenzene	NA											
1,2-Dichlorobenzene	NA											
1,2-Dichloroethane	NA	9J	10U	10U	10U	10U	22J	ND	10U	10U	10U	10U
1,2-Dichloropropane	0.56											
1,3,5-Trimethylbenzene	NA											
1,3-Dichlorobenzene	NA	5J	10U	10U	10U	10U	ND	5J	10U	10U	10U	10U
1,4-Dichlorobenzene	1.8	ND	6J	6J	10U	7J						
2-Butanone	NA											
2-Chlorotoluene	NA											
4-Isopropyltoluene	NA											
Acetone	NA						ND	66	10U	10U	10U	10U
Benzene	5	1J	10U	10U	10U	10U						
Carbon disulfide	NA											
Chlorobenzene	100											
Chloroethane	NA											
Chloroform	NA						ND	22	10U	10U	10U	10U
cis-1,2-Dichloroethene	NA											
Ethyl benzene	NA	180	4J	3J	4J	1J	380	52	10U	10U	10U	10U
Isopropylbenzene	NA											
Methylcyclohezene	NA	ND	130	140	160	58						
Naphthalene	NA											
n-Propylbenzene	NA											
sec-Butylbenzene	NA											
t-Butylbenzene	NA											
Tetrachloroethene	NA											
Toluene	NA	190	10U	10U	10U	10U	830	30	10U	10U	10U	10U
Total xylenes	400	850	25	19	16	7J	1800	320	10U	10U	10U	10U
Trichloroethane	NA											
Vinyl chloride	0.0015											

1. Blank = not historically detected.
2. Boxed = or exceeds RL Bold; DLs = or exceed RL
3. ND – Not detected. DL unknown.
3. U = Not detected at premium quantization limit.
4. J – Est. value; NA – Not analyzed.
5. Source: Mountain Env. (2003)

APPENDIX B1
GROUNDWATER RESULTS (1991-2002)

Benfield Industries Site – Waynesville, North Carolina

Well Number	Remediation Level	MW03SH					MW03S					
Sample Date	(ug/L)	1994	Aug-01	Feb-02	Jul-02	Oct-02	1991	1994	Aug-01	Feb-02	Jul-02	Oct-02
Semivolatile Organics (ug/L)												
1,1-Biphenyl	NA	ND	360 J	450 J	61 J	10U						
2-Chloronaphthalene	NA											
2-Methylnaphthalene	NA	430J	1200	1300	220	10U	250J	430J	10U	10U	10U	10U
2-Methylphenol	NA											
Acenaphthalene	NA	520J	1600	2100	560	10U	330J	520J	10U	10U	10U	10U
Acenaphthylene	NA	58 J	110 J	130 J	23J	10U	28J	58J	10U	10U	10U	10U
Anthracene	NA	23J	740 J	720 J	91J	10U	13J	23J	10U	10U	10U	10U
Benzo(a)anthracene	0.1	11J	470 J	490 J	64J	10U	ND	11J	10U	10U	10U	10U
Benzo(a)pyrene	0.2	4 J	220 J	210 J	21J	10U	ND	4J	10U	10U	10U	10U
Benzo(b or k)fluorethane	0.2	9J	NA	NA	NA	NA	ND	9J	NA	NA	NA	NA
Benzo(b)fluorethane	NA	NA	150 J	280 J	25J	10U						
Benzo(g,h,i)perylene	NA	ND	36	1000U	100U	10U						
Benzo(k)fluoranthene	NA	NA	300 J	130 J	24J	10U						
Benzyl butyl phthalate	NA	ND	43	1000U	100U	10U						
Bis (2-ethylexyl) phthalate	NA	ND	330 J	1000U	100U	10U						
Caprolactan	NA											
Carbonzole	5	150J	56	1000U	10J	10U	45J	150J	10U	10U	10U	10U
Chysene	0.2	6J	400 J	380J	41J	10U	ND	6J	10U	10U	10U	10U
Dibenzo(a,h)anthracene	NA	ND	20	1000U	100U	10U						
Dibenzofuran	NA	370J	1300	1800	430	10U	230J	370J	10U	10U	10U	10U
Di-n-buthylphthalate	NA	ND	51	1000U	100U	10U						
Di-n-octylphthalate	NA	ND	11	1000U	100U	10U						
Fluoranthene	NA	71J	2100	2400	450	10U	21J	71J	4 J	10U	1J	10U
Fluorene	NA	360J	1500	2100	470	10U	220J	360J	10U	10U	10U	10U
Indeno (1,2,3-cd)pyrene	0.4	ND	52	1000U	100U	10U						
Naphthalene	100	1300J	240 J	280 J	65J	10U	590J	1300J	10U	10U	10U	10U
Pentachlorophenol	1											
Pentananthrene	NA	410J	5200	5100	1100	10U	250J	410J	10U	10U	10U	10U
Pyrene	NA	45J	1,500 J	1600	260	10U	12J	45J	2 J	10U	10U	10U

1. Blank = not historically detected.
2. Boxed = or exceeds RL Bold; DLs = or exceed RL
3. ND – Not detected. DL unknown.
3. U = Not detected at premium quantization limit.
4. J –Est. value; NA – Not analyzed.
5. Source: Mountain Env. (2003)

APPENDIX B1
GROUNDWATER RESULTS (1991-2002)

Benfield Industries Site – Waynesville, North Carolina

Well Number	Remediation Level (ug/L)	MW02SH					MW02DP					
Sample Date		**1994**	**Aug-01**	**Feb-02**	**Jul-02**	**Oct-02**	**1991**	**1994**	**Aug-01**	**Feb-02**	**Jul-02**	**Oct-02**
Total Metal (ug/L)												
Aluminum	NA	NA	NA	24,000 J	4100	100 U	NA	NA	NA	1,200 J	1300	20 U
Antimony	6											
Arsenic	NA											
Barium	1800	ND	NA	230	71J	30	1400	ND	NA	60	66J	33
Beryllium	4	ND	NA	1.1	0.20U	1.0 U						
Cadmium	NA											
Calcium	NA	NA	NA	5300	4400	4800	NA	NA	NA	3900	3100	3300
Chromium	60	ND	NA	46	8.8	1.0 U	240	ND	NA	8.6	5.4	1.0 U
Cobalt	NA	ND	NA	14	2.3U	1.0 U	96	ND	NA	3.2 R	2.4U	1.3 R
Copper	NA	NA	NA	42	10U	1.0 U	NA	NA	NA	7.7	5.2U	1.0 U
Iron	NA	NA	NA	33000	9500	5000	NA	NA	NA	1700	2400	170
Lead	15	33	NA	16	6	2.0 U	170000J	ND	NA	2.0U	1.2U	2.0 U
Magnesium	NA	NA	NA	6600	2100	1500	NA	NA	NA	1700	1700	1200
Manganese	50	ND	NA	460	280	310	3400J	ND	NA	230	310	200
Mercury	NA											
Nickel	100	ND	NA	27	7.2	1.0 U	130	ND	NA	9.7	6.2	2.2
Potassium	NA	NA	NA	4800	2000	1600	NA	NA	NA	1600	1200	820
Selenium	NA											
Silver	NA											
Sodium	NA	NA	NA	3,300 J	3600	3,200 J	NA	NA	NA	2,800	3100	2,800 J
Thallium	NA											
Vanadium	200	ND	NA	52	12U	1.0 U	330	ND	NA	3.1	4.4U	1.0 U
Zinc	NA	NA	NA	110	18	3.6 J	NA	NA	NA	14	1.9	7.7 J

1. Blank = not historically detected.
2. Boxed = or exceeds RL Bold; DLs = or exceed RL
3. ND – Not detected. DL unknown.
3. U = Not detected at premium quantization limit.
4. J – Est. value; NA – Not analyzed.
5. Source: Mountain Env. (2003)

APPENDIX B1
GROUNDWATER RESULTS (1991-2002)

Benfield Industries Site – Waynesville, North Carolina

Well Number	Remediation	MW04SH						MW04DP					
	Level												
Sample Date	(ug/L)	1991	1994	Aug-01	Feb-02	Jul-02	Oct-02	1991	1994	Aug-01	Feb-02	Jul-02	Oct-02
Volatile Organic (ug/L)													
1,1,1-Trichloroethane	NA												
1,1-Dichlorobenzene	NA												
1,1-Dichloroethane	NA							ND	ND	6 J	2J	2J	6J
1,2,4-Trichlorobenzene	NA												
1,2,4-Trimethylbenzene	NA												
1,2-Dichlorobenzene	NA							ND	ND	4J	10U	10U	10U
1,2-Dichloroethane	NA							3J	1J	10U	10U	10U	4J
1,2-Dichloropropane	0.56												
1,3,5-Trimethylbenzene	NA												
1,3-Dichlorobenzene	NA												
1,4-Dichlorobenzene	1.8												
2-Butanone	NA												
2-Chlorotoluene	NA												
4-Isopropyltoluene	NA												
Acetone	NA												
Benzene	5	1J	ND	10U	10U	10U	10U	2J	ND	10U	10U	10U	10U
Carbon disulfide	NA												
Chlorobenzene	100	50	39	10U	10U	10U	10U	100	48	19	10U	6 J	18
Chloroethane	NA	2J	ND	10U	10U	10U	10U	12J	ND	10U	10U	10U	10U
Chloroform	NA	1J	ND	10U	10U	10U	10U	1J	ND	10U	10U	10U	10U
cis-1,2-Dichloroethene	NA							ND	ND	13	1J	2J	5J
Ethyl benzene	NA	41J	ND	10U	10U	10U	10U						
Isopropylbenzene	NA												
Methylcyclohezene	NA												
Naphthalene	NA												
n-Propylbenzene	NA												
sec-Butylbenzene	NA												
t-Butylbenzene	NA												
Tetrachloroethene	NA							ND	ND	2J	10U	10U	10U
Toluene	NA												
Total xylenes	400	230J	ND	10U	10U	10U	10U						
Trichloroethane	NA							ND	ND	10U	10U	10U	1J
Vinyl chloride	0.0015							9J	6J	4J	10U	10U	10U

1. Blank = not historically detected.
2. Boxed = or exceeds RL Bold; DLs = or exceed RL
3. ND – Not detected. DL unknown.
3. U = Not detected at premium quantization limit.
4. J – Est. value; NA – Not analyzed.
5. Source: Mountain Env. (2003)

APPENDIX B1
GROUNDWATER RESULTS (1991-2002)

Benfield Industries Site – Waynesville, North Carolina

Well Number	Remediation	MW04SH						MW04DP					
	Level												
Sample Date	**(ug/L)**	**1991**	**1994**	**Aug-01**	**Feb-02**	**Jul-02**	**Oct-02**	**1991**	**1994**	**Aug-01**	**Feb-02**	**Jul-02**	**Oct-02**
Semivolatile Organics (ug/L)													
1,1-Biphenyl	NA							ND	ND	1 J	10U	10U	10U
2-Chloronaphthalene	NA												
2-Methylnaphthalene	NA	4J	ND	10U	10U	10U	10U						
2-Methylphenol	NA												
Acenaphthalene	NA	ND	18J	10U	10U	10U	10U	10	ND	10U	10U	10U	10U
Acenaphthylene	NA												
Anthracene	NA												
Benzo(a)anthracene	0.1	6000	ND	10U	10U	10U	10U						
Benzo(a)pyrene	0.2	2400J	ND	10U	10U	10U	10U						
Benzo(b or k)fluorethane	0.2	5400J	ND	NA	NA	NA	NA						
Benzo(b)fluorethane	NA												
Benzo(g,h,i)perylene	NA												
Benzo(k)fluoranthene	NA												
Benzyl butyl phthalate	NA												
Bis (2-ethylexyl) phthalate	NA												
Caprolactan	NA												
Carbonzole	5	6J	5J	10U	10U	10U	10U	12	5J	10U	10U	10U	10U
Chysene	0.2	4200J	ND	10U	10U	10U	10U						
Dibenzo(a,h)anthracene	NA												
Dibenzofuran	NA	8J	13J	10U	10U	10U	10U	26	19J	6 J	10U	10U	2J
Di-n-buthylphthalate	NA												
Di-n-octylphthalate	NA												
Fluoranthene	NA												
Fluorene	NA	6J	15J	2J	10U	10U	10U	6J	3J	10U	10U	10U	10U
Indeno (1,2,3-cd)pyrene	0.4	750 J	ND	10U	10U	10U	10U						
Naphthalene	100	34	ND	10U	10U	10U	10U						
Pentachlorophenol	1												
Pentananthrene	NA	4J	3J	10U	10U	10U	10U	9J	7J	10U	10U	10U	10U
Pyrene	NA	16000	ND	10U	10U	10U	10U	7J	ND	10U	10U	10U	10U

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4. J – Est. value; NA – Not analyzed.
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APPENDIX B1
GROUNDWATER RESULTS (1991-2002)

