Five-Year Review Report

First Five-Year Review Report
for
The Tibbetts Road Superfund Site
Town of Barrington
Strafford County, New Hampshire

September 2003

Prepared by:
The United States Environmental Protection Agency
Region 1, New England
Boston, Massachusetts

EPA
New England

Approved by: Date:

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Table of Contents

Figures, Tables, and Appendices

LIST OF ACRONYMS AND ABBREVIATIONS

ARARs	Applicable or Relevant and Appropriate Requirements
ARCADIS	Arcadis Geraghty & Miller, Inc.
CD	Consent Decree
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
Cis-1,2-DCE	Cis-1,2-Dichloroethylene
EPA	US Environmental Protection Agency
EW	Extraction Well
Ford	Ford Motor Company
FS	Feasibility Study
HEAST	Health Effects Assessment Summary Tables
HI	Hazard Index
ICL(s)	Interim Cleanup Level(s)
IRIS	Integrated Risk Information System
MW(s)	Monitoring Well(s)
MCL(s)	Maximum Contaminant Level(s)
MCLG(s)	Maximum Contaminant Level Goal(s)
NCP	National Contingency Plan
mg/L	Milligrams per Liter
MIBK	4-methyl-2-pentanone (Methyl Isobutyl Ketone)
NHDES	New Hampshire Department of Environmental Services
NPL	National Priorities List
O&M	Operation and Maintenance
OU(s)	Operable Unit(s)
PCBs	Polychlorinated Biphenyls
PCE	Tetrachloroethylene
ppb	Parts per Billion
ppm	Parts per Million
PRPs	Potentially Responsible Parties
RA	Remedial Action
RAOs	Remedial Action Objectives
RCRA	Resource Conservation and Recovery Act
RD/RA	Remedial Design/Remedial Action
RfD	Reference Dose
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study

ROD	Record of Decision
RPM	Remedial Project Manager
SDWA	Safe Drinking Water Act
Site	Tibbetts Road Superfund Site
SOW	Statement of Work
SVOCs	Semi-Volatile Organic Compounds
TCE	Trichloroethylene
ug/L	Micrograms per Liter
VER	Vacuum Enhanced Recovery
VOCs	Volatile Organic Compounds
Water District	Swains Lake Village Water District

Executive Summary

The EPA New England, Region 1 has conducted the first five-year review for the Tibbetts Road Superfund Site in Barrington, New Hampshire (the Site). The methods, findings, and conclusions of this Five-Year Review report are documented herein. The purpose of the five-year review is to determine whether the remedies implemented at the Site are protective of human health and the environment.

The assessment of this five-year review found that: 1) the remedies implemented at the Site were constructed in accordance with the requirements of the Record of Decision (9/29/1992) and as later modified in the Amended Record of Decision (9/28/98); 2) institutional controls in the form of a local ordinance have been instituted by the Swains Lake Village Water District for properties nearby the Site; 3) residents affected or potentially affected by groundwater contamination at the Site have been provided with an alternate source of potable water; and 4) progress is being made at the Site to achieve the cleanup levels identified in the Record of Decision and Amended Record of Decision.

Because the remedial actions being implemented at the Site are protective, the Site is protective of human health and the environment.

Five-Year Review Summary Form

SITE IDENTIFICATION		
Site name *(from WasteLAN)*: Tibbetts Road		
EPA ID *(from WasteLAN)*: NHD989090469		
Region: 01	**State:** NH	**City/County:** Barrington/Strafford

SITE STATUS	
NPL status: Final	
Remediation status (choose all that apply): ✔Operating ; ✔ Construction Completed	
Multiple OUs?* NO	**Construction completion date:** 09/29/98
Has site been put into reuse? NO	

REVIEW STATUS	
Lead agency: EPA, Region 1 – New England	
Author name: Neil Handler	
Author title: Remedial Project Manager	**Author affiliation:** U.S. EPA, Region 1- New England

Review period: March - September 2003	
Date(s) of site inspection: 03 / 24 / 2003	
Type of review: Post-SARA Policy Review	
Review number: 1	
Triggering action: Completion of construction at the site (i.e., completion of PCOR)	
Triggering action date *(from WasteLAN)*: 09/29/98	
Due date *(five years after triggering action date)*: 09/29/03	

Five-Year Review Summary Form, cont'd.

Issues:

1. Ability to achieve cleanup levels throughout the on-site contaminated groundwater plume: Concentrations of several Contaminants of Concern as identified in the 1992 Record of Decision and 1998 Amended Record of Decision still remain at or above the interim cleanup levels at several locations in the on-site overburden groundwater plume. However, overall there has been a downward trend observed for groundwater concentrations indicating that the remedy has been successful in controlling the extent of the on-site groundwater plume as well as removing and reducing the contaminant mass in the groundwater on-site.

2. Ability to achieve cleanup levels throughout the off-site contaminated groundwater plume: An isolated area of groundwater contamination containing elevated levels of some of the Contaminants of Concern extends into the bedrock aquifer to the northeast of the Site. Remediation efforts appear to have had a limited impact on reducing the extent as well as the overall concentration of contaminants in this area of the off-site plume.

3. Long-Term Monitoring: An alternate public water supply has been constructed for residents affected or potentially affected by groundwater contamination at the Site and institutional controls have been implemented through the local water district as part of the overall site-wide remedy. The extent of the off-site plume continues to require monitoring to confirm that the plume does not migrate beyond areas protected by the alternate water supply and the institutional controls.

4. Vapor Intrusion into Indoor Air Pathway: New EPA guidance has become available regarding the potential for vapor intrusion into indoor air from contaminated groundwater and soil. An initial review of the screening criteria provided in the guidance indicates that the conditions at the Site will likely require further investigation to determine if this pathway presents any risks to human health.

Recommendations and Follow-up Actions:

1. Continue to monitor the effectiveness of bioremediation and phytoremediation in achieving the required cleanup levels in the overburden aquifer and assess the need for continued treatment of "hot spots" in the overburden.

2. Conduct a pilot test using in-situ oxidation treatment technology for the area of bedrock groundwater contamination northeast of the Site to determine whether this technology can accelerate the cleanup of the groundwater in this area.

3. Continue to monitor groundwater and review existing monitoring network to ensure that the extent of the off-site plume is not changing and that the alternate water supply and institutional controls already in place remain protective of human health and the environment.

Five-Year Review Summary Form, cont'd.

Recommendations and Follow-up Actions, cont'd:

4. Further investigate the potential vapor intrusion pathway at the Site to determine if this pathway presents any risks to human health.

Protectiveness Statement(s):
Because the remedial actions being implemented at the Tibbetts Road Superfund Site are protective, the Site is protective of human health and the environment.

Other Comments:
None

Tibbetts Road Superfund Site
Barrington, New Hampshire

First Five-Year Review Report

I. INTRODUCTION

The purpose of the five-year review is to determine whether the remedy at a site is protective of human health and the environment. The methods, findings, and conclusions of the review are documented in Five-Year Review reports. In addition, Five-Year Review reports identify issues found during the review, if any, and identify recommendations to address them.

The Agency is preparing this Five-Year Review report for the Tibbetts Road Superfund Site (the Site) pursuant to Section 121 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). CERCLA Section 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 reviews.*

The Agency interpreted this requirement further in the NCP; 40 CFR Section 300.430(f)(4)(ii) states:

> *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.*

The EPA New England, Region 1 conducted a five-year review of the remedial actions implemented at the Tibbetts Road Superfund Site in Barrington, New Hampshire. This review, which is the first five-year review to be completed for the Site, was conducted from March 2003

through September 2003. The review is being conducted as a matter of EPA policy since the proposed remedial action for the Site, upon completion, will not leave hazardous substances, pollutants, or contaminants above levels that allow for unlimited use and unrestricted exposure; however the action requires five years or more to complete. The trigger for this review is the date of construction completion, which has been identified as September 29, 1998, based on the date of the completion of the Preliminary Close Out Report, Accordingly, this five-year review is to be completed by September 29, 2003.

II. SITE CHRONOLOGY

A chronology of significant site events for the Tibbetts Road Superfund Site is provided in **Table 1.**

III. BACKGROUND

This section describes the fundamental aspects of the Site to assist in identifying the threats posed to human health and the environment and the basis for the actions taken by EPA and the State of New Hampshire.

A. Physical Characteristics and Land Use

The Site as shown in **Figure 1**, is located at 216 Tibbetts Road in the southeastern portion of New Hampshire, in the Town of Barrington (Strafford County). The Site is approximately eight miles west of the City of Dover, and approximately 15 miles northwest of the City of Portsmouth, New Hampshire. The Site consists of approximately two acres of land in a rural, residential neighborhood with nearby pockets of dense forested areas. The Site is located on a topographic high, a ridge, that serves as the drainage divide between the Oyster River and Bellamy River watersheds. Wetland areas exist approximately seven hundred feet northeast and five hundred feet southwest of the Site. Surface water drainage at the Site occurs primarily as sheet flow. The nearest permanent water body, Swains Lake, is located approximately nine hundred feet to the north. This lake is used for recreational purposes and as a source of drinking water for individuals living near the Site.

B. History of Contamination

Originally, the property contained a single family residence belonging to Mr. Alexander Johnson. It is reported that during the time frame of 1945 - 1958, Mr. Johnson transported numerous drums containing wastes from industrial processes, primarily automobile production and painting, to his property for storage and use. During an initial

investigation of the Site by State of New Hampshire personnel in 1982, it became apparent that the contents of many of the drums stored at the Site had leaked on to the ground. Subsequent testing of the drums showed the presence of Volatile Organic Compounds (VOCs) such as acetone, toluene, benzene, xylene, trichloroethylene (TCE), tetrachloroethylene (PCE), 4-methyl-2-pentanone (also known as methyl isobutyl ketone or MIBK), and polychlorinated biphenyls (PCBs).

C. Initial Response Actions

With the discovery of contamination at the Site in 1982, the State of New Hampshire also began to monitor residential wells in the vicinity of the Site. Many of the same compounds detected in the drums at the Site were also detected in nearby residential wells. From 1984 to 1987, there were several response actions initiated by EPA at the request of the State of New Hampshire to address the most immediate hazards presented by the Site. The initial response actions or Removal Actions taken by EPA included: 1) the off-site disposal of over 300 drums containing various amounts of liquid and solid materials; 2) the excavation and off-site disposal of approximately 405 cubic yards of soil contaminated with VOCs, PCBs, and other organic compounds; 3) the excavation and on-site incineration of approximately 4 cubic yards of dioxin contaminated soil; and 4) the construction of a public water supply system for residents affected or threatened by groundwater contamination associated with the Site. In addition to the actions described above, the original Johnson residence was demolished in September of 1995 as part of the efforts to clean up the Site.

Most of the residences within approximately one-half mile of the Site now receive their water from the Swains Lake Village Water District (Water District). The Water District was created as a result of settlement discussions between EPA, the State of New Hampshire, and Ford Motor Company (Ford), the Potentially Responsible Party (PRP). The Water District operates and maintains the alternate water supply system constructed by EPA and the State of New Hampshire from1987 to 1988. Water obtained from Swains Lake is filtered and then pumped through the distribution network as shown at the time of the ROD in **Figure 2**. The Water District has also enacted an ordinance to provide institutional controls for homes affected or threatened by groundwater contamination associated with the Site.

D. Basis for Taking Action

The Removal Actions which were taken by EPA as summarized above, eliminated many of the source areas of contamination at the Site and provided relief from those risks posing an immediate threat to human health and the environment. However, these actions

did not completely address the future risks to human health and environment posed by residual contamination in the soil and the groundwater. Contamination at the Site has impacted both the shallow overburden and deeper bedrock aquifers. Residents located outside of the service area of the Water District continue to use the groundwater as their source of drinking water.

IV. REMEDIAL ACTIONS

A. Remedy Selection

During the summer of 1992, EPA held an informational meeting to discuss the results of the Remedial Investigation (RI) and the cleanup alternatives presented in the Feasibility Study (FS). Around this time, EPA also identified the Agency's Proposed Plan for the cleanup of the Site and held a public comment period on the plan to solicit comments from interested members of the community. Since many of the earlier Removal Actions had dealt with the mitigation of the source areas at the Site, the main focus of the Proposed Plan was for the recovery and treatment of contaminated groundwater at the Site. After receiving and responding to comments from the public, the cleanup approach for the Site was finalized and documented in the September 29, 1992, Record of Decision (ROD) for the Site. The remedial action objectives (RAOs) identified for the Site in the ROD included:

- Eliminate or minimize the threat posed to human health by preventing the ingestion of contaminated groundwater;
- Prevent further migration of groundwater contamination to uncontaminated portions of the overburden and bedrock aquifers;
- Restore contaminated groundwater in the overburden and bedrock aquifers to Federal and State applicable or relevant and appropriate requirements (ARARs), including drinking water standards, such that consumption of groundwater is protective of human health; and
- Prevent the dermal contact, ingestion, or inhalation of the contents of 12 drums of incinerator ash and three VOC-contaminated barrels used for water filtration.

To meet these objectives the ROD remedy included the following components:

- Upgrade and improve the existing drinking water distribution system;

- Capture of contaminated groundwater in the overburden and bedrock aquifers through the use of trenches and wells;

- Treatment and removal of inorganic and organic contaminants through flocculation and ultra-violet catalyzed oxidation, respectively;

- Dewatering and in-situ treatment of groundwater and soil gas using a vacuum extraction system; and

- Discharge of treated groundwater into the overburden and bedrock aquifers to effect containment and enhance groundwater recovery and cleanup.