Benfield Industries Site – Waynesville, North Carolina

Well Number	Remediation	MW04SH						MW04DP					
	Level												
Sample Date	**(ug/L)**	**1991**	**1994**	**Aug-01**	**Feb-02**	**Jul-02**	**Oct-02**	**1991**	**1994**	**Aug-01**	**Feb-02**	**Jul-02**	**Oct-02**
Total Metal (ug/L)													
Aluminum	NA	NA	NA	NA	18,000 J	1400	16 U	NA	NA	NA	970 J	18000	110 U
Antimony	6												
Arsenic	NA												
Barium	1000	1400	ND	NA	250	100J	97	70	ND	NA	64	400J	64
Beryllium	4				1	0.20U							
Cadmium	NA												
Calcium	NA	NA	NA	NA	24000	22000	25000	NA	NA	NA	16000	14000	17000
Chromium	50	64	390	NA	47	4.4	1.0 U	10J	ND	NA	11	73	1.0 U
Cobalt	NA	96	ND	NA	42	25U	27	ND	ND	NA	2.6	14U	1.0 R
Copper	NA	NA	NA	NA	23	3.7U	1.0 U	NA	NA	NA	6.7	42	1.0 U
Iron	NA	NA	NA	NA	55000	26000	33000	NA	NA	NA	1600	32000	140
Lead	15	47	49	NA	10	1.5U	11	5	ND	NA	2.0U	20	2.0 U
Magnesium	NA	NA	NA	NA	9500	5000	5400	NA	NA	NA	4900	14000	4700
Manganese	50	18000J	ND	NA	5500	4800	5200	140J	ND	NA	55	760	300
Mercury	NA	0.52	ND	NA	0.10U	0.10U	0.10U						
Nickel	100	65	ND	NA	21	3.3	2.2	ND	ND	NA	6.7	41	2
Potassium	NA	NA	NA	NA	7300	4700	5300	NA	NA	NA	3100	10000	1700
Selenium	NA												
Silver	NA												
Sodium	NA	NA	NA	NA	16000 J	17000 J	18000 J	NA	NA	NA	7,000 J	7800	6,300 J
Thallium	NA												
Vanadium	200	200	ND	NA	68	7.5U	1.0U	ND	ND	NA	4.1	62	1.0 U
Zinc	NA	NA	NA	NA	50	3.6	1.8 J	NA	NA	NA	28	120	2.3 J

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4. J – Est. value; NA – Not analyzed.
5. Source: Mountain Env. (2003)

APPENDIX B1
GROUNDWATER RESULTS (1991-2002)

Benfield Industries Site – Waynesville, North Carolina

Well Number	Remediation	MW05SH					MW05S					
	Level											
Sample Date	**(ug/L)**	**1994**	**Aug-01**	**Feb-02**	**Jul-02**	**Oct-02**	**1991**	**1994**	**Aug-01**	**Feb-02**	**Jul-02**	**Oct-02**
Volatile Organic (ug/L)												
1,1,1-Trichloroethane	NA	20	10U	10U	10U	10U	22J	13	10U	10U	10U	10U
1,1-Dichlorobenzene	NA											
1,1-Dichloroethane	NA						60	ND	10U	10U	10U	10U
1,2,4-Trichlorobenzene	NA											
1,2,4-Trimethylbenzene	NA											
1,2-Dichlorobenzene	NA	ND	2J	2J	10U	1J	51	180	2J	2J	10U	1J
1,2-Dichloroethane	NA	24	10U	10U	10U	10U	29J	6J	10U	10U	10U	10U
1,2-Dichloropropane	0.56											
1,3,5-Trimethylbenzene	NA											
1,3-Dichlorobenzene	NA	4J	10U	10U	10U	10U	3J	3J	10U	10U	10U	10U
1,4-Dichlorobenzene	1.8	ND	2J	1J	10U	2J	6J	10	3J	1J	10U	1J
2-Butanone	NA											
2-Chlorotoluene	NA											
4-Isopropyltoluene	NA											
Acetone	NA											
Benzene	5	18	10U	10U	10U	10U	2J	11	10U	10U	10U	10U
Carbon disulfide	NA											
Chlorobenzene	100	160	2J	2J	10U	1J	ND	21	2J	2J	10U	1J
Chloroethane	NA						ND	7J	10U	10U	10U	10U
Chloroform	NA											
cis-1,2-Dichloroethene	NA											
Ethyl benzene	NA	860	10U	10U	10U	10U	440	18	10U	10U	10U	10U
Isopropylbenzene	NA											
Methylcyclohezene	NA											
Naphthalene	NA											
n-Propylbenzene	NA											
sec-Butylbenzene	NA											
t-Butylbenzene	NA											
Tetrachloroethene	NA											
Toluene	NA	390	10U	10U	10U	10U	190	6J	10U	10U	10U	10U
Total xylenes	400	1700	10U	10U	10U	10U	600	27	10U	10U	10U	10U
Trichloroethane	NA											
Vinyl chloride	0.0015	35	10U	10U	10U	10U	33J	26	10U	10U	10U	10U

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3. ND – Not detected. DL unknown.
3. U = Not detected at premium quantization limit.
4. J – Est. value; NA – Not analyzed.
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APPENDIX B1
GROUNDWATER RESULTS (1991-2002)

Benfield Industries Site – Waynesville, North Carolina

Well Number	Remediation	MW05SH					MW05S					
	Level											
Sample Date	(ug/L)	1994	Aug-01	Feb-02	Jul-02	Oct-02	1991	1994	Aug-01	Feb-02	Jul-02	Oct-02
Semivolatile Organics (ug/L)												
1,1-Biphenyl	NA						ND	ND	10U	5 J	10U	10UJ
2-Chloronaphthalene	NA						4	ND	10U	10U	10U	10UJ
2-Methylnaphthalene	NA	390J	10U	10U	10U	10U	390J	68	10U	10U	10U	10UJ
2-Methylphenol	NA						6J	ND	10U	10U	10U	10UJ
Acenaphthalene	NA	440	86	65	75	69J	220J	64	16	3 J	10U	10UJ
Acenaphthylene	NA	30	2 J	2 J	10U	10U	38	2J	10U	10U	10U	10UJ
Anthracene	NA	6J	4 J	4 J	2J	1J	26	ND	10U	10U	10U	10UJ
Benzo(a)anthracene	0.1	ND	10U	1 J	10U	10U	14	ND	10U	10U	10U	10UJ
Benzo(a)pyrene	0.2						5	ND	10U	10U	10U	10UJ
Benzo(b or k)fluorethane	0.2						11J	NA	NA	NA	NA	NA
Benzo(b)fluorethane	NA											
Benzo(g,h,i)perylene	NA						1J	ND	10U	10U	10U	10U
Benzo(k)fluoranthene	NA											
Benzyl butyl phthalate	NA											
Bis (2-ethylexyl) phthalate	NA											
Caprolactan	NA											
Carbonzole	5	250	7 J	10U	5J	3J	210J	210	10U	6 J	10U	10UJ
Chysene	0.2	ND	10U	5 J	10U	10U	12J	ND	10U	10U	10U	10UJ
Dibenzo(a,h)anthracene	NA											
Dibenzofuran	NA	290	35	16	2J	10UJ	200J	150	2 J	2 J	10U	10UJ
Di-n-buthylphthalate	NA											
Di-n-octylphthalate	NA											
Fluoranthene	NA	11	27	15	10	6J	64	12	10U	10U	1J	2J
Fluorene	NA	230	58	55	46	38J	160J	46	10U	10U	10U	10UJ
Indeno(1,2,3-cd)pyrene	0.4						2J	ND	10U	10U	10U	10UJ
Naphthalene	100	3400	10U	10U	10U	10UJ	2400J	1400	10U	10U	10U	10UJ
Pentachlorophenol	1											
Pentananthrene	NA	220	6 J	4 J	10U	10UJ	250J	46	10U	10U	10U	10U
Pyrene	NA	5J	8 J	9 J	6J	4J	41	7J	10U	10U	10U	1J

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2. Boxed = or exceeds RL Bold; DLs = or exceed RL
3. ND – Not detected. DL unknown.
3. U = Not detected at premium quantization limit.
4. J – Est. value; NA – Not analyzed.
5. Source: Mountain Env. (2003)

APPENDIX B1
GROUNDWATER RESULTS (1991-2002)

Benfield Industries Site – Waynesville, North Carolina

Well Number	Remediation Level (ug/L)	MW05SH					MW05S					
Sample Date:		1994	Aug-01	Feb-02	Jul-02	Oct-02	1991	1994	Aug-01	Feb-02	Jul-02	Oct-02
Total Metals (ug/L)												
Aluminum	NA	NA	NA	940 J	1300	22 U	NA	NA	NA	3,000 J	2400	16 U
Antimony	6											
Arsenic	NA											
Barium	1000	ND	NA	64	72J	69	2600	ND	NA	180	190J	99
Beryllium	4						7	ND	NA	1.0U	0.20U	1.0 U
Cadmium	NA											
Calcium	NA	NA	NA	20000	16000	19000	NA	NA	NA	29000	26000	28000
Chromium	50	200	NA	1.5 R	2.6	1.0 U	740	ND	NA	12	13	1.0 U
Cobalt	NA	ND	NA	2.8	1.2U	1.7	220	ND	NA	8	6.8U	2.3
Copper	NA	NA	NA	1.0 R	4.1U	1.0 U	NA	NA	NA	6.3	9.2U	1.0 U
Iron	NA	NA	NA	16000	16000	17000	NA	NA	NA	4200	4800	160
Lead	15	17	NA	2.0U	0.70U	4.9	87	ND	NA	2.0U	1.3U	2.0 U
Magnesium	NA	NA	NA	3200	2400	3000	NA	NA	NA	11000	9600	9300
Manganese	50	ND	NA	2100	1700	2000	13000	ND	NA	1100	1000	950
Mercury	NA											
Nickel	100						380	ND	NA	19	16	2.2
Potassium	NA	NA	NA	2300	2200	2800	NA	NA	NA	1600	1600	1200
Selenium	NA											
Silver	NA											
Sodium	NA	NA	NA	3,600 J	4200	4,100 J	NA	NA	NA	6,200 J	6500	6,000 J
Thallium	NA											
Vanadium	200	ND	NA	2	4.2U	1.0U	940	ND	NA	11	14U	1.0 U
Zinc	NA	NA	NA	8.8	1.9	2.1 J	NA	NA	NA	10	5.9	2.0 J

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3. ND – Not detected. DL unknown.
3. U = Not detected at premium quantization limit.
4. J – Est. value; NA – Not analyzed.
5. Source: Mountain Env. (2003)

APPENDIX B1
GROUNDWATER RESULTS (1991-2002)

Benfield Industries Site – Waynesville, North Carolina

Well Number	Remediation	MW07SH				MW07S				
	Level									
Sample Date	(ug/L)	Aug-01	Feb-02	Jul-02	Oct-02	1994	Aug-01	Feb-02	Jul-02	Oct-02
Volatile Organic (ug/L)										
1,1,1-Trichloroethane	NA									
1,1-Dichlorobenzene	NA									
1,1-Dichloroethane	NA									
1,2,4-Trichlorobenzene	NA									
1,2,4-Trimethylbenzene	NA									
1,2-Dichlorobenzene	NA	2J	2J	10U	2J	4 J	3J	2J	2J	2J
1,2-Dichloroethane	NA					11	10U	10U	10U	10U
1,2-Dichloropropane	0.56									
1,3,5-Trimethylbenzene	NA									
1,3-Dichlorobenzene	NA									
1,4-Dichlorobenzene	1.8	2J	2J	10U	10U	4J	2J	10U	10U	1J
2-Butanone	NA									
2-Chlorotoluene	NA									
4-Isopropyltoluene	NA									
Acetone	NA									
Benzene	5					3J	10U	10U	10U	10U
Carbon disulfide	NA	1J	1J	10U	10U					
Chlorobenzene	100	1J	1J	10U	2J	2J	2J	2J	2J	3J
Chloroethane	NA									
Chloroform	NA					1J	10U	10U	10U	10U
cis-1,2-Dichloroethene	NA									
Ethyl benzene	NA									
Isopropylbenzene	NA									
Methylcyclohezene	NA									
Naphthalene	NA									
n-Propylbenzene	NA									
sec-Butylbenzene	NA									
t-Butylbenzene	NA									
Tetrachloroethene	NA									
Toluene	NA									
Total xylenes	400					2J	10U	10U	10U	10U
Trichloroethane	NA									
Vinyl chloride	0.0015									

1. Blank = not historically detected.
2. Boxed = or exceeds RL Bold; DLs = or exceed RL
3. ND – Not detected. DL unknown.
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APPENDIX B1
GROUNDWATER RESULTS (1991-2002)

Benfield Industries Site – Waynesville, North Carolina

Well Number	Remediation	MW07SH				MW07S				
	Level									
Sample Date	(ug/L)	Aug-01	Feb-02	Jul-02	Oct-02	1994	Aug-01	Feb-02	Jul-02	Oct-02
Semivolatile Organics (ug/L)										
1,1-Biphenyl	NA	5 J	1 J	10U	1J	ND	10U	1 J	10U	10UJ
2-Chloronaphthalene	NA									
2-Methylnaphthalene	NA	5 J	10U	10U	10UJ					
2-Methylphenol	NA									
Acenaphthalene	NA	75	58	25	36J	44	15	11	3J	10UJ
Acenaphthylene	NA	6 J	2 J	10U	10UJ					
Anthracene	NA	15	7 J	2J	2J	4J	10U	10U	10U	10UJ
Benzo(a)anthracene	0.1	21	5 J	2J	10UJ					
Benzo(a)pyrene	0.2	18	4 J	10U	10UJ					
Benzo(b or k)fluorethane	0.2									
Benzo(b)fluorethane	NA	18	7 J	1J	10UJ					
Benzo(g,h,i)perylene	NA	6 J	2 J	10U	10UJ					
Benzo(k)fluoranthene	NA	21	4 J	1J	10UJ					
Benzyl butyl phthalate	NA									
Bis (2-ethylexyl) phthalate	NA	24	13	10U	10UJ					
Caprolactan	NA									
Carbonzole	5	8 J	6 J	2J	3J	29	10U	10U	10U	10UJ
Chysene	0.2	31	13	3J	10UJ					
Dibenzo(a,h)anthracene	NA	3 J	10U	10U	10UJ					
Dibenzofuran	NA	35	4 J	1J	10UJ	95	28	23	3J	10UJ
Di-n-buthylphthalate	NA									
Di-n-octylphthalate	NA									
Fluoranthene	NA	74	23	9J	10UJ	11	10U	10U	10U	10UJ
Fluorene	NA	75	51	20	10UJ	33	1 J	10U	10U	10UJ
Indeno (1,2,3-cd)pyrene	0.4	9 J	3 J	10U	10UJ					
Naphthalene	100	10U	2 J	10U	10UJ	2J	10U	10U	10U	10UJ
Pentachlorophenol	1									
Pentananthrene	NA	45	9 J	2J	10UJ	37	10U	10U	10U	10UJ
Pyrene	NA	37 J	15	5J	10UJ	7J	10U	10U	10U	10UJ