B. Remedy Implementation

One of the first actions taken by EPA in conformance with the ROD was the expansion of the existing drinking water distribution system. Through a removal action taken by EPA during the summer of 1993, several additional residences and a seasonal campground located to the north of the Site were added to the existing water supply system installed by EPA and the State of New Hampshire. In 1995, the 12 drums stored at the Site containing incinerator ash and the three VOC-contaminated barrels used for water filtration were removed and transported off-site for disposal at a RCRA Subtitle C landfill in Model City, New York. The original Johnson residence at the Site was also demolished in 1995 and a majority of this debris was disposed of at a RCRA Subtitle D landfill in Rochester, New Hampshire.

As part of its enforcement activities, EPA negotiated a Consent Decree (CD) between the State of New Hampshire, Ford, and the Swains Lake Village Water District. Under the CD which was entered by the District Court on March 20, 1995, Ford agreed, among other items, to conduct the cleanup of the Site as specified in the ROD and to subsidize the Water District during the cleanup of the Site for a portion of their operating costs. The Water District agreed to operate and maintain an alternate water supply for affected residences and to restrict the use of the groundwater in the impacted area.

To provide the groundwater Institutional Controls called for in the CD, the Water District enacted a local ordinance to prevent the use of groundwater at the Site as well as within the impacted area surrounding the Site. The enactment of the ordinance by the Water District also complied with the statutory requirements identified under the State of New Hampshire's Groundwater Management Zone Regulations (Env-Ws 410).

In order to avoid an extended design process and thereby expedite the cleanup, EPA, the State of New Hampshire, and Ford agreed to the implementation of a pilot-scale vacuum enhanced recovery (VER) system at the Site. Ford's consultant, ARCADIS Geraghty & Miller (ARCADIS), began performing the vacuum extraction component of the ROD remedy in the summer of 1995. The remedy was expanded to full-scale and operated from 1996 to 1997. The vacuum extraction wells were positioned within the overburden aquifer primarily in and around the three source areas at the Site identified in **Figure 3** as drum storage Areas A, B, and C. In addition, the Site was paved within the fenced area to reduce the infiltration of groundwater and enhance the effectiveness of the VER system. The ROD remedy estimated that it would take approximately twenty years to attain cleanup levels in the overburden aquifer and approximately 30 years in the bedrock aquifer.

A significant reduction in the amount of subsurface contamination was achieved during the three years the VER system was operated. Approximately 800 pounds of hydrocarbons were extracted, captured, and treated. During its peak operation, the VER system removed as much as 3.5 pounds of contaminants per day. Shortly before the system was shut down in 1997, the system was removing less than one ounce of contaminants per day. Through treatment, as well as other natural processes occurring at the Site, the Interim Cleanup Levels (ICLs) for VOCs as identified in the ROD and **Table 2** of this report were achieved in the shallow groundwater (e.g., overburden aquifer) beneath one of the three source areas undergoing treatment (drum storage Area C). In addition, VOC concentrations in the overburden aquifer beneath drum storage Area A were significantly reduced and were approaching cleanup levels at the time the VER system was shut down. The remaining known source area undergoing treatment at the Site, drum storage Area B, showed more limited progress in achieving the cleanup levels identified in the ROD. As discussed later in Section VI.D. of this report, the contamination beneath and to the northeast of former drum storage Area B has migrated down into the bedrock aquifer. Based on the concentrations of VOCs remaining in the bedrock aquifer at the time the VER system was shut down, it was evident that some residual pockets of contamination in this area would continue to require further treatment in order to achieve the ICLs.

The overall reduction in the recovery efficiency of the VER system led EPA to consider other cleanup alternatives for the Site including bioremediation and phytoremediation. Bioremediation or the use of naturally occurring microbes has been shown to be effective in degrading chlorinated and non-chlorinated VOCs, both of which are found at the Site. Modeling of bioremediation indicated that cleanup levels could be attained at the Site within a time frame and removal rate equivalent to that estimated for the VER system. To further confirm whether bioremediation would be effective at the Site, EPA collected

samples and conducted laboratory microcosm studies. The studies demonstrated that a number of VOCs were being degraded in the groundwater at the Site by naturally occurring anaerobic microorganisms.

Phytoremediation, which uses plants to change the physical properties of the subsurface environment, can minimize water infiltration and dewater the Site, thereby minimizing the contaminant flow off-site. A mature poplar tree can transpire approximately 600 to 1,000 gallons of water per year (Schnoor, 1997). The trees also appear to have the ability through a number of different mechanisms (i.e., enhanced microbial activity in the root zone as well as uptake by the tree and metabolism within the tree) to help contribute to the breakdown of contaminants such as those found at the Site.

During design and construction of the VER system, it also became apparent that the removal of groundwater from the weathered bedrock aquifer would likely draw groundwater from the overburden aquifer down into the weathered bedrock. This would encourage the flow of the more highly contaminated groundwater from the overburden aquifer downward thereby exacerbating the contamination problem in the weathered bedrock below.

As a result of the above information, the ROD was amended on September 28,1998, to include the following changes. Treatment of the overburden aquifer would be accomplished through bioremediation and phytoremediation with the possibility of some limited "hot spot"remediation using the existing VER system. Bioremediation will continue to reduce the amount of contamination in the overburden aquifer as well as the amount that is able to migrate into the weathered bedrock. Bioremediation will also eliminate the need to pump-and-treat the bedrock aquifer. Phytoremediation will reduce the rate at which groundwater and contaminants flow from the overburden into the weathered bedrock and eliminate the need for a trench or cluster of wells to control the off-site migration of contaminants. The need for metals precipitation and ultraviolet oxidation as discussed in the ROD was also eliminated due to the smaller volume of groundwater which would be produced during the intermittent use of the VER system. An existing carbon filtration system continues to be used to treat any groundwater extracted by the VER system at the Site.

Approximately 1,600 poplar trees (one year old rooted Deltoides x Nigra hybrid) were planted at the Site in May of 1998 after the removal of the asphalt cap. The trees which were three to five feet tall at the time of planting, were planted in rows which were 10-feet apart at intervals of every three feet. With the planting of the poplar trees, all construction activities associated with the use of phytoremediation at the Site were completed. No additional activities were required to implement the bioremediation

component of the Amended ROD since it is a natural process which was already occurring at the Site. The Preliminary Close Out Report was signed by EPA on September 29, 1998, signifying the completion of construction activities at the Site.

C. Operation and Maintenance

The operation and maintenance (O&M) activities required for the remedy as described in the Amended ROD consist primarily of maintaining the trees, maintaining the VER system, and performing the required environmental monitoring. During the first few years after planting, the trees were irrigated, fertilized, pruned, and protected from pests. As the trees have matured, the level of O&M needed to maintain them has diminished. At the time of the writing of this five-year review many of the trees at the Site are over 25 feet tall and their root systems are well established into and below the water table. Accordingly, the need for irrigation has been eliminated and the effort required to fertilize and control pests has been reduced significantly. Over the next several years, pruning will be the major O&M activity required for the trees as they continue to grow and form a canopy over the Site.

The configuration of the VER system includes a liquid ring pump, a 150-gallon knockout tank, a centrifugal type transfer pump, a cartridge type particulate bag filter, a pair of 100-pound liquid-phase granular activated carbon drums in series, and a pair of 100-pound vapor-phase granular activated carbon drums in series. The VER system uses a liquid ring pump to recover both groundwater and soil gas from the extraction wells. From there, the air/water mixture flows into the knockout tank where the vapors are passed through the two vapor-phase carbon drums prior to being discharged to the atmosphere. Groundwater in the knockout tank is then pumped through a particulate filter bag and then through two liquid-phase carbon drums before being discharged to the ground surface at the Site.

During 2002, the VER system, which was operated from April 25, 2002 through November 4, 2002, was used to recover liquid and vapors from extraction wells EW5S and EW10S located in former drum storage Area A (see **Figure 4**). In addition, a new bedrock extraction well was installed and brought on line in August of 2002. The new well, 169R, was installed to the northeast of the Site in an area down gradient of former drum storage Area B where the VOC concentrations have remained above ICLs. The new bedrock well was installed in addition to an existing well in that area (69R) to expedite the treatment of VOCs. Groundwater which was recovered from well 169R using a submersible pump was combined in the liquid knockout tank with the water obtained from wells EW5S and EW10S. Approximately 92,873 gallons of groundwater was treated by the system in 2002 at an average flow rate of 0.61 gallons per minute. A

majority of the extracted groundwater came from well 169R. Since the Amended ROD, the configuration of the VER extraction system has been modified slightly to reflect changes noted in VOC concentrations in the groundwater at the Site. These changes have included the elimination of some older extraction wells (e.g., 69R and 103R) as well as the addition of a new extraction well (169R).

Groundwater samples collected from the effluent of the VER system during the 2002 reporting period did not show the presence of any VOCs above their respective ICLs. No off-gas effluent vapor samples were submitted for analysis in 2002 due to the fact that most if not all of the air produced by the treatment system during this time consisted of ambient air which was metered into the system for temperature control. O&M for the VER system consists mainly of replacing the particulate filter bag cartridges fouled by the oxidation of inorganic minerals found in the groundwater, winterizing of the system when it is shut down each year, and groundwater monitoring for the contaminants of concern on a semi-annual basis. The annual O&M costs for the Site have averaged approximately $150,000 to $350,000 per year since the Amended ROD.

In 2003, the VER system was not operated because the levels of VOCs found in EW5S and EW10S were at or below ICLs. In addition, groundwater was not extracted from monitoring well (MW) 169R during 2003 because it was determined that it would be more beneficial to focus on the performance of a pilot scale test using in-situ oxidation in the vicinity of MW 169R. Maintaining a static state in MW 169R (e.g, by not pumping the well) was necessary for the performance of the pilot test. The work plan prepared and finalized by ARCADIS to implement the pilot scale test in the bedrock aquifer to the northeast of the Site was approved by EPA on August 28, 2003. The objective of the pilot test is to evaluate the effectiveness of sodium permanganate in reducing the concentrations of VOCs in the groundwater. The concentrations of VOCs found in the target zone of the pilot test area and the anticipated effect of sodium permanganate on the VOCs detected can be found in **Table 3**.

Sodium permanganate will be injected into the weathered and upper portions of the bedrock aquifer in the area surrounding MW 169R. Several additional extraction wells and monitoring wells will be installed near MW 169R prior to the pilot test. The pilot test, which is expected to begin in the fall of 2003, will last several months. During the pilot test groundwater monitoring data will be gathered on a weekly and then a monthly basis to document the effectiveness of the technology. A report will be produced upon completion of the pilot test discussing the effectiveness of the technology in accelerating cleanup processes in this area of the Site as well as the applicability of the technology to other portions of the Site.

V. PROGRESS SINCE THE LAST FIVE-YEAR REVIEW

This is the first five-year review for the Site.

VI. FIVE-YEAR REVIEW PROCESS

A. Administrative Components

The Tibbetts Road five-year review was conducted by Neil Handler, the EPA Remedial Project Manager (RPM) for the Site, with assistance from EPA risk assessment and hydrogeological support personnel, and Thomas Andrews, the NHDES RPM. ARCADIS provided assistance with some of the figures, tables, and charts included in the Five-Year Review report.

B. Community Involvement

The level of community interest in the Site has been low to moderate within the last several years. The most recent public informational meeting took place on September 23, 2002, when members of the local community and Barrington Town Officials were invited to attend a meeting held at the Site. The purpose of the informational meeting was to provide the public and local officials with an opportunity to tour the Site as well as update them as to the progress of the cleanup and discuss potential options for future uses of the Site. Approximately ten residents and five Town officials attended the meeting. Also present were representatives of EPA, NHDES, ARCADIS, Ford, and the Wildlife Habitat Council. In general, local residents and local officials were satisfied with the current condition of the Site as well as the cleanup progress being made. There was a request made from several residents who live nearby the Site for the following work to be performed: 1) remove the remaining portions of the chain link fence surrounding the Site; 2) make some minor changes to the current configuration of the driveway to make it less appealing for teenagers to use; and 3) re-grade the Site along portions of the western edge to prevent runoff from entering neighboring properties. Ford agreed to the above changes and the work was implemented and completed during the summer of 2003.

During the public informational meeting there was also some discussion of potential future uses of the Site upon completion of the cleanup. Several ideas were discussed with the residents and Town Officials including the use of the Site as a wildlife habitat and/or environmental educational facility. The local residents expressed concerns regarding both of these potential uses. They stated that they did not feel that the use of the Site as a "park" would be appropriate given the current residential nature of the area. They indicated that such a use might have some undesirable impacts on the neighborhood (e.g.,

by increasing traffic and vandalism). Local residents expressed a preference for keeping the Site as is (e.g., conservation land) and indicated that they would discuss this further amongst themselves as well as with their local elected officials. There was also a brief discussion with residents and Town officials on issues related to the Town acquiring the property for back taxes owed.

Copies of this review are being placed in the information repository located at EPA New England, Region 1 in Boston, MA as well as the local repository located at the Barrington Public Library, in Barrington, NH.

C. Document Review

This five year review included a review of relevant documents including decision documents, work plans, and various monitoring reports. A complete list of the documents reviewed is provided in **Appendix A**.