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2. Boxed = or exceeds RL Bold; DLs = or exceed RL
3. ND – Not detected. DL unknown.
3. U = Not detected at premium quantization limit.
4. J – Est. value; NA – Not analyzed.
5. Source: Mountain Env. (2003)

APPENDIX B1
GROUNDWATER RESULTS (1991-2002)

Benfield Industries Site – Waynesville, North Carolina

Well Number	Remediation Level (ug/L)	MW07SH				MW07S				
Sample Date:		**Aug-01**	**Feb-02**	**Jul-02**	**Oct-02**	**1994**	**Aug-01**	**Feb-02**	**Jul-02**	**Oct-02**
Total Metals (ug/L)										
Aluminum	NA	NA	8,600 J	2500	100 U	NA	NA	8,400 J	84	16 U
Antimony	6									
Arsenic	NA									
Barium	1000	NA	150	110J	86	ND	NA	180	310J	50
Beryllium	4									
Cadmium	NA									
Calcium	NA	NA	23000	16000	17000	NA	NA	26000	26000	26000
Chromium	50	NA	12	4.3	1.0 U	ND	NA	14	17	1.0 U
Cobalt	NA	NA	5.2	2.0U	1.0 U	ND	NA	7.7	10U	3
Copper	NA	NA	16	8.6	1.0 U	NA	NA	16	24U	1.0 U
Iron	NA	NA	26000	19000	15000	NA	NA	8000	13000	350
Lead	15	NA	3.4	3.4	5.2	NA	NA	2.0 U	5.2	2.0 U
Magnesium	NA	NA	5100	3400	3000	NA	NA	8600	9200	7200
Manganese	50	NA	3000	2800	2200	ND	NA	5000	5500	5400
Mercury	NA									
Nickel	100	NA	10	2.9	1.0 U	ND	NA	17	12	3.2
Potassium	NA	NA	3000	2600	2600	NA	NA	3900	4400	170
Selenium	NA									
Silver	NA									
Sodium	NA	NA	4,500 J	4600	4,200	NA	NA	8,600 J	9300	7,900 J
Thallium	NA									
Vanadium	200	NA	14	5.8U	1.0 U	ND	NA	15	27U	1.0 U
Zinc	NA	NA	49	21	2.1 J	NA	NA	24	22	3.6 J

1. Blank = not historically detected.
2. Boxed = or exceeds RL Bold; DLs = or exceed RL
3. ND – Not detected. DL unknown.
3. U = Not detected at premium quantization limit.
4. J – Est. value; NA – Not analyzed.
5. Source: Mountain Env. (2003)

APPENDIX B1
GROUNDWATER RESULTS (1991-2002)

Benfield Industries Site – Waynesville, North Carolina

Well Number	Remediation Level (ug/L)	MW08A / MW02SH						MW08S				
Sample Date:		**1994**	**May-99**	**Aug-01**	**Feb-02**	**Jul-02**	**Oct-02**	**May-99**	**Aug-01**	**Feb-02**	**Jul-02**	**Oct-02**
Volatile Organics (ug/L)												
1,1,1-Trichloroethane	NA											
1,1-Dichlorobenzene	NA	ND	4	10U	10U	10U	10U	2	10U	10U	10U	10U
1,1-Dichloroethane	NA	21	ND	10U	10U	10U	10U	ND	2J	10U	10U	10U
1,2,4-Trichlorobenzene	NA											
1,2,4-Trimethylbenzene	NA											
1,2-Dichlorobenzene	NA	ND	4	10U	10U	10U	1J	2	10U	10U	10U	2J
1,2-Dichloroethane	NA											
1,2-Dichloropropane	0.56	2J	ND	10U	10U	10U	10U					
1,3,5-Trimethylbenzene	NA											
1,3-Dichlorobenzene	NA	1J	ND	10U	10U	10U	10U					
1,4-Dichlorobenzene	1.8	3J	2	10U	10U	10U	10U	ND	2J	10U	10U	10U
2-Butanone	NA											
2-Chlorotoluene	NA											
4-Isopropyltoluene	NA											
Acetone	NA											
Benzene	5	4J	ND	10U	10U	10U	10U					
Carbon disulfide	NA											
Chlorobenzene	100	37	11	1J	2J	10U	1J	2	2J	2J	10U	2J
Chloroethane	NA											
Chloroform	NA											
cis-1,2-Dichloroethene	NA											
Ethyl benzene	NA											
Isopropylbenzene	NA											
Methylcyclohezene	NA											
Naphthalene	NA											
n-Propylbenzene	NA											
sec-Butylbenzene	NA											
t-Butylbenzene	NA											
Tetrachloroethene	NA											
Toluene	NA											
Total xylenes	400											
Trichloroethane	NA	ND	ND	10U	10U	10U	1J					
Vinyl chloride	0.0015											

1. Blank = not historically detected.
2. Boxed = or exceeds RL Bold; DLs = or exceed RL
3. ND – Not detected. DL unknown.
3. U = Not detected at premium quantization limit.
4. J – Est. value; NA – Not analyzed.
5. Source: Mountain Env. (2003)

APPENDIX B1
GROUNDWATER RESULTS (1991-2002)

Benfield Industries Site – Waynesville, North Carolina

Well Number	Remediation Level (ug/L)	MW08A / MW02SH						MW08S				
Sample Date:		1994	May-99	Aug-01	Feb-02	Jul-02	Oct-02	May-99	Aug-01	Feb-02	Jul-02	Oct-02
Semivolatile Organics (ug/L)												
1,1-Biphenyl	NA											
2-Chloronaphthalene	NA											
2-Methylnaphthalene	NA											
2-Methylphenol	NA											
Acenaphthalene	NA	37	ND	6 J	10U	10	3J	9	10U	10	10U	10U
Acenaphthylene	NA	2J	ND	10U	10U	10U	10U					
Anthracene	NA											
Benzo(a)anthracene	0.1											
Benzo(a)pyrene	0.2											
Benzo(b or k)fluorethane	0.2											
Benzo(b)fluorethane	NA											
Benzo(g,h,i)perylene	NA											
Benzo(k)fluoranthene	NA											
Benzyl butyl phthalate	NA											
Bis (2-ethylexyl) phthalate	NA											
Caprolactan	NA											
Carbonzole	5	27	ND	10U	10U	10U	10U	5	10U	10U	10U	10U
Chysene	0.2											
Dibenzo(a,h)anthracene	NA											
Dibenzofuran	NA	18	ND	10U	10U	10U	10U					
Di-n-buthylphthalate	NA											
Di-n-octylphthalate	NA											
Fluoranthene	NA	ND	ND	2 J	10U	3J	10U	2J	10U	3 J	10U	10U
Fluorene	NA	27	ND	2 J	10U	4J	10U	5	10U	5 J	10U	10U
Indeno (1,2,3-cd)pyrene	0.4											
Naphthalene	100											
Pentachlorophenol	1											
Pentananthrene	NA											
Pyrene	NA	ND	ND	10U	10U	2J	2J	ND	10U	2 J	10U	10U

1. Blank = not historically detected.
2. Boxed = or exceeds RL Bold; DLs = or exceed RL
3. ND – Not detected. DL unknown.
3. U = Not detected at premium quantization limit.
4. J – Est. value; NA – Not analyzed.
5. Source: Mountain Env. (2003)

APPENDIX B1
GROUNDWATER RESULTS (1991-2002)

Benfield Industries Site – Waynesville, North Carolina

Well Number	Remediation Level (ug/L)	MW08A / MW02SH						MW08S				
Sample Date:		**1994**	**May-99**	**Aug-01**	**Feb-02**	**Jul-02**	**Oct-02**	**May-99**	**Aug-01**	**Feb-02**	**Jul-02**	**Oct-02**
Total Metals (ug/L)												
Aluminum	NA	NA	NA	NA	12,000 J	2900	18 U	NA	NA	1,400 J	1800	870
Antimony	6											
Arsenic	NA											
Barium	1000	2500	94		220	140J	96	62	NA	75	85J	81
Beryllium	4											
Cadmium	NA											
Calcium	NA	NA	NA	NA	29000	24000	29000	NA	NA	11000	10000	12000
Chromium	50	250	ND	NA	18	5.3	1.0 U	ND	NA	4.2	3.8	1.8
Cobalt	NA	ND	ND	NA	10	3.8U	2.5 R	ND	NA	3 R	1.9U	1.3 R
Copper	NA	NA	NA	NA	14	5.6U	1.0 U	NA	NA	2.1	4.6U	1.1
Iron	NA	NA	NA	NA	27000	14000	7800	NA	NA	2000	3100	1200
Lead	15	69	ND	2.0U	2.0U	2.0U	2.3					
Magnesium	NA	NA	NA	NA	8600	5100	500	NA	NA	5000	4800	4800
Manganese	50	NA	310	NA	2100	2100	2200	1400	NA	160	170	190
Mercury	NA											
Nickel	100	ND	ND	NA	10	2.9	1.0 U	ND	NA	2.1	2	1.5 R
Potassium	NA	NA	NA	NA	5400	3700	3800	NA	NA	2100	2200	1900
Selenium	NA											
Silver	NA											
Sodium	NA	NA	NA	NA	5,000 J	5800	5,900 J	NA	NA	14,000 J	17000	15,000J
Thallium	NA											
Vanadium	200	NA	NA	NA	25	8.3U	1.0 U	NA	NA	3.9	6.1U	2.5
Zinc	NA	NA	NA	NA	39	6.3	1.5 J	NA	NA	12	4.5	4.1 J

1. Blank = not historically detected.
2. Boxed = or exceeds RL Bold; DLs = or exceed RL
3. ND – Not detected. DL unknown.
3. U = Not detected at premium quantization limit.
4. J – Est. value; NA – Not analyzed.
5. Source: Mountain Env. (2003)

APPENDIX B1
GROUNDWATER RESULTS (1991-2002)

Benfield Industries Site – Waynesville, North Carolina

Well Number	Remediation Level (ug/L)	PZ05A				EXT02					EXT03				
Sample Date:		Aug-01	Feb-02	Jul-02	Oct-02	Apr-01	Aug-01	Feb-02	Jul-02	Oct-02	Apr-01	Aug-01	Feb-02	Jul-02	Oct-02
Volatile Organics (ug/L)															
1,1,1-Trichloroethane	NA					0.9	10U	10U	10U	10U					
1,1-Dichlorobenzene	NA														
1,1-Dichloroethane	NA					3.7	2J	10U	10U	10U					
1,2,4-Trichlorobenzene	NA					4.2	10U	10U	10U	10U					
1,2,4-Trimethylbenzene	NA					1	10U	10U	10U	10U	1.8	10U	10U	10U	10U
1,2-Dichlorobenzene	NA					9.6	6J	2J	2J	2J					
1,2-Dichloroethane	NA														
1,2-Dichloropropane	0.56										1.2	10U	10U	10U	10U
1,3,5-Trimethylbenzene	NA														
1,3-Dichlorobenzene	NA					2	10U	10U	10U	10U					
1,4-Dichlorobenzene	1.8					4.2	2J	1J	10U	1J	1U	2J	1J	10U	1J
2-Butanone	NA					18.8	10U	10U	10U	10U	12.1	10U	10U	10U	10U
2-Chlorotoluene	NA					3	10U	10U	10U	10U					
4-Isopropyltoluene	NA										3	10U	10U	10U	10U
Acetone	NA														
Benzene	5					0.8	10U	10U	10U	10U					
Carbon disulfide	NA					1	10U	10U	10U	10U	0.6	10U	10U	10U	10U
Chlorobenzene	100					22.2	8J	10U	2J	3J					
Chloroethane	NA														
Chloroform	NA														
cis-1,2-Dichloroethene	NA					0.8	10U	5J	10U	10U					
Ethyl benzene	NA										0.5	10U	10U	10U	10U
Isopropylbenzene	NA					0.9	10U	10U	10U	10U	0.8	10U	10U	10U	10U
Methylcyclohezene	NA														
Naphthalene	NA										18.2	10U	10U	10U	10U
n-Propylbenzene	NA										0.5	10U	10U	10U	10U
sec-Butylbenzene	NA					2	10U	10U	10U	10U	0.9	10U	10U	10U	10U
t-Butylbenzene	NA					1.2	10U	10U	10U	10U					
Tetrachloroethene	NA														
Toluene	NA					0.8	10U	10U	10U	10U	0.7	10U	10U	10U	10U
Total xylenes	400					0.6	10U	10U	10U	10U	1.3	10U	10U	10U	10U
Trichloroethane	NA					0.9	10U	10U	10U	10U					
Vinyl chloride	0.0015					3.7	2J	10U	10U	10U					