D. Data Review

Data is regularly collected for the Site in accordance with the Environmental Monitoring Work Plan and Project Operations Plan prepared in support of the ongoing Remedial Action (RA). Groundwater monitoring data is collected semiannually, typically in July and December of each year and is summarized in an annual environmental monitoring report prepared by ARCADIS. A separate annual performance report describing the operation of the VER system is also prepared by ARCADIS.

In attempting to understand the contaminant trends found at the Site, it is important to look at these trends in the context of the Site geology and hydrogeology. The groundwater historically impacted by contamination at the Site includes the shallower overburden and deeper bedrock aquifers. The overburden can be divided into two distinct layers. The upper-most layer is an unconsolidated, saturated, sandy to silty glacial till that is approximately twenty-five feet thick in the vicinity of the Site. The water table in this upper-most layer varies from being at the ground surface in the spring and autumn months to being eight feet below the ground surface in the summer. Groundwater flow within the upper overburden is approximately radial as the Site occupies a topographic high. However on a broader scale flow beyond the Site is either to the northeast or the west. The upper overburden aquifer, which is highly permeable, contained the most contaminated groundwater at the Site prior to the remedial efforts. Those contaminants released from the three drum storage areas entered the upper-most overburden aquifer and migrated horizontally either to the west/southwest or to the northeast, depending upon which side of the drainage divide the storage areas were located. The reason for the more

limited vertical component of contaminant migration in most areas of the Site is likely due to the reduced permeability of the lower-most portion of the overburden aquifer, as discussed below.

The lower-most portion of the overburden is comprised of a dense, nearly consolidated, silt to clay material that acts as an aquitard, restricting the vertical flow of groundwater into the bedrock aquifer below. This dense, silty overburden material, which is limited in lateral extent, is thickest beneath the Site (approximately 50 feet thick). The layer thins out rapidly as you move away from the Site. In general, concentrations of contaminants in the lower-most portion of the overburden are much lower than those found in the upper-most portion due to the reduced permeability of the layer. In areas of the Site where the thickness of the aquitard thins out (e.g, northeast of the Site) there is more evidence of the vertical migration of contamination which in turn has introduced contaminants into the weathered bedrock below.

The bedrock aquifer consists of weathered and competent bedrock. The weathered bedrock or the upper-most zone is highly fractured and relatively permeable (approximately 1.2×10^{-4} centimeters per second). The weathered bedrock varies in thickness near the Site from approximately five feet to forty feet. Groundwater within the weathered bedrock has an overall flow direction to the north and northwest. In general, VOC concentrations are much lower in the bedrock than the overburden with the exception of one area directly northeast of the Site. Some of the highest concentrations of VOCs detected at the Site were found in the weathered bedrock nearby monitoring wells 69R and 169R. The high concentrations of VOCs found in the weathered bedrock in this area are probably a result of its location (e.g., it's located immediately down gradient from drum storage Area B, one of the largest former drum storage areas) and the thinning of the overburden aquitard in this portion of the Site.

The underlying, more competent bedrock has fewer fractures. However, water yields from deep, single fractures in portions of this bedrock unit are capable of producing flows of over one hundred gallons per minute. Groundwater flow within the competent bedrock roughly mimics that found in the weathered bedrock.

A review of the groundwater monitoring data collected over the last several years as shown in **Appendix B** shows an overall reduction in VOC concentrations in many of the groundwater monitoring wells at the Site. To further support whether any trends in concentrations could be identified, ARCADIS recently evaluated some of the groundwater data from the Site using the Mann-Kendall test for trends. A copy of the results of the trend testing is included in **Appendix C** of this report. For this testing, the data gathered from 23 groundwater monitoring wells since approximately 1998 (i.e., the

date of the Amended ROD and implementation of phytoremediation) were evaluated to determine whether there were any increasing or decreasing trends in chemical concentrations which could be identified. A review of the data in general and the Mann-Kendall test trends allows the following conclusions to be drawn:

1. The levels of VOCs in much of the overburden aquifer, which historically has shown some of the highest concentrations, are now at or approaching the cleanup levels identified in the ROD and Amended ROD. A review of the most recent data from overburden wells (both shallow and deep) in the vicinity of drum storage Areas A and C did not show any VOCs above their respective ICLs. Area B, the largest former drum storage area, exceeded the ICL for cis-1,2-dichloroethylene (cis-1,2-DCE) at a concentration of 120 ug/L in shallow overburden monitoring well (MW) 57S (see **Figure 4**) and for benzene at 12 ug/L in deeper overburden extraction well (EW) EW-1D. The ICLs for cis-1,2-DCE and benzene are 70 ug/L and 5 ug/L, respectively.

2. In general, arsenic and manganese were detected above their respective ICLs at a greater frequency than VOCs in both the shallow and deeper portions of the overburden aquifer. The variability of the concentrations of arsenic and manganese detected in the overburden makes it difficult to identify any trends at this time. However, the concentrations of arsenic and manganese were typically within an order of magnitude of their respective ICLs. It is believed that arsenic and manganese were not a primary component of the wastes brought to the Site and their presence in the groundwater beneath the Site is thought to be the result of changes which took place in the subsurface environment (i.e., naturally occurring arsenic and manganese were mobilized when conditions in the groundwater changed from aerobic to anaerobic with the introduction of organic compounds such as VOCs). It is anticipated that the subsurface environment will return to its natural conditions (i.e., an aerobic environment) and the arsenic and manganese concentrations will decrease once the supply of organic compounds in the groundwater is eliminated. However, the extent to which arsenic and manganese will decrease and the time frame over which such a change will take place still remains to be determined through the ongoing groundwater monitoring program.

3. It is more challenging to identify any overall trends for VOC concentrations in the bedrock aquifer at the Site given the variability of the groundwater data and the more limited placement of bedrock wells. On-site groundwater concentrations of VOCs have historically for the most part been lower in the bedrock aquifer than those found in the overburden. As discussed earlier in this section, the aquitard