1. Blank = not historically detected.
2. Boxed = or exceeds RL Bold; DLs = or exceed RL
3. ND – Not detected. DL unknown.
3. U = Not detected at premium quantization limit.
4. J – Est. value; NA – Not analyzed.
5. Source: Mountain Env. (2003)

APPENDIX B1
GROUNDWATER RESULTS (1991-2002)

Benfield Industries Site – Waynesville, North Carolina

Well Number	Remediation Level (ug/L)	PZ05A				EXT02					EXT03				
Sample Date:		Aug-01	Feb-02	Jul-02	Oct-02	Apr-01	Aug-01	Feb-02	Jul-02	Oct-02	Apr-01	Aug-01	Feb-02	Jul-02	Oct-02
Semivolatile Organics (ug/L)															
1,1-Biphenyl	NA					1U	2 J	3 J	10U	10U	1U	10U	4 J	10U	10U
2-Chloronaphthalene	NA														
2-Methylnaphthalene	NA										22	10U	10U	10U	10U
2-Methylphenol	NA														
Acenaphthalene	NA					1U	6 J	3 J	10U	10U	41	25	49	52	22
Acenaphthylene	NA										1U	4 J	1 J	10U	1J
Anthracene	NA										16	10U	2 J	10U	10U
Benzo(a)anthracene	0.1														
Benzo(a)pyrene	0.2														
Benzo(b or k)fluorethane	0.2														
Benzo(b)fluorethane	NA														
Benzo(g,h,i)perylene	NA														
Benzo(k)fluoranthene	NA														
Benzyl butyl phthalate	NA														
Bis (2-ethylexyl) phthalate	NA														
Caprolactan	NA														
Carbonzole	5					1U	2 J	10U	10U	10U	1U	10U	5 J	3J	10U
Chysene	0.2														
Dibenzo(a,h)anthracene	NA														
Dibenzofuran	NA					35	15	10	4J	3J	28	8 J	37	22	4J
Di-n-buthylphthalate	NA														
Di-n-octylphthalate	NA														
Fluoranthene	NA					1U	6 J	6 J	4J	6J	1U	6 J	8 J	7J	6J
Fluorene	NA										24	6 J	21	9J	10U
Indeno (1,2,3-cd)pyrene	0.4														
Naphthalene	100										41	10U	10U	10U	10U
Pentachlorophenol	1														
Pentananthrene	NA					1U	3 J	2 J	1J	10U	17	10U	10U	10U	10U
Pyrene	NA					1U	2 J	2 J	2J	3J	1U	2 J	3 J	4J	3J

1. Blank = not historically detected.
2. Boxed = or exceeds RL Bold; DLs = or exceed RL
3. ND – Not detected. DL unknown.
3. U = Not detected at premium quantization limit.
4. J – Est. value; NA – Not analyzed.
5. Source: Mountain Env. (2003)

APPENDIX B1
GROUNDWATER RESULTS (1991-2002)

Benfield Industries Site – Waynesville, North Carolina

Well Number	Remediation Level (ug/L)	PZ05A				EXT02					EXT03				
Sample Date		Aug-01	Feb-02	Jul-02	Oct-02	Apr-01	Aug-01	Feb-02	Jul-02	Oct-02	Apr-01	Aug-01	Feb-02	Jul-02	Oct-02
Total Metal (ug/L)															
Aluminum	NA	NA	21,000 J	4300	16 U	NA	NA	1,300 J	58U	16 U					
Antimony	6														
Arsenic	NA					4.8	NA	4.0U	1.3U	1.0 U					
Barium	1000	NA	310	150J	95	164	NA	180	150J	150	30	NA	26	30J	30
Beryllium	4														
Cadmium	NA														
Calcium	NA	NA	24000	21000	25000	NA	NA	24000	24000	25000	NA	NA	9600	8800	10000
Chromium	50	NA	23	5.9	1.0 U	5U	NA	5.5	0.60U	1.0 U	NA	NA	1.5 U	0.66	1.0 U
Cobalt	NA	NA	10	2.4U	1.0 U	NA	NA	5.1	2.6U	3.5	NA	NA	3.2 R	2.3U	2.5 R
Copper	NA	NA	25	7.6U	1.0 U	NA	NA	180	5.0U	24	NA	NA	1.8	4.8U	1.0
Iron	NA	NA	26000	6600	16J	NA	NA	2100	420	220	NA	NA	240	1300	450
Lead	15	NA	4.6	3.3	2.0 U	57	NA	760	4.4	16	20	NA	2.0U	8.3	2.8
Magnesium	NA	NA	10000	6000	5600	NA	NA	7100	6400	6700	NA	NA	3200	2900	3200
Manganese	50	NA	1200	380	40	NA	NA	540	600	570	NA	NA	1900	1900	2100
Mercury	NA														
Nickel	100	NA	17	3.9	1.0 U	NA	NA	5.6	2.4	3.8					
Potassium	NA	NA	5900	3600	3300	NA	NA	2400	1900	2100	NA	NA	1200	1100	1500
Selenium	NA					11	NA	4.0U	2.9U	3.0U					
Silver	NA														
Sodium	NA	NA	9,500 J	10000	9,600 J	NA	NA	6,700 J	7600	6,800 J	NA	NA	3,800 J	4200	4,000 J
Thallium	NA														
Vanadium	200	NA	36	9.7U	1.0 U	NA	NA	6.4	0.40U	1.0 U					
Zinc	NA	NA	56	16	1.5 J	NA	NA	1600	7.9	180 J	NA	NA	16	5.1	13 J

1. Blank = not historically detected.
2. Boxed = or exceeds RL Bold; DLs = or exceed RL
3. ND – Not detected. DL unknown.
3. U = Not detected at premium quantization limit.
4. J – Est. value; NA – Not analyzed.
5. Source: Mountain Env. (2003)

APPENDIX B2
OCTOBER 2002 SUBSURFACE SOIL SAMPLING RESULTS
Benfield Industries Site - Waynesville, North Carolina

Station ID		SB-1	SB-2	SB-3	SB-3 DUP	SB-4
Sample No.	Remediation	631	632	633	634	635
Sample ID	Level	D1L34	D1L35	D1L36	D1L37	D1L38
Sample Depth (feet)	(ug/kg)	4.5	4.5	4.5	4.5	4
Date Sampled		10/30/02	10/30/02	10/30/02	10/30/02	10/30/02
VOLATILE ORGANICS COMPOUNDS (Concentration in µg/kg)						
None Detected						
SEMIVOLATILE ORGANIC COMPOUNDS (Concentration in µg/kg)						
2-Methylnaphthalene	NA	370 U	360 U	50 J	42 J	380 U
Acenaphthene	NA	41 J	360 U	48 J	44 J	41 J
Acenaphtylene	NA	52 J	42 J	65 J	45 J	42 J
Anthracene	NA	160 J	130 J	180 J	190 J	88 J
Benzo(a)anthracene	800	170 J	140 J	310 J	180 J	160 J
Benzo(a)pyrene	300	430	280 J	490	380	250 J
Benzo(b)fluorethane	1,600	340 J	230 J	510	340 J	210 J
Benzo(ghi)perylene	NA	190 J	100 J	120 J	150 J	170 J
Benzo(k)fluoranthene	1,600	340 J	230 J	410	300 J	180 J
Bis (2-ethylexyl) phthalate	NA	690	780	890	740	940
Chysene	2,800	310 J	250 J	450	370	190 J
Dibenzo(a,h)anthracene	NA	86 J	54 J	76 J	64 J	65 J
Dibenzofuran	NA	56 J	45 J	74 J	63 J	53 J
Di-n-buthylphthalate	NA	690	360 U	550	460	360 U
Fluoranthene	NA	400	260 U	550	370 U	330 J
Fluorene	NA	45 J	360 U	49 J	350 J	360 U
Indeno (1,2,3-cd)pyrene	NA	370	260 J	370	300 J	310 J
Naphthalene	10,000	49 J	56 J	75 J	70 J	60 J
Pentananthrene	NA	200 J	170 J	240 J	210 J	210 J
Pyrene	NA	310 J	220 J	550	300 J	270 J
TOTAL METALS (Concentration in mg/kg)						
Aluminum	NA	17,000	16,000	15,000	16,000	14,000
Barium	NA	230	230	210	220	190
Beryllium	NA	0.48	0.50	0.42	0.38	0.48
Calcium	NA	5,000	2,300	1,800	1,800	2,500
Chromium	NA	40	73	32	34	35
Cobalt	NA	13	14	12	13	12
Copper	NA	46	76	42	52	38
Iron	NA	29,000	27,000	25,000	26,000	26,000
Lead	NA	30	33	29	26	40
Magnesium	NA	6,700	7,000	6,300	6,800	5,500
Manganese	NA	370	350	310	320	340
Nickel	NA	23	36	17	19	17
Potassium	NA	5,400	5,700	5,300	5,100	3,900
Selenium	NA	1.3 J	1.2 J	1.4 J	0.90 R	1.2 J
Sodium	NA	460	430	420	430	360
Thallium	NA	2.5	2.3 J	2.1 R	3.2 J	3.5
Vanadium	NA	50	48	45	47	41
Zinc	NA	110 J	130 J	110 J	110 J	110 J

Source: Mountain Environmental Services (2003)

1. Shaded value means remediation level was exceeded.
2. U – Indicates that the parameter was analyzed but nor detected.
   The value shown is the minimum quantitation limit.
3. J – Indicates estimated value.
4. R – Indicates a rejected value.
5. Only compounds detected were included in this table.
6. NA = Not Analyzed or Not Applicable.

APPENDIX B3
OCTOBER 2002 SUBSURFACE WATER SAMPLING RESULTS
Benfield Industries Site - Waynesville, North Carolina

Station ID		**SW-1**	**SW-2**	**SW-2 DUP**	**SW-3**
Sample No.	**Screening**	636	638	639	642
Sample ID	**Criteria**	D1L39	D1L41	D1L42	D1L45
Date Sampled	**(ug/L)**	10/31/02	10/31/02	10/31/02	10/31/02
VOLATILE ORGANICS COMPOUNDS (Concentration in µg/kg)					
None Detected					
SEMIVOLATILE ORGANIC COMPOUNDS (Concentration in µg/kg)					
None Detected					
TOTAL METALS (Concentration in µg/kg)					
Aluminum	NA	140 U	240	110 U	160 U
Barium	1,000	24	25	23	25
Calcium	NA	4,900	5,100	4,800	4,800
Copper	NA	1.0 U	1.4	1.0 U	6.2 R
Iron	NA	250	390	210	260 J
Lead	NA	1,600	1,700	1,600	1,500
Magnesium	NA	22	21	18	16
Manganese	NA	1,600	1,700	1,500	1,400
Sodium	NA	3,400 J	3,500 J	3,400 J	3,200
Zinc	NA	5.0 J	5.9 J	5.8 J	6.8 J

Source: Mountain Environmental Services (2003)

-- Shared value means remediation level was exceeded.
-- Screening criteria from 1992 ROD *(USEPA, 1992)*
-- U = Indicates that the parameter was analyzed but nor detected.
The value shown is the minimum quantitation limit.
-- J = Indicates estimated value.
-- R = Indicates a rejected value
-- Only compounds detected were included in this table
-- NA = Not Analyzed or Not Applicable

APPENDIX B4
SUMMARY OF OCTOBER 2002 SEDIMENT SAMPLING RESULTS
Benfield Industries Site - Waynesville, North Carolina

Station ID	**Screening**	**SD-1**	**SD-2**	**SD-2 DUP**	**SB-3**
Sample No.	**Criteria**	637	640	641	643
Sample ID	**(mg/Kg)**	D1L40	D1L43	D1L44	D1L46
Date Sampled	**ER-L/ER-M**	10/3102	10/31/02	10/31/02	10/31/02
VOLATILE ORGANICS COMPOUNDS (Concentration in µg/kg)					
Toluene		13 U	2 J	2 J	4 J
SEMIVOLATILE ORGANIC COMPOUNDS (Concentration in µg/kg)					
Anthracene	85/960	53 J	48 J	430 U	570 U
Benzo(a)anthracene	230/1600	130 J	180 J	68 J	84 J
Benzo(a)pyrene	400/2500	120 J	150 J	90 J	83 J
Benzo(b)fluorethane	NA	120 J	170 J	94 J	130 J
Benzo(ghi)perylene	NA	95 J	83 J	60 J	64 J
Benzo(k)fluoranthene	NA	130 J	160 J	98 J	130 J
Carbazole	NA	420 U	47 J	430 U	570 U
Caprolactarn	NA	130 J	430 U	430 U	570 U
Chysene	400/2800	160 J	200 J	120 J	140 J
Fluoranthene	600/3600	300 J	460	170 J	200 J
Indeno (1,2,3-cd)pyrene	NA	91 J	99 J	60 J	85 J
Pentachlorophenol	NA	450 J	1100 U	1,100 U	1400 U
Pentananthrene	225/1380	290 J	280 J	88 J	94 J
Pyrene	350/2200	280 J	390 J	180 J	230 J
TOTAL METALS (Concentration in mg/kg)					
Aluminum	NA	7,400	20,000	9,900	15,000
Barium	NA	94	260	120	160
Beryllium	NA	0.26 U	0.49	0.27	0.51
Calcium	NA	490	2,200	740	1,300
Chromium	NA	22	42	36	43
Cobalt	NA	5.5 U	15	7.5 U	11
Copper	70/390	13	52	13	25
Iron	NA	16,000	32,000	16,000	24,000
Lead	35/110	11	31	11	20
Magnesium	NA	3,200	7,600	4,600	6,000
Manganese	NA	200	380	140	260
Nickel	30/50	7.1	23	11	14
Potassium	NA	2,400	6,100	2,900	3,800
Selenium	NA	1.1 R	1.2 J	0.78 UJ	1.9 J
Sodium	NA	420	470	360	510
Thallium	NA	2.4 R	3.2	1.7 R	2.5 R
Vanadium	NA	24	54	26	40
Zinc	120/270	66 J	120 J	80 J	120 J

Source: Mountain Environmental Services (2003)

-- Shared value means remediation level was exceeded.
-- Screening criteria from 1992 ROD *(USEPA, 1992)*
-- U = Indicates that the parameter was analyzed but nor detected.
The value shown is the minimum quantitation limit.
-- J = Indicates estimated value.
-- R = Indicates a rejected value
-- Only compounds detected were included in this table
-- NA = Not Analyzed or Not Applicable

Appendix C -- Memo from USEPA's Groundwater Technical Support Center (1/16/03)

OPTIONAL FORM 99 (7-90)

FAX TRANSMITTAL # of pages ▸

To Doug Mullendore	From Jon Bornholm
Dept/Agency	Phone #
Fax #	Fax # 615-736-7676

NSN 7540-01-317-7368 5099-101 GENERAL SERVICES ADMINISTRATION

ENCY
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OFFICE OF
RESEARCH AND DEVELOPMENT

January 16, 2003

MEMORANDUM

SUBJECT: Technical Review Comments for the Benfield Superfund Site, Waynesville, NC (03-R04-002)

FROM: David S. Burden, Ph.D., Director /s/
Ground-Water Technical Support Center

TO: Jon Bornholm, RPM
U.S. EPA Region 4

Per your request, the following are technical review comments and recommendations regarding review of the ground-water extraction system at the Benfield Superfund Site in Waynesville, NC. Several supporting documents were supplied to assist in the review, and per your request, two primary questions were addressed: 1) Is or will the current ground-water extraction system accomplish the goal of capturing and removing the plume?; and 2) If not, what modifications need to be made to improve the system? The review was conducted by Mr. Mark Paddock, Robert Dover, and Dr. Hai Shen of the Dynamac Corporation, with my oversight. Dynamac is a contractor for EPA's Ground-Water Technical Support Center. I have reviewed their comments and concur with them. If upon review of these comments, you have any questions, please contact me at your convenience.

General Comments

It is stipulated in the site's Record of Decision (ROD), that among other things, the remedy includes extraction of contaminated ground water via extraction wells within and at the periphery of the plume. The November 18, 1994 Preliminary Design Report for the site also states "the goal during ground-water extraction will be to maximize pumpage from the extraction wells allowed by both the aquifer system and the extraction well system, so that plume removal will occur as quickly as possible."

Based on the data provided, the current ground-water extraction system appears to be providing limited hydraulic containment for the portion of the plume(s) remaining on-site. Review of the provided data also indicates the current extraction well configurations are not adequate for the efficient and expeditious removal of the remaining on-site contaminant plume mass. The extraction wells are screened deeper than the main plume mass, which allows the removal of a relatively large volume of "clean" ground water from the deeper saprolite unit, versus a concentrated effort to remove the remaining main plume mass identified in the shallow alluvium at the site, namely in the vicinity of monitoring wells MW03SH and MW07SH. Due to the inadequate design of the extraction system, it will be difficult, if not impossible, to substantially enhance the removal of some contaminants remaining in the shallow alluvium aquifer simply through operating the current extraction system at the current pumping rates (or by increased pumping rates). The easy adsorption of PAHs by aquifer solid materials, as well as the differences in hydraulic conductivities between the alluvium and saprolite, may limit the transport of these contaminants to the extraction wells There are other concerns as well, such as the increasing organic concentrations in monitoring well MW03SH, and its proximal distance to Browning Branch, which are also addressed in the subsequent sections of this memorandum.

The following general comments/conclusions are provided based on the review of provided data:

1. The potentiometric data do not indicate that the plume is being substantially contained or captured. The February 2002 monitoring report states that the closed contours on the potentiometric map (Figure 2) indicate “some measure” of containment of the plume. While we agree that limited containment of the plume(s) may be occurring within the vicinity of the extraction wells, total plume containment is probably not occurring as a result of the extraction system’s operation.

   Several problems exist with the presentation of water level data in Figure 2 to determine whether the extraction system is capturing the plume. First, the only water level measurements which show any substantial depression in the potentiometric surface are the measurements in the extraction wells themselves. However, extraction wells should be avoided for creating water level maps. If the hydraulic head from art extraction well is used, the assumptions are that the flow is horizontal and the efficiency of the well is known for the given pumping rate. In some cases, assumptions and estimates can be used to make corrections of water levels in extraction wells - this was not done in this case. In general, the potentiometric surface should be measured in wells and piezometers surrounding, and in close proximity to, the extraction wells, but not from the extraction wells themselves,

   If the two extraction well data points are eliminated from Figure 2, the other measuring points show little or no depression of the potentiometric surface. For instance, the pre-remediation water level presented for well MW-03SH (the most contaminated well, near EX-03) in the *Preliminary Design Report* is about 2,719 feet The data point for the same well in February 2002, after almost a full year of operation of the system, was 2,715.5. This represents a reduction of about 3.5 feet that *may* be due to a cone of depression surrounding EX-03. However, the reduction of 3.5 feet is well within the natural variation reported for the area, and could easily have been caused by natural seasonal variations or drought conditions. Even if the reduction in this well is entirely due to a cone of depression around EX-03, it is a relatively small reduction for a well located within 100 feet of the extraction well, showing a very limited area of depression.

Based on above analysis, it is clear that capture zone analysis for the extraction wells is necessary at the site. This type of analysis will provide information which can be used to increase the effic iency of the extraction wells. The capture zone of an extraction well is the portion of the subsurface containing ground water that actually discharges to the well. To prevent the plume from escaping beyond the extraction wells, the capture zone must be la rge enough so that the proposed entire contaminant area can be contained. It should be emphasized that Figure 2 only shows the zone of influence by the extraction wells. The capture zone of a well is not coincident with its drawdown zone of influence. The extent of the influence zone depends largely on transmissivity and pumping rate. However, the dimensions of the capture zone depend on the natural hydraulic gradient, as well as pumping rate and transmissivity. Relatively high natural hydraulic gradients result in narrow capture zones that do not extend far enough in the downgradient direction. To prove the effectiveness of the containment capture zone, an analysis should be conducted, and well location and pumping rates should be optimized, based on monitoring hydraulic heads and flow rates during operation of the extraction system. The conceptual model refinement through monitoring of the system operation is an essential procedure that can lead to effective design and operation of the extraction system. The capture zone analysis tool and procedures can be referenced in *Design Guideline for Conventional Pump-and Treat Systems* (EFA/540/S-97/504, September 1997).

The report's reference to "closed contours" as evidence of containment of the plume is misleading. Removal of water in an extraction well at a rate exceeding the natural ground-water flow rate toward that well will always generate a "closure" of some contours, depending on the contour interval used. In order to evaluate whether the extraction system is effectively containing the plume, closure of some contours is not enough - the closure must be shown to extend beyond the boundaries of the plume, showing a reversal of flow directions and transport of the plume toward the extraction well. Closure of contours in a limited area near the extraction well is to be expected, but has no implications for the effect of the well on the plume as a whole.

2. The June 27 memo by Mountain Environmental stated evidence for the inefficient operation of the system was based on low concentrations identified in the extraction wells completed in the saprolite unit versus the high contaminant concentrations identified in adjacent monitoring wells completed in the alluvial aquifer. The most recent ground-water monitoring data provided supports this statement, and indicates ground-water impact above regulatory concern in the vicinity of alluvial monitoring wells MW03SH, MW05SH, and MW07SH. The most recent ground-water quality data collected from the saprolite extraction wells EXT02 and EXT03 indicates these deeper wells contained low-level quantities of organic contaminants. The provided data support the conclusion that the two extraction wells are nee adequately capturing and removing the main plume contaminant mass as intended.

3. The provided data indicate the main contaminant mass occurs near the ground-water interface down to a depth of about 20 ft or less, and is associated with the shallow

alluvium beneath the site. The two ground-water extraction wells arc screened at deeper depths (16.5 to 26.5 ft bgs for EXT03, and 23 to 33 ft bgs for EXT02) within the underlying saprolite unit. Although the alluvium and saprolite units are reportedly hydraulically connected, the saprolite unit has historically displayed relatively low concentrations of organic contaminants. The monitoring data suggests a large portion of the recovered ground water is originating from the deeper saprolite unit, while only a limited portion of the "impacted" ground water from the upper alluvium unit is being captured by the ground-water extraction wells.

The June 27 memo implies that the reason for the ineffectiveness of plume mass recovery is the placement of extraction wells in a hydrogeologic unit (saprolite) below the most contaminated unit (alluvium). The real problem is not the vertical difference between the extraction wells and the plume; it is the difference in hydraulic conductivity between the saprolite and alluvium if the saprolite had a similar conductivity to the alluvium, then extraction from the base of the combined system would be sufficient to drain the ground water from both units. The alluvial water would simply flow downwards, by gravity, towards the extraction well screen. However, because the alluvium has much higher conductivity than the saprolite, it is much easier for the shallow, contaminated ground water to flow horizontally within the alluvium than vertically into the saprolite. Therefore, the extraction system is not capturing the shallow ground water, as seen in Figure 2. We agree with the solution to this problem recommended in Mountain Environmental's June 27 memo. Additional extraction wells or recovery trenches would need to be installed within the alluvium to capture the shallow contaminated ground water.

4. We also have some concerns regarding surface water quality associated with Browning Branch. Based on the data provided, the last time this surface water feature was sampled was in the early 1990's as part of the 1994 Preliminary Design Report. MW03SH, situated approximately 70 ft east of Browning Branch, has consistently displayed organic compounds that are of regulatory concern, and cumulative ground-water monitoring data for this well indicate an increase in some of these compounds since 1994. Although potemiometric data indic ate ground-water flow at the site in a north/northwest direction, a portion of the on-site plume(s), particularly near MW03SH, could also be in communication with surface water associated with Browning Branch. There are currently no other monitoring wells between MW03SH and Browning Branch to clearly delineate this margin of the plume to acceptable regulatory levels, which indicates the need for further assessment (e.g., installation of additional monitor wells) to better delineate the west margin of the plume in the vicinity of MW03SH, and possibly in the vicinity of MW07SH. The additional wells would also provide a means of confirming/monitoring the effectiveness of the ground-water pump and treat system in containing the plume(s) in these areas. This assessment/monitoring activity could possibly also be augmented by periodic sampling along the hypotheic zone (groundwater/surface water interface) using piezometers and/or surface water sampling to confirm whether or not organic compounds are discharging into Browning Branch

through ground water.

5. On Page 2 of the February, 2002 monitoring report, a comparison is made between current contaminant concentrations (2001 and 2002) versus pre-remedial contaminant concentrations identified during sampling events in 1991 and 1994. If this is all the data that exists, then a comparison can be done, but should be qualified with a statement that the intervening time gap of seven years between samples makes comparisons highly questionable. Ideally, samples should have been collected and analyzed shortly before the initiation of ground-water extraction, and should be the primary benchmark for comparisons to evaluate system effectiveness. If more recent data exist, these should be presented in future reports.

   In the future, more data sets (e.g., ground-water monitoring events) will have to be collected in order to adequately determine long-term trends relating to ground-water quality and remedial progress at the site. Based on the monitoring data that have been collected thus far, we are in agreement that overall ground-water quality has improved beneath most portions of the site since 1994. However, this is most likely in response to treatment of source area soils at the site and cannot be accurately correlated to operation of the ground-water extraction system. The one area that is the exception is situated in the vicinity of MW03SH. Organic compounds in this area have displayed an increase since monitoring began in 1994. The increase of these compounds could be in response no plume movement/migration associated with ground-water exaction at EXT03. Although this extraction well may be capturing a portion of this plume, it does nor appear to be capturing a large volume of the increasing contaminant mass within this area.

6. On Page 2, the February, 2002 monitoring report states that elevated iron concentrations within the plume may indicate natural attenuation of contaminants. This statement is highly questionable. Elevated iron concentrations within the plume may also indicate a release of dissolved iron from the waste source. If information exists within the literature suggesting that elevated iron concentrations indicate natural attenuation of organic contaminants, that information should be presented in the report. In addition, although indicators of various kinds may be used to indicate whether natural attenuation processes are likely at a site, only data showing decreasing contaminant concentrations can be used to demonstrate whether these processes are actually occurring, or are occurring at a rate fast enough to achieve the goals of the remedial activity.

7. In future monitoring reports, several means of presenting data can be used to assist reviewers in determining whether the system is operating effectively. The current monitoring report presents a table of Historical Ground Water Analytical Results (Table 3), which is useful, but could be improved. One noted problem is that it appears to be incomplete. The August, 23 EPA Region 4 memo states that EPA approved the elimination of one-extraction well based on analytical data from samples collected in October 2000. Table 3, which lists historical ground-water data, does not list any results for samples collected in October 2000. While it is good that the report presents historical

data that can be used to help assess the effectiveness of the system, it should present *all* of the existing historical data, not just a few selected data points.

In addition, instead of simply presenting historical data in a table, the report should present time-plots of the concentrations of major contaminants on a well-by-well basis. This would provide a visual presentation of any increasing or decreasing concentration trends that may indicate the effectiveness of the system. Finally, the analytical data should also be presented in the form of isoconcentration maps for selected major contaminants. These maps, presented over time, will allow reviewers to observe the shrinkage, growth, and/or movement of the plume.