making up the lower layer of the overburden, has limited and slowed the extent of the vertical migration of contamination from the overburden into the bedrock aquifer. The concentrations of VOCs detected in the bedrock aquifer where the aquitard is thickest, as evidenced by the results identified for monitoring wells 61R, 63R, 65R, and 67R, are typically within an order of magnitude of their respective ICLs. The principle contaminants of concern to date in these wells have been TCE and benzene. In areas of the Site and adjacent to it, where the thickness of the aquitard decreases, there is an increase in the number of and concentrations of VOCs detected in the bedrock aquifer. An example of where this occurs at the Site includes a portion of former drum storage Area B and the area to the northeast of this former storage area. Very high levels of primarily TCE, cis-1,2-DCE, benzene, ethylbenzene, MIBK, and toluene were historically detected in the bedrock monitoring wells installed in this area. The concentrations of VOCs found in the bedrock in this area were several orders of magnitude higher than those seen in the overburden. For example, in bedrock well 169R, the concentrations detected for benzene (3,300 ug/L), cis-1,2-DCE (770 ug/L), ethylbenzene (880 ug/L), MIBK (25,000 ug/L), and toluene (15,000 ug/L) in June of 2003, were several orders of magnitude greater than their respective ICLs. While in nearby shallow overburden well 52S there were no VOCs detected at all. In addition, the concentration of many of the VOCs found in the bedrock wells do not appear to be decreasing as evidenced by the benzene concentrations detected in MW 69R over the past 13 years. Since 1990, benzene concentrations in MW 69R have consistently ranged from approximately 2,000 to 5,000 ug/L and most recently in June of this year benzene was detected at 3,700 ug/L. The overall high concentrations of VOCs found combined with their recalcitrant nature points to the need for the investigation of additional in-situ remedial technologies for the bedrock aquifer in this portion of the Site. To address this need, a pilot scale in-situ oxidation test will be implemented at the Site during the fall of 2003. In addition, there is a need to better understand the flow paths of contaminants in the bedrock in this area to confirm that the plume is not expanding and that the current remedy (e.g., alternate water supply and institutional controls) remains protective of human health and the environment. This will be accomplished through the continued monitoring of the groundwater data at the Site and a review of the existing monitoring network.

4. Although there was also some variability in the concentrations of arsenic and manganese detected in the bedrock aquifer, in general the concentrations were much lower than those detected in the overburden aquifer. A majority of the bedrock wells on-site as well as off-site had arsenic and manganese concentrations below their respective ICLs. The one exception to this being the

area to the northeast of the Site where very high concentrations of VOCs were detected in the bedrock aquifer. Although the concentrations of arsenic and manganese in monitoring wells 69R (130 ug/L and 4,900 ug/L, respectively) and 169R (77 ug/L and 5,200 ug/L) exceeded their ICLs (50 ug/L and 3,650 ug/L) the results were both within an order of magnitude of the respective ICLs.

E. Site Inspection

Representatives of EPA, NHDES, and ARCADIS participated in the Site inspection held on March 24, 2003. During the inspection conditions at the Site were reviewed and no problems were observed. Additional details concerning the Site inspection are included in **Appendix D**.

VII. TECHNICAL ASSESSMENT

A. Question: Is the Remedy Functioning as Intended by the Decision Documents?

Yes. The active components of the cleanup remedy as described in the ROD (e.g., VER system, expansion of the alternate water supply, institutional controls, and disposal of remaining drums stored at the Site) and as later modified in the Amended ROD (e.g., bioremediation and phytoremediation) have been implemented and the results of groundwater monitoring indicate that the current remedy is functioning as intended. VOC contaminant levels in the overburden aquifer beneath most areas of the Site appear to be at or approaching the ICLs identified in the ROD and Amended ROD. A small portion of the overburden aquifer located beneath former drum storage Area B and the weathered bedrock aquifer located to the northeast of the drum storage area has shown more limited progress in achieving the required cleanup levels for VOCs. A pilot test using the in-situ chemical oxidation technology will be conducted during the fall of 2003 in this area. The objective of the pilot-test is to evaluate the effectiveness of sodium permanganate in reducing the concentrations of VOCs remaining in the groundwater in this area. Upon completion of the pilot-test, a report will be produced, discussing the effectiveness of the technology in accelerating the cleanup processes in the weathered bedrock as well as the potential applicability of the technology to other portions of the Site.

The trends seen in the groundwater at the Site for inorganic contaminants, primarily arsenic and manganese, are not as clearly evident at this point. As discussed in Section VI.D., it is believed that arsenic and manganese were not a primary component of the wastes brought to the Site. Rather, their presence in the groundwater beneath the Site is

thought to be the result of changes which took place in the subsurface environment (i.e., naturally occurring arsenic and manganese were mobilized when conditions in the groundwater changed from aerobic to anaerobic with the introduction of organic compounds such as VOCs). It is anticipated that the subsurface environment will return to its natural conditions (i.e., an aerobic environment) and the arsenic and manganese concentrations will decrease once the supply of organic compounds in the groundwater is eliminated. However, the extent to which arsenic and manganese will decrease and the time frame over which such a change will take place still remains to be determined through the ongoing groundwater monitoring program.

B. Question: Are the Exposure Assumptions, Toxicity Data, Cleanup Levels, and Remedial Action Objectives (RAOs) Used at the Time of the Remedy Selection Still Valid?

There have been no changes in the Site setting and surrounding land use which would affect exposure assumptions and RAOs developed in the ROD and Amended ROD. Early Removal Actions taken by EPA reduced the levels of contamination found in the soil at the Site so that there was no longer a risk posed by direct human contact. However, the aquifer in contact with groundwater from the Site continues to be used as a drinking water source for residents living beyond the public water supply system. Accordingly, maximum contaminant levels (MCLs) and non-zero maximum contaminant level goals (MCLGs) established under the Safe Drinking Water Act (SDWA), NHDES GW-1 Standards, and risk based cleanup levels are ARARs for the Site.

A review of the above ARARs pertaining to drinking water standards indicates that the values for several compounds have changed. The most notable change impacts the arsenic standard. The arsenic MCL has decreased from 50 ppb to 10 ppb. The new lower standard may extend the time frame to achieve cleanup levels at the Site since a number of wells currently exceed the old standard. As discussed in Section VII.A., it is anticipated that arsenic concentrations in the groundwater beneath the Site will decrease over time. However, it still remains to be seen how quickly the concentrations will decrease and whether they will decrease below the new arsenic MCL of 10 ppb.

Other compounds whose risk-based numbers have changed slightly since the time of the ROD and the Amended ROD, include bis(2-ethylhexyl)phthalate, 4-methyl-2-pentanone, naphthalene, and manganese. The risk-based cleanup level for 4-methyl-2-pentanone, a compound which continues to be detected above its ICL at the Site, was based on a reference dose (RfD) of 0.05 mg/kg/day from the Integrated Risk Information System (IRIS) database at the time of the ROD. Currently, no oral toxicity values are available on IRIS or on the National Center for Environmental Assessment Peer Review Toxicity

Value list. A RfD of 0.08 mg/kg/day is available on the Health Effects Assessment Summary Tables (HEAST). Based on the HEAST value the cleanup level identified in the ROD for 4-methyl-2-pentanone at 1,825 ug/L is still considered protective. The RfD for manganese has been revised since the ROD and the former risk-based cleanup level is no longer considered protective. Based on the new RfD, the risk-based cleanup level for manganese at the Site will decrease from 3,650 ug/L to 840 ug/L. Similar to the arsenic discussion above, the lower cleanup level may extend the overall cleanup time for the Site since a number of wells currently exceed the old standard. It is anticipated that manganese concentrations in the groundwater beneath the Site will also decrease over time as the overall VOC concentrations are reduced. Accordingly, the protectiveness of the remedy is not expected to be impacted by this change. The cleanup level for naphthalene has also changed and based on the current IRIS toxicity value, the new ICL is 730 ug/L (versus 1,460 ug/L). The new ICL for naphthalene, although lower, is not expected to impact the protectiveness of the remedy since naphthalene has not regularly been detected at the Site.

Recently, new EPA guidance has become available regarding the potential for subsurface contaminants to contribute to human health risks via vapor intrusion into indoor air. An initial review of the screening criteria provided in the guidance indicates that conditions at the Site (e.g., presence of TCE in the groundwater at concentrations above its MCL and the proximity of the contaminant plume to nearby residences) will likely require further investigation to determine if this pathway presents any risks to human health. The investigation of this new potential exposure pathway will be one of the followup actions recommended by EPA in this report.

C. Question: Has any Other Information Come to Light that Could Call into Question the Protectiveness of the Remedy?

No. Progress is being made towards achieving the cleanup objectives at the Site. A small portion of the weathered bedrock aquifer located to the northeast of the Site has shown more limited progress in achieving the required cleanup levels. To see if the cleanup processes in this area can be accelerated, ARCADIS will conduct a pilot test during the fall of 2003 using the in-situ chemical oxidation technology. The pilot test will evaluate the effectiveness of sodium permanganate in reducing the concentrations of VOCs remaining in the groundwater in the weathered bedrock in this area. Upon completion of the pilot test, a report will be produced discussing the effectiveness of the technology and its potential applicability to other portions of the Site. No other information has come to light in the course of this review which could call into question the protectiveness of the remedy.

D. Technical Assessment Summary

The active components of the cleanup remedy as described in the ROD (e.g., VER system, expansion of the alternate water supply, institutional controls, and disposal of remaining drums stored at the Site) and as later modified in the Amended ROD (e.g., bioremediation and phytoremediation) have been implemented and the results of groundwater monitoring indicate that the current remedy is functioning as intended. VOC contaminant levels in the overburden aquifer beneath most areas of the Site appear to be at or approaching the ICLs identified in the ROD and the Amended ROD. A small portion of the overburden aquifer located near former drum storage Area B and the weathered bedrock aquifer located to the northeast of the drum storage area have shown more limited progress in achieving the required cleanup levels for VOCs. A pilot-test using the in-situ chemical oxidation technology will be conducted in this area during the fall of 2003 to determine whether cleanup processes in the weathered bedrock can be accelerated.

There have been no changes in the Site setting and surrounding land use which would affect exposure assumptions and RAOs developed in the ROD and Amended ROD. A review of the above ARARs pertaining to drinking water standards indicates that the values for several compounds have changed since the ROD. The most notable of the changes impacts the arsenic and manganese standards. The arsenic MCL has decreased from 50 ppb to 10 ppb and the risk-based cleanup level for manganese has decreased from 3,650 ppb to 840 ppb. The new lower standards may extend the time frame to achieve cleanup levels at the Site since a number of wells currently exceed the old standards.

New EPA guidance has become available regarding the potential for vapor intrusion into indoor air from subsurface contamination located in the groundwater and soil. An initial review of the screening criteria provided in the guidance indicates that the conditions at the Site will likely require further investigation to determine if this pathway presents any risks to human health. The investigation of this new potential exposure pathway will be one of the follow-up actions recommended by EPA for completion.

VIII. ISSUES

Groundwater monitoring data shows that progress is being made towards achieving the required cleanup levels in the groundwater beneath the Site through the use of VER, bioremediation, and phytoremediation. Overall, there has been a downward trend observed for VOC concentrations in most areas of the overburden aquifer indicating that the remedy has been successful in reducing

the extent of the groundwater plume, removing a significant mass of contamination, and being protective of human health and the environment.

There is one area of off-site groundwater contamination to the northeast of the Site in the weathered bedrock where progress in reducing the concentrations of VOCs has been more limited. ARCADIS will conduct a pilot test in this area during the fall of 2003 to evaluate the effectiveness of the in-situ chemical oxidation technology in reducing the concentrations of VOCs found there. Upon completion of the pilot test, a report will be produced discussing the effectiveness of the technology and its potential applicability to other portions of the Site. In addition, there is a need to better understand the flow paths of contaminants in the bedrock in this area to confirm that the plume is not expanding and that the current remedy remains protective of human health and the environment. This will be accomplished through the continued collection of groundwater monitoring data at the Site and a review of the existing monitoring network

The trends seen in the groundwater at the Site for inorganic contaminants, primarily arsenic and manganese, are less evident at this point. It is believed that arsenic and manganese concentrations will decrease with time as the concentrations of VOCs in the groundwater are reduced. However, the extent to which arsenic and manganese will decrease and the time frame over which such a change will take place still remains to be determined through the ongoing groundwater monitoring program.

New EPA guidance has become available regarding the potential for vapor intrusion into indoor air from subsurface contamination located in the groundwater and soil. An initial review of the screening criteria provided in the guidance indicates that the conditions at the Site will likely require further investigation to determine if this pathway presents any risks to human health. The investigation of this new potential exposure pathway will be one of the follow-up actions recommended by EPA for completion.

IX. RECOMMENDATIONS AND FOLLOW-UP ACTIONS

Recommendations and follow-up actions for the Site based on the results of this first five-year review are summarized in **Table 4**.