8. The monitoring reports should include summaries of the volume of water produced by the system (preferably on a daily basis), at least monthly sample results from the effluent, estimates of the volume of mass of contaminants captured by the system, and precipitation data from a nearby weather station. If the system is effective, these data will demonstrate this to Agency reviewers by showing an actual increase in the mass of contaminants removed, and (hopefully) a gradual reduction in the mass of contaminants removed over time. Comparison of the daily water production data with precipitation data will allow evaluation of the impact that precipitation has on ground-water flow in the system, as well as possible flushing of contaminants from the soil. Finally, these data may identify modifications that can be made in pumping times and rates, pump repair, or other factors, that can optimize the system.

Detailed Comments and Notes

Review of tables and figures presented in the *Ground-Water Monitoring Report - February 2002* indicates there are discrepancies in data reporting for the February 2002 ground-water monitoring event. These discrepancies make it confusing to the reader and should be edited for correctness in future ground-water monitoring reports. The discrepancies noted are as follows:

MW035H

1. Table 2 and Figure 3 report a chrysene concentration of 380 J µg/L while a chrysene concentrations is not reported in Table 3.

2. Table 2 and Figure 3 report a dibenzofuran concentration of 1,800 µg/L, while a dibenzofuran concentration of 380 J is listed in Table 3.

3. Table 2 and Figure 3 do not indicate the presence of di-n-butylphthalate, while Table 3 lists this compound at a concentration of 1,800 µg/L.

MW05SH

4. Table 2 and Figure 3 list a carbazole concentration of 5 J µg/L, while the presence of chrysene is not indicated in these data sources. Table 3 on the other hand, lists a chrysene concentration of 5 J µg/L, but does not indicate the presence of carbazole. This will be important in clarifying since there is an MCL of 0.2 µg/L for chrysene, while there is not an MCL or NC State Ground-Water Standard for carbazole.

Conclusions and Recommendations

Based an the data provided, operation of the current system configuration appears to be providing limited containment of the remaining portions of the organic plume(s), but does not appear to be functioning in a manner that is achieving site cleanup through removal of the main plume mass. Because of this, the following recommendations are being made to assist in overcoming these problems:

A) Installation and Tie-In of Additional Shallow Extraction Wells.

We are in agreement with the June 2002 memorandum that suggested the installation of additional shallow ground-water extraction wells in the vicinity of MW03SH and MW07SH. A capture zone analysis should also be conducted in order to aid in the decision-making process regarding placement of additional extraction wells, and to improve the efficiency of the extraction system. These new extraction wells would need to be completed to a maximum depth of 20 ft bgs, with a screened interval occurring from total depth to across the water table. This option would provide the most cost- and time-effective means of promoting removal of remaining plume. This option would, however, require extra capital cases in order to install the new shallow extraction wells, tie-in into the current ground-water extraction system piping, purchase and install additional submersible pumps and associated well-head instrumentation, and modify the existing groundwater pump control system.

B) Increasing the Pumping Rate of the Two Extraction Wells

Increasing the pumping rate of the existing extraction wells to a point where the wells are pumped dry on an almost continual basis would result to de-watering of the saprolite unit in the vicinity of the two extraction wells. This could also promote the downward migration of impacted ground water to the extraction well inlets. An advantage of doing this would be possible enhancement of contaminant mass recovery without major modifications to the current extraction well configurations.

Disadvantages would include an increased volume in recovered ground water, and downward migration of the contaminant plume into portions of the aquifer that may have been previously un-impacted. In addition, increases in pumping rates for the extraction wells may have limited capability to enhance recovery of certain PAH contaminants detected in the shallow alluvial aquifer, such as anthracene, benzo(a)pyrene, chrysene, fluoranthene, pyrene, etc. These 3

- (or more) rings PAHs commonly have a very low solubility in water and can be easily absorbed by aquifer media before reaching the extraction wells, thereby limiting the effectiveness of plume mass recovery. Another potential disadvantage is the effectiveness that this approach might have due to the lower hydraulic conductivity of the saprolite unit which could limit the downward migration of the contaminant plume from the more conductive alluvium.

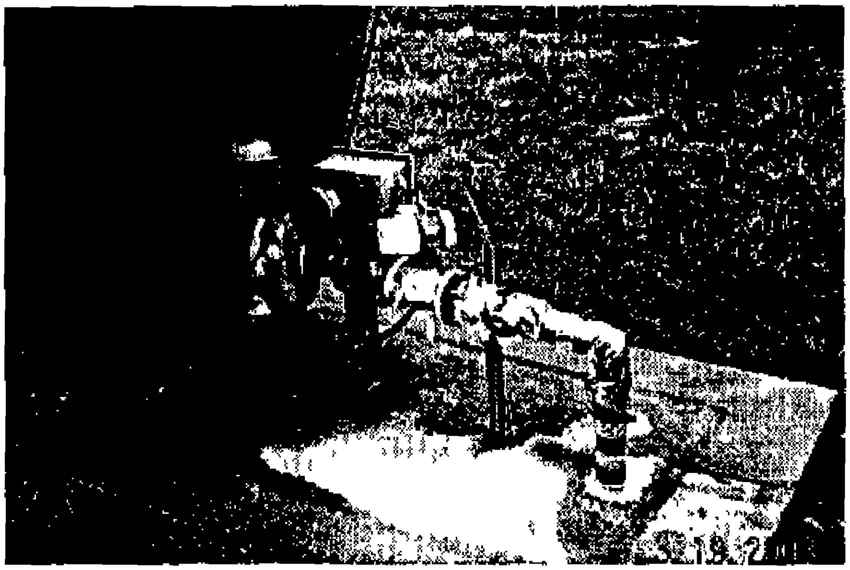
C) Installation of a Ground-Water Extraction Trench

Installation of ground-water extraction trenches would provide an efficient means of recovering impacted ground water and restoring ground-water quality in a fairly short time period. This option, however, would be the most costly to implement, and there would be engineering obstacles that would need to be overcome. The most notable would be trenching to sufficient depth in water-laden alluvial sediment that could be in-cohesive and prone to sloughing and cave-ins. Another consideration would be generation and disposal of soil originating from trenching activities. Additional capital costs such as recovery wells within the trench(es), and necessary equipment installation/system modifications (also described for installation of the shallow extraction wells) would also have to be included to complete this task.

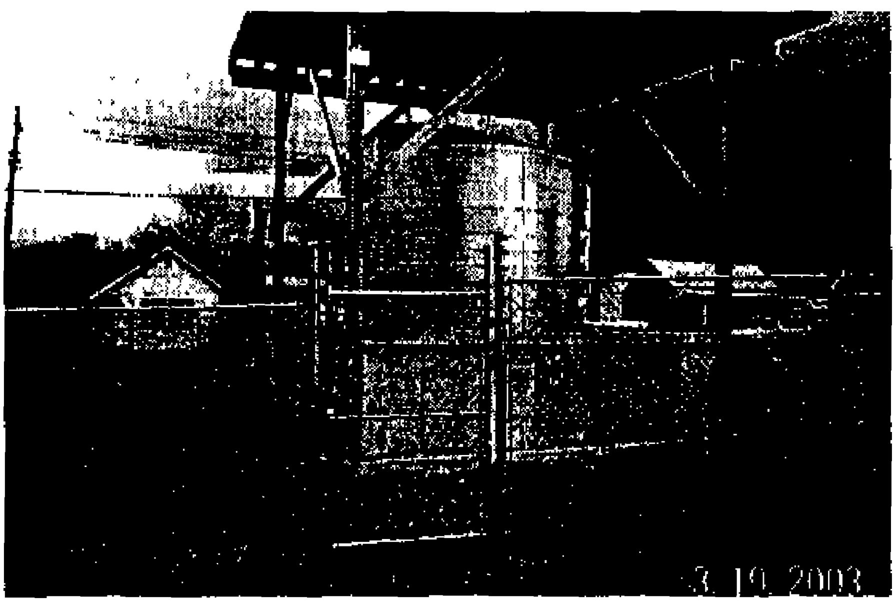
One additional option that could be considered in reducing the remaining plume mass in lieu of system modifications would include the use of a portable high vacuum multi-phase extraction (HVME, or dual-phase recovery) system. This could possibly be achieved by periodically utilizing a portable system (e.g. vacuum truck or portable liquid ring pump) capable of pulling sufficient vacuum to remove both impacted ground water and soil gas vapors from MW03SH and MW07SH. The recovered ground water could be transferred to the treatment system, or if necessary, transported off-site for treatment/disposal. The captured soil gas vapors could undergo off-gas treatment utilizing a portable catalytic oxidizer. This option could aid in the expedited removal of the remaining plume mass that is associated with the areas surrounding MW03SH and MW07SH, and would not require the necessary capital costs to modify the current ground-water extraction system.

cc: Rich Steimle (5102G)
John M. Cunningham (5204G)
Kay Wischkaemper, Region 4
Felicia Barnett, Region 4

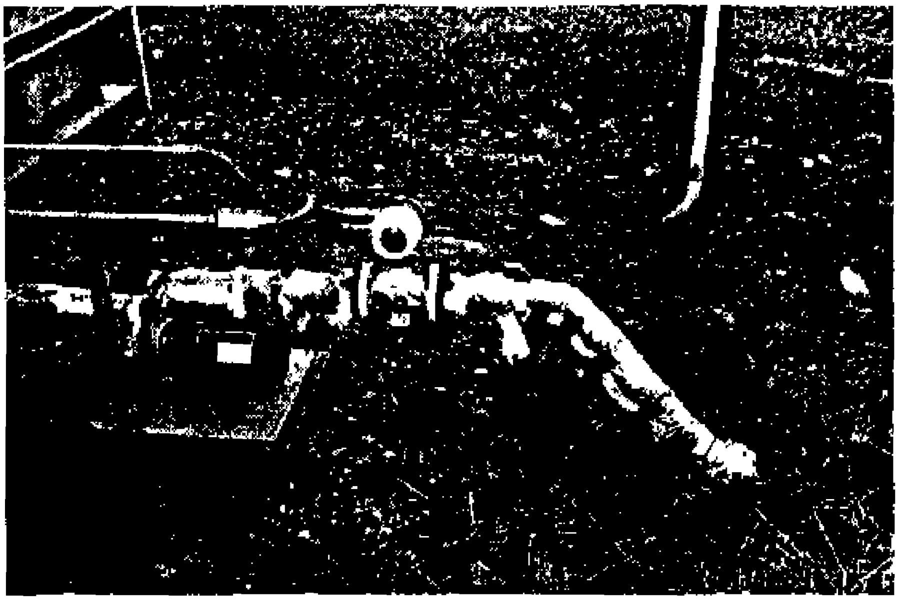
Appendix D -- Site Photographs



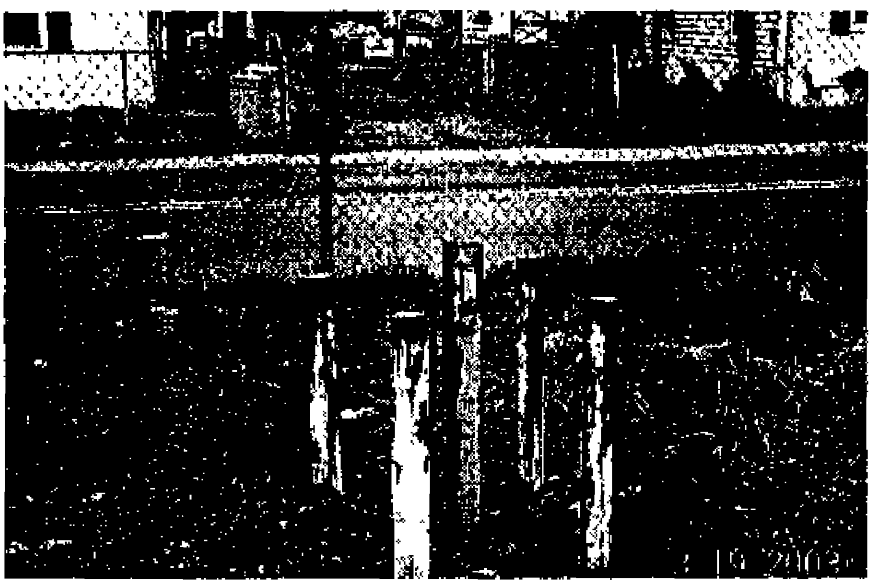
Photograph 1 - Extraction Well EXT02. Notice newly repaired concrete and installed *freeze* protection. The well housing is secured by a wing nut but is left unlocked.



Photograph 2 - Holding Tank and Containment Structure. The property owner recently installed the fence surrounding the tank. A lock secures the gate.

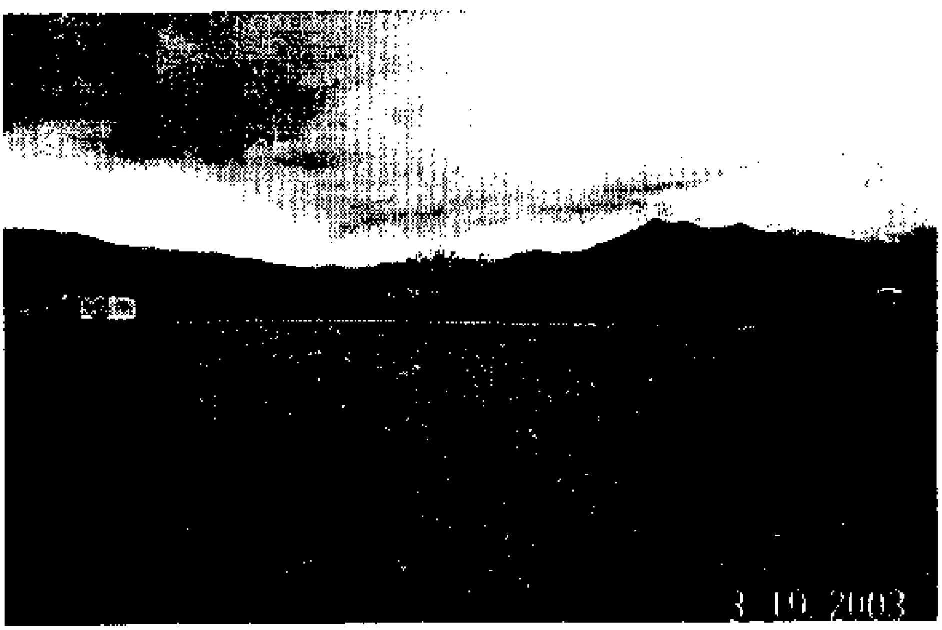


Photograph 3 - Discharge point from Holding Tank to City of Waynesville's POTW. Notice the insulation around the piping, this was added after the lines were damaged during a hard freeze. The discharge point is inside the fence surrounding the holding tank.



Photograph 4 - Piezometer PZ05A with residence along Riverbend Street in the background. This piezometer is locked, but piezometers and wells at the site were not.

Photograph 5 - Monitoring Wells MW03 and MW03SH. The pile of branches and logs are the result of the property owner removing the old water tower that was located on the Sites western perimeter. It was during the removal of the water tower that the perimeter fence in this area was damaged and removed.



Photograph 6 - View of the Site looking south. The well cluster in the foreground is MW07SH and MW07S. The area just south of this well cluster is where soils not meeting the treatment performance standards were buried. The area behind the parked trailers is the approximate location if the proposed Vocational Technical Training Center.

Photograph 7 - Photograph facing northwest showing monitoring well pair MW07SH and MW07S. Notice the perimeter fencing in the background. Similar fencing in the vicinity of MW03S and MW03SH was knocked down and removed during the removal of the water tower.

Photograph 8 - Photograph facing south in the vicinity of MW03S and MW03SH. A ground scar is evident in the middle of the picture. This is the area where the water tower fell and was cut up before removal from the site.

Appendix E - Site Inspection Checklist

APPENDIX E
Site Inspection Checklist

I. SITE INFORMATION	
Site name: *Benefield*	**Date of inspection:** *3/26/03*
Location and Region: *Waynesville, NC; Region 4*	**EPA ID:** *NCD981026479*
Agency, office, or company leading the five year review: *USACE, Nashville District Becky Terry, Doug Mullendore*	**Weather/temperature:** overcast, mild

Remedy Includes: (Cheek all that apply)

- ☐ Landfill cover/containment
- ☐ Access controls
- ☒ Institutional controls
- ☐ Groundwater pump and treatment
- ☐ Surface water collection and treatment
- ☐ Other ______________________
- ☐ Monitored natural attenuation
- ☒ Groundwater containment
- ☐ Vertical barrier walls

____

Attachments: ☐ Inspection team roster attached (See Report) ☐ Site map attached

II. INTERVIEWS (Check all that apply)

1. O&M site manager David Traylor, Mountain Environmental Services, *Civil Engineer, 3/26/03*

Interviewed ☐ at site ☒ at office ☐ by phone Phone no. *828-456-5189*
Problems, suggestions; ✕ Report attached

____
____

2. O&M staff
Interviewed ☐ at site ☒ at office ☐ by phone Phone no.
Problems, suggestions; ✕ Report attached______________________
____

3. Local regulatory authorities and response agencies (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

Agency______________________
Contact______________________ ____________ ________ __________
Name Title Date Phone no.
Problems, suggestions; ☐ Report attached______________________
____

Agency______________________
Contact______________________ ____________ ________ __________
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached______________________

Agency___________________________
Contact___________________________ ________________ __________ ____________

Name | Title | Date | Phone no.

Problems; suggestions; ☐ Report attached____

____

Agency___________________________
Contact___________________________ ________________ __________ ____________

Name | Title | Date | Phone no.

Problems; suggestions; ☐ Report attached____

4. Other interviews (optional) ☐ Report attached.

George Marshall – Maywood Vocational Tech – President,

Fred Baker – POTW Town of Waynesville -

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1. O&M Documents

☒ O&M manual	☐ Readily available	☐ Up to date	☐ N/A
☐ As-built drawings	☐ Readily available	☐ Up to date	☐ N/A
☐ Maintenance logs	☐ Readily available	☐ Up to date	☐ N/A

Remarks
O & M well-documented but O & M manual not up to date

2. Site-Specific Health and Safety Plan ☐ Readily available ☐ Up to date ☐ N/A
☒ Contingency plan/emergency response plan ☐ Readily available ☐ Up to date ☐ N/A
Remarks
Worked under contractors

3. O&M and OSHA Training Records ☒ Readily available ☒ Up to date ☐ N/A
Remarks
Contractor holds O&M and OSHA Training Records

4. Permits and Service Agreements

☐ Air discharge permit	☐ Readily available	☐ Up to date	☐ N/A
☒ Effluent discharge	☒ Readily available	☒ Up to date	☐ N/A
☒ Waste disposal, POTW	☒ Readily available	☒ Up to date	☐ N/A

☐ Other permits ___________________________ ☐ Readily available
☐ Up to date ☐ N/A
Remarks POTW permit is on a volumetric basis (0.8 MGD)

5. **Gas Generation Records** ☐ Readily available ☐ Up to date ☒ N/A
Remarks

6. **Settlement Monument Records** ☐ Readily available ☐ Up to date ☒ N/A
Remarks

7. **Groundwater Monitoring Records** ☒ Readily available ☐ Up to date ☐ N/A
Remarks

8. **Leacheate Extraction Records** ☒ Readily available ☐ Up to date ☐ N/A
Remarks

9. **Discharge Compliance Records**

☐ Air ☐ Readily available ☐ Up to date ☐ N/A
☒ Water (effluent) ☒ Readily available ☐ Up to date ☐ N/A
Remarks

10. **Daily Access/Security Logs** ☐ Readily available ☐ Up to date ☒ N/A
Remarks

IV. O&M COSTS

1. **O&M Organization**

☐ State in-house ☐ Contractor for State
☐ PRP in-house ☐ Contractor for PRP
☐ Federal Facility in-house ☐ Contractor for Federal Facility
☒ Other Contractor for EPA

2. **O&M Cost Records**

☒ Readily available ☒ Up to date
☐ Funding mechanism/agreement in place
Original O&M cost estimate *$ 40,000* ☐ Breakdown attached

Total annual cost by year for review period if available

From (Date)	To (Date)	Total cost	
1/2002	2/2002	$4,128/month	☐ Breakdown attached
3/2002	3/2003	$2,500/month	☐ Breakdown attached
			☐ Breakdown attached
			☐ Breakdown attached
			☐ Breakdown attached

3. **Unanticipated or Unusually High O&M Costs During Review Period**
Describe costs and reasons;
none

V. ACCESS AND INSTITUTIONAL CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. **Fencing damaged** ☒ Location shown on site map ☒ Gates secured ☐ N/A
Remarks

B. Other Access Restrictions

1. **Signs and other security measures** ☐ Location shown on site map ☐ N/A
Remarks
Signs posted ____

C. Institutional Controls (Ms)

1. **Implementation and enforcement**
Site conditions imply ICs not properly implemented ☐ Yes ☒ No ☐ N/A
Site conditions imply ICs not being fully enforced ☐ Yes ☒ No ☐ N/A

Type of monitoring (*e.g.*, self-reporting, drive by) Onsite check/inspection of wells, and holding tank
Frequency 3/week
Responsible party/agency Mountain Environmental

Contact	David Traylor	Civil Engineer	828-456-5189
	Name	Title	Phone no.

Reporting is up-to-date ☒ Yes ☐ No ☐ N/A
Reports are verified by the lead agency ☒ Yes ☐ No ☐ N/A

Specific requirements in deed or decision documents have been met ☒ Yes ☐ No ☐ N/A
Violations have been reported ☐ Yes ☐ No ☒ N/A
Other problems or suggestions: ☐ Report attached

2. **Adequacy** ☒ ICs are adequate ☐ ICs are inadequate ☐ N/A
Remarks

D. General

1. **Vandalism/trespassing** ☐ Location shown on site map ☒ No vandalism evident
Remarks Some trespassing____
____

2. **Land use changes on site**
Remarks Property owner proposes to develop southerly end of property for Vocational Tech Training Center (45,000sq ft)

3. **Land use change of site**
Remarks no ____
____

VI. GENERAL SITE CONDITIONS

A. Roads ☐ Applicable ☒ N/A	
1.	**Roads damaged** ☐ Location shown on site map ☐ Roads adequate ☐ N/A Remarks ____ ____
B. Other Site Conditions	
	Remarks
VII. SOIL COVERS ☒ Applicable ☐ N/A	
A. Landfill Surface	
1.	**Settlement (Low spots)** ☐ Location Shown on Site map ☒ Settlement not evident Remarks
2.	**Cracks** ☐ Location shown on site map ☒ Cracking not evident Lengths ____________ Widths _______________ Depths______________ Remarks
3.	**Erosion** ☐ Location shown on site map ☒ Erosion not evident Areas extent _____________ Depth_________________ Remarks
4.	**Holes** ☐ Location shown on site map ☒ Holes not evident Areas extent _____________ Depth_________________ Remarks
5.	**Vegetative Cover** ☒ Grass ☐ Cover properly established ☐ No signs of stress ☐ Trees/Shrubs (indicate site and locations on a diagram) Remarks
6.	**Alternative Cover (armored rock, concrete, etc)** ☐ N/A Remarks ____
7.	**Bulges** ☐ Location shown on site map ☐ Bulges not evident Areas extent _____________ High _________________ Remarks____ ____
8.	**Wet Areas/Water Damage** ☐ Wet areas/water damage not evident ☐ Wet areas ☐ Location shown on site map ☐ Areal extent ______________ ☐ Ponding ☐ Location shown on site map ☐ Areal extent ______________ ☐ Seeps ☐ Location shown on site map ☐ Areal extent ______________ ☐ Soft subgrade ☐ Location shown on site map ☐ Areal extent ______________ Remarks
9.	**Slope Instability** ☐ Slides ☐ Location &haws on site map ☐ No evidence of slope instability Areas extent _____________ Remarks____ ____
B. Benches ☐ Applicable ☒ N/A	
1.	**Flows Bypass Bench** ☐ Location shown on site map ✕ N/A or okay

Remarks____
____

2. **Bench Breached** ☐ Location shown on site map ✕ N/A or okay
Remarks____
____

3. **Bench Overtopped** ☐ Location shown on site map ✕ N/A or okay
Remarks____
____

C. Letdown Channels ☐ Applicable ☒ N/A

1. **Settlement** ☐ Location shown on site map ☐ No evidence of settlement
Areal extent ____________ Depth _______________
Remarks____
____

2. **Material Degradation** ☐ Location shown on site map ☐ No evidence of degradation
Material type____________ Areal extent _______________
Remarks____
____

3. **Erosion** ☐ Location shown on site map ☐ No evidence of erosion
Areal extent ____________ Depth _______________
Remarks
Minor erosion present on most caps, small riffles; need to be repaired before they become worse

4. **Undercutting** ☐ Location shown on site map ☐ No evidence of erosion
Areal extent ____________ Depth _______________
Remarks____
____

5. **Obstructions** Type ________________ ☐ No obstructions
☐ Location shown on site map Areal extent _________________
Size _______________
Remarks____
____

6. **Erosive Vegetative Growth** Type ________________
☐ No evidence of excessive growth
☐ Vegetation in channels does not obstruct flow
☐ Location shown on site map Areal extent _________________
Remarks____
____

D. Cover Penetrations ☐ Applicable ☒ N/A

1. **Gas Vents** ☐ Active ☐ Passive ☐ Properly secured/locked ☐ Functioning
☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance
☐ N/A
Remarks____
____

2. **Gas Monitoring Probes**
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition

☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks____
____

3. Monitoring Welts (within surface area of landfill)
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks **Some wells are unlocked**

4. Leacheate Extraction Wells
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☒ N/A
Remarks____
____

5. Settlement Monuments ☐ Located ☐ Routinely Surveyed ☐ N/A
Remarks____
____

E. Gas Collection and Treatment Applicable ☐ N/A

1. Gas Treatment Facilities
☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
☐ Good condition ☐ Needs Maintenance
Remarks____
____

2. Gas Collection Wells, Manifolds and Piping
☐ Good condition ☐ Needs Maintenance
Remarks____
____

3. Gas Monitoring Facilities (e.g., gas monitoring of adjacent homes or buildings)
☐ Good condition ☐ Needs Maintenance ☐ N/A
Remarks____
____

F. Cover Drainage Layer Applicable ☒ N/A

1. Outlet Pipes Inspected ☐ Functioning ☐ N/A
Remarks____
____

2. Outlet Rock Inspected ☐ Functioning ☐ N/A
Remarks____
____

G. Detention/Sedimentation Ponds ☐ Applicable ☒ N/A

1. Siltation Areal extent ____________________ Depth __________________ ☐ N/A
☐ Siltation not evident
Remarks____
____

2. Erosion Areal extent ____________ Depth _______________

	☐ Erosion not evident Remarks____ ____
3.	**Outlet Works** ☐ Functioning ☐ N/A Remarks____ ____
4.	**Dam** ☐ Functioning ☐ N/A Remarks____ ____
H. Retaining Walls ☐ Applicable ☒ N/A	
1.	**Deformations** ☐ Location shown on site map ☐ Deformation not evident Horizontal displacement _______________ Vertical displacement ________________ Rotational displacement _______________ Remarks____ ____
2.	**Degradation** ☐ Location shown on site map ☐ Degradation not evident Remarks____ ____
I. Perimeter Ditches/Off-Site Discharge ☐ Applicable ☒ N/A	
1.	**Siltation** ☐ Location shown on site map ☐ Siltation not evident Areal extent ____________ Depth ______________ Remarks____ ____
2.	**Vegetation Growth** ☐ Location shown on site map ☐ N/A ☐ Vegetation does not impede flow Areas extent _____________ Depth________________ Remarks____ ____
3.	**Erosion** ☐ Location shown on site map ☐ Erosion not evident Areas extent _____________ Depth________________ Remarks____ ____
4.	**Discharge Structure** ☐ Functioning ☐ N/A Remarks____ ____
VIII. VERTICAL BARRIER WALLS ☐ **Applicable** ☒ **N/A**	
1.	**Settlement** ☐ Location Shown on Site map ☐ Settlement not evident Areas extent _____________ Depth________________ Remarks____ ____
2.	**Performance Monitoring** Type of monitoring ________________________________ ☐ Performance not monitored Frequency________________ ☐ Evidence of breaching Head differential________________________ Remarks

IX. GROUNDWATER/SURFACE WATER REMEDIES ☒ Applicable ☐ N/A

A. Groundwater Extraction Wells, Pumps, and Pipelines ☒ Applicable ☐ N/A

1. Pumps, Wellhead Plumbing, and Electrical
☒ Good condition ☐ All required wells properly operating ☐ Needs Maintenance ☐ N/A
Remarks

2. Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances
☒ Good condition ☐ Needs Maintenance
Remarks
In general,

3. Spare Parts and Equipment
☒ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided
Remarks

B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☒ N/A

1. Collection Structures, Pumps, and Electrical
☐ Good condition ☐ Needs Maintenance
Remarks

2. Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances
☐ Good condition ☐ Needs Maintenance
Remarks

3. Spare Parts and Equipment
☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided
Remarks
See above

C. Treatment System ☒ Applicable ☐ N/A

1. Treatment Train (Check components that apply)
☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
☐ Air stripping ☐ Carbon absorbers
☐ Filters
☐ Additive (e.g., chelation agent, flocculent), *caustic soda*
☐ Others
☐ Good condition ☐ Needs Maintenance
☐ Sampling ports properly marked and functional
☐ Sampling/maintenance log displayed and up to date
☐ Equipment properly identified
☐ Quantity of groundwater treated annually
☐ Quantity of surface water treated annually
Remarks

2. Electrical Enclosures and Panels (properly rated and functional)
☐ N/A ☒ Good condition ☐ Needs Maintenance

	Remarks____
3.	**Tanks, Vaults, Storage Vessels** ☐ N/A ☒ Good condition ☐ Proper secondary containment ☐ Needs Maintenance Remarks____
4.	**Discharge Structure and Appurtenances** ☐ N/A ☒ Good condition ☐ Needs Maintenance Remarks____
5.	**Treatment Building(s)** ☐ N/A ☒ Good condition (esp, roof and doorways) ☐ Needs repair ☐ Chemicals and equipment properly stored Remarks Need to lock exterior well housing
6.	**Monitoring Wells** (pump and treatment remedy) ☐ Properly secured/locked ☒ Functioning ☒ Routinely sampled ☒ Good condition ☒ All required wells located ☐ Needs Maintenance ☐ N/A Remarks Some wells requite
D. Monitoring Data	
	☒ Monitoring Data ☒ Is routinely submitted on time ☐ Is of acceptable quality
Monitoring data suggests:	☐ Groundwater plume is effectively contained ☒ Contaminant concentrations are declining
D. Monitored Natural Attenuation	
1.	**Monitoring Wells** (natural attenuation remedy) ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition ☐ All required wells located ☐ Needs Maintenance ☒ N/A Remarks____

X. OTHER REMEDIES

If there are remedied applied at the site which are riot covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.)

See text of five year review report.

B. Adequacy of O&M

	Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy. *See text of five year review report.*
C.	**Early Indicators of Potential Remedy Problems**
	Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs, that suggest that the protectiveness of the remedy may be compromised in the future. *See text of five year review report.*
D.	**Opportunities for Optimization**
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. *See text of five year review report.*

APPENDIX F
Completed Interview Questionnaires

5-Year Review Questionnaire

Site: Benfield Industries

City/State: Waynesville, NC.

[illegible]

Date: May 9, 2003 Phone No. [redacted]

Name of Citizen [redacted]

Address [redacted]

Waynesville, NC 28786

How long have you lived near the Site? Lives across street from Site

Are you familiar with EPA activities over the past years? Yes

Do you still have any concerns regarding EPA clean up activities of the Site?

None today.

Overall, have you been **pleased** or displeased with EPA actions at this Site?

Yes now - but when the manure was there it drew a lot of flies - flies aren't there now.

Do you think you have been adequately informed about clean up activities at the Site?

Yes, EPA did an excellent job.

Is there any information about the Site that you would like to share with us that would assist in our 5-year review of site activities?

No - nothing has occurred at the Site other than people checking monitoring wells or mowing grass.

Is there someone else that you would like to recommend we contact for more information?

No

Do you have any suggestions that EPA can implement to improve communication with the public?

No, EPA did a good job.

(A copy of the 5-year review will be placed in the Site Information Repository file located in the Site Information Repository at ______________

Interview conducted by: Diane Barrett

Date conducted: 5/5/03

5-Year Review Questionnaire

Site Benfield Industries

City/State Waynesville, N.C. 28786

Date: May 9, 2003 Phone No. [redacted]

Name of Citizen [redacted]

Address

Waynesville, NC 28786

How long have you lived near the Site? Lives across street from Site

Are you familiar with EPA activities over the past years? Yes

Do you still have any concerns regarding EPA clean up activities of the Site?

Have 150% concerns that remaining EPA or cleanup crew were suppose to put 12" of clean soil, that has not been done. Soil level is lower in front areas. Concern for health issues is still sore point.

Overall, have you been pleased or displeased with EPA actions at this Site?

Displeased because of the action taken – their health was definitely impacted by cleanup actions taken; their doctors so stated. However, they do appreciate everything that RPM & CIC did to help them during the process.

Do you think you have been adequately informed about clean up activities at the Site?

Yes, definitely they were kept inform

Is there any information about the Site that you would like to share with us that would assist in our 5-year review of site activities?

Not that they know of – only saw people come to monitor groundwater & new owners have grass mowed. How close to monitoring well can construction occur?

Is there someone else that you would like to recommend we contact for more information?

No

Do you have any suggestions that EPA can implement to improve communication with the public?

No

[A copy of the 5-year review will be placed in the Site Information Repository file located in the Site Information Repository at

Interview conducted by: Diane Barrett

Date conducted : 5/9/03

5-Year Review Questionnaire

Site Benfield Industries

City/State Waynesville, NC.

Date: May 9, 2003 Phone No. [redacted]

Name of Citizen [redacted]

Address [redacted]

Waynesville 28786

How long have you lived near the Site? 42 years

Are you familiar with EPA activities over the past years? Yes

Do you still have any concerns regarding EPA clean up activities of the Site?

No - when plant blew up the chemicals ruined paint on her house and car. She has had respiratory problems ever since that time.

Overall, have you been pleased or displeased with EPA actions at this Site?

Can't say that she is one way or the other

Do you think you have been adequately informed about clean up activities at the Site?

Yes, guess so.

Is there any information about the Site that you would like to share with us that would assist in our 5-year review of site activities?

No

Is there someone else that you would like to recommend we contact for more information?

[redacted]

Do you have any suggestions that EPA can implement to improve communication with the public?

No

[A copy of the 5-year review will be placed in the Site Information Repository file located in the Site Information Repository at ______

Interview conducted by: Diane Barrett

Date conducted : 5/9/03

5-Year Review Questionnaire

Site Benfield Industries

City/State Waynesville, NC 28786

Date: May 9, 2003 Phone No. [redacted]

Name of Citizen [redacted]

Address [redacted]

Waynesville, NC 28786

How long have you lived near the Site? Lives across street from site

Are you familiar with EPA activities over the past years? Yes

Do you still have any concerns regarding EPA clean up activities of the Site?

Yes, been cleaned up

Overall, have you been pleased or displeased with EPA actions at this Site?

Pleased

Do you think you have been adequately informed about clean up activities at the Site?

Yes

Is there any information about the Site that you would like to share with us that would assist in our 5-year review of site activities?

Only people that sample the monitoring wells have been on property

Is there someone else that you would like to recommend we contact for more information?

No

Do you have any suggestions that EPA can implement to improve communication with the public?

Don't have any.

[A copy of the 5-year review will be placed in the Site Information Repository file located in the Site Information Repository at: ______

Interview conducted by: Diane Barrett

Date conducted: 5/9/03

5-Year Review Questionnaire

Site Benfield Industries

City/State Waynesville NC 28786

Date: May 9, 2003 Phone No. [redacted]

Name of Citizen [redacted]

Address [redacted]

Waynesville, NC.

Do you live near the Site? If yes, how long? 13 years

Are you familiar with EPA activities over the past years? Watch everything

What is your overall impression of the project? Thought it was stupid to wash rocks

Overall, have you been pleased or displeased with clean up actions at this Site?

Displeased -- they opened section of fence to remove soil to take to landfill. A lot of soil spilled on street in front of house. Then sweeping machine would come along to get dirt up.

... effects, if any, have site operations had on the surrounding community? Negative impact - dust everywhere, bad smell, flies

Do you still have any concerns regarding EPA clean up activities of the Site?

Reason to have some concern - regarding putting well caps. Neighbors weren't suppose to dig into ground because of restrictions! A deck. EPA violated their own restrictions!

Do you think you have been kept adequately informed about clean up activities at the Site?

Fairly

Are you aware of any events, incidents, or activities at the site such as vandalism, trespassing, or emergency responses from local authorities? If so, please give details.

No - kids opening big chainlink fence. Subcontractors were the people that were drilling perimeter wells drove into front yard & did damage to yard - someone else had to repair damage.

Is there someone else that you would like to recommend we contact for more information?

No

Do you have any suggestions that EPA can implement to improve communication with the public?

None

Interview conducted by: Diane Barrett

Date conducted: 5/9/03

5-Year Review Questionnaire for Govt. Officials

Site Benfield Industries Site

City/State Waynesville, N.C. 28786 Jeff ...

Date: May 9, 2003 Phone No. [redacted]

Name [redacted]

Address Town of Waynesville
Waynesville, NC

What is your overall impression of the project? Assume has been handled well. People anxious to purchase.

Have there been routine communications or activities conducted by your office regarding the Site? (Site visits, inspections, reporting activities, etc.) If so, please give purpose and results.
Did not conduct site visits.

Have there been any complaints, violations or other incidents related to the Site requiring a response by your office? If so, please give details of the events and results.
Just dust & that problem was handled by EPA's contractor

Do you feel well informed about the Site's activities and progress? Yes, more than enough

Do you think clean up activities at the Site have had a positive or negative impact on the community? In what ways?
Remains to be seen if reused.

Do you have any comments, suggestions, or recommendations regarding the Site's management or operation?
No

Interview conducted by Diane Barrett

Date conducted 5/12/03

5-Year Review Questionnaire for Govt. Officials

Site Benfield Industries

City/State Waynesville, NC

Date: May 9, 2003 Phone No. [redacted]

Name [redacted]

Address [redacted]

Waynesville, NC. 28786

What is your overall impression of the project? The property was cleaned up. However, time to implement was too long and cost too much. Soil should have been dug up & removed & clean soil put there - would have been much quicker and cost less.

Have there been routine communications or activities conducted by your office regarding the Site? (Site visits, inspections, reporting activities, etc.) If so, please give purpose and results.

Not to his knowledge. Maybe Economic Development Commission has had more involvement in their efforts to redevelop property. Also, City of Waynesville has had involvement.

Have there been any complaints, violations or other incidents related to the Site requiring a response by your office? If so, please give details of the events and results.

Not that he knows of

Do you feel well informed about the Site's activities and progress? Yes

Do you think clean up activities at the Site have had a positive or negative impact on the community? In what ways?

Positive - it took contaminated property, an eye sore, a health hazard, and made it a viable property.

Do you have any comments, suggestions, or recommendations regarding the Site's management or operation? No, why did it take so long.

Interview conducted by Diane Barrett

Date conducted 5-9-03

5-Year Review Questionnaire for Govt. Officials

Site: Benfield Industries
City/State: Waynesville, N.C.

Date: May 9, 2003 Phone No. [redacted]

Name [redacted]

Address: Haywood County Health Dept.
2177 Asheville Road, Waynesville 28786

What is your overall impression of the project? Did fantastic job, but took way too long to clean up.

Have there been routine communications or activities conducted by your office regarding the Site? (Site visits, inspections, reporting activities, etc.) If so, please give purpose and results.
No

Have there been any complaints, violations or other incidents related to the Site requiring a response by your office? If so, please give details of the events and results.
Nothing more than ... questions

Do you feel well informed about the Site's activities and progress? Recall receiving only one communication about site.

Do you think clean up activities at the Site have had a positive or negative impact on the community? In what ways?
Positive in that it was cleaned up, but negative in that it took so long & had & still has a negative stigma on the neighborhood.

Do you have any comments, suggestions, or recommendations regarding the Site's management or operation?
No

Interview conducted by: Diane Barrett

Date conducted: 5/9/03