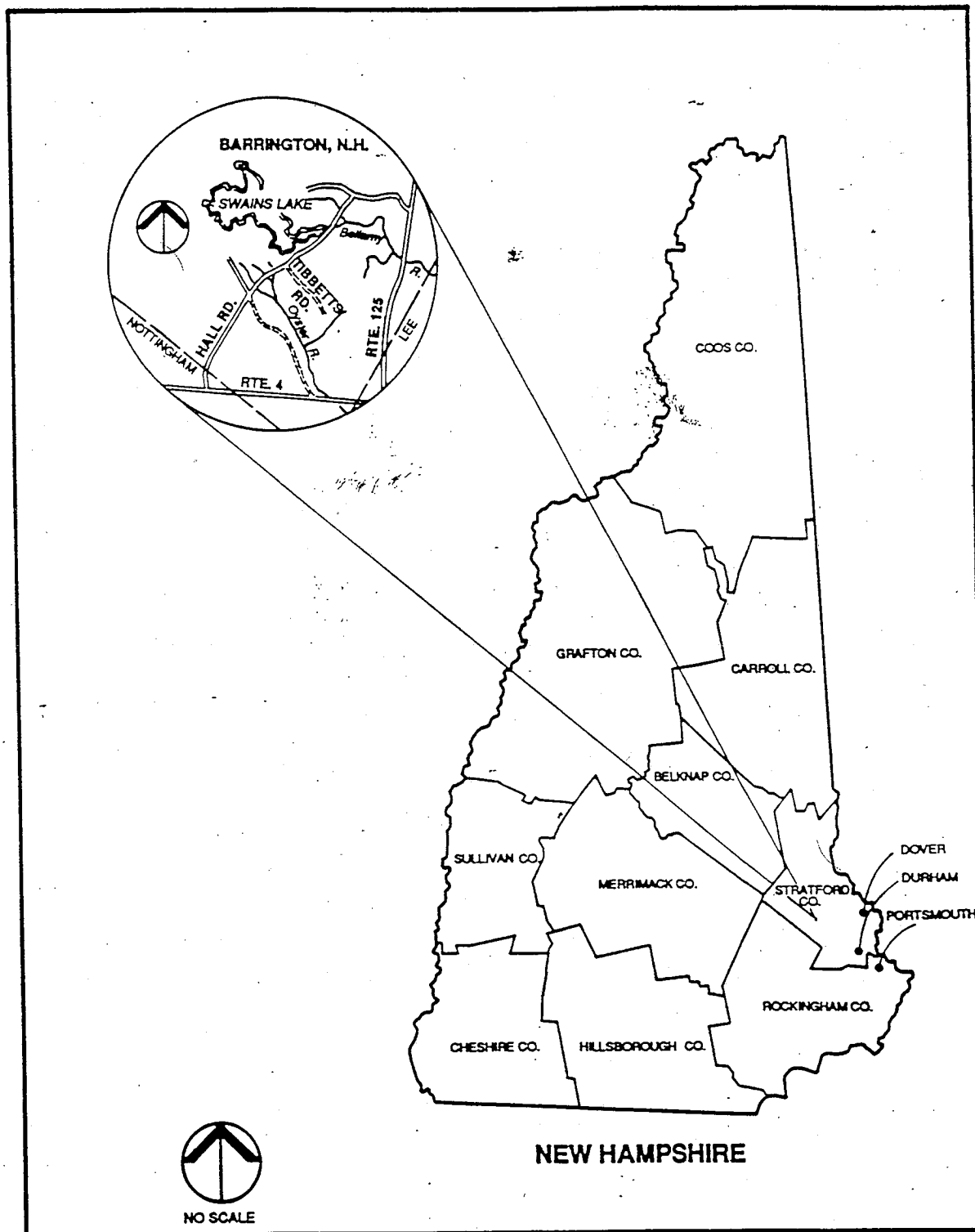
X. PROTECTIVENESS STATEMENT

Because the remedial actions being implemented at the Tibbetts Road Superfund Site are protective, the Site is protective of human health and the environment.

XI. NEXT REVIEW

The proposed remedial action for the Site, upon completion, will not leave hazardous substances, pollutants, or contaminants at levels that prevent unlimited and unrestricted use of the Site. However, the remedial action is expected to take more than five years to complete. Thus the date for completion of the next five-year policy review will be five years from the date of signature of this review.

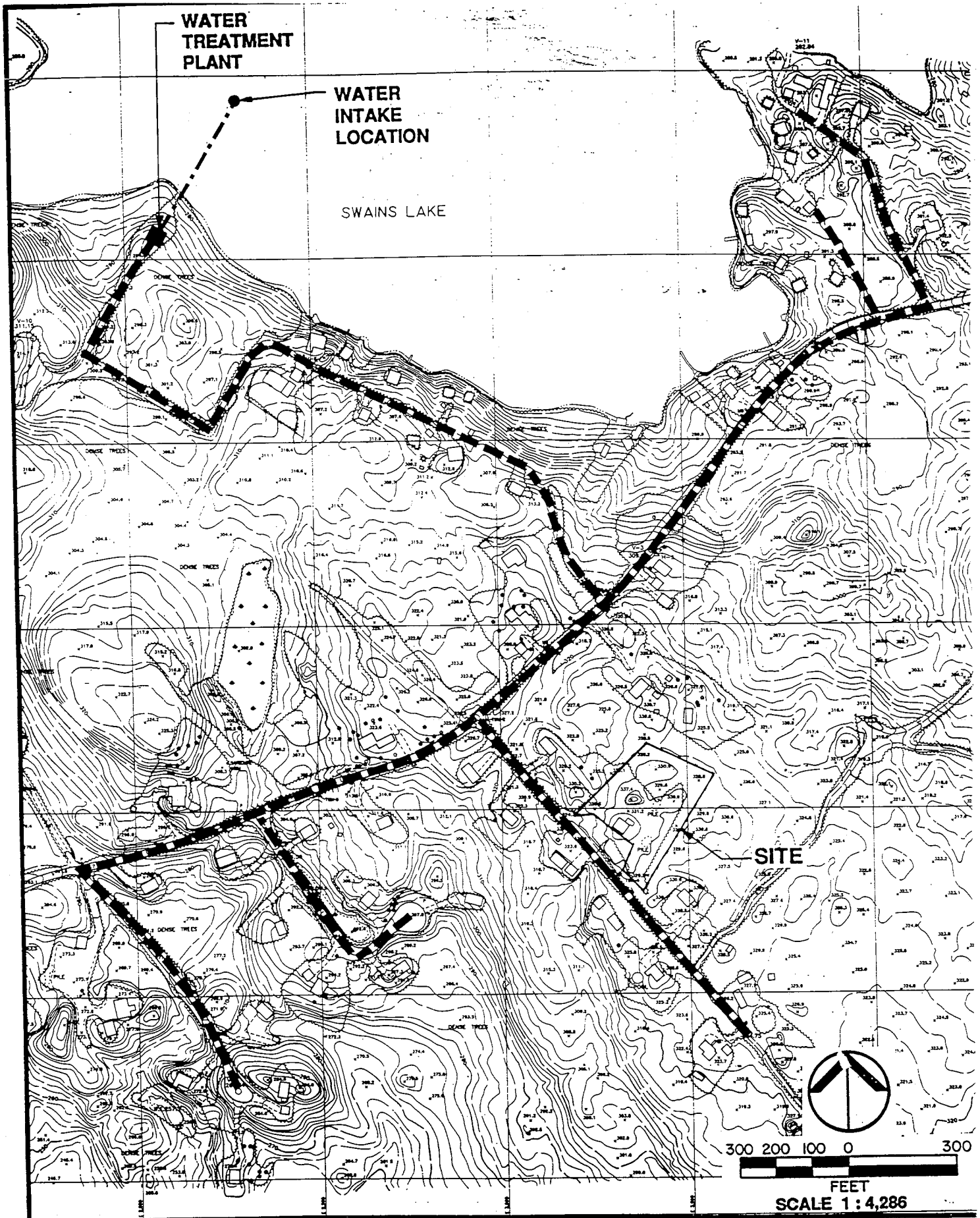
FIGURES



TIBBETTS ROAD SITE
BARRINGTON, NEW HAMPSHIRE

GENERAL LOCATION MAP

FIG. 1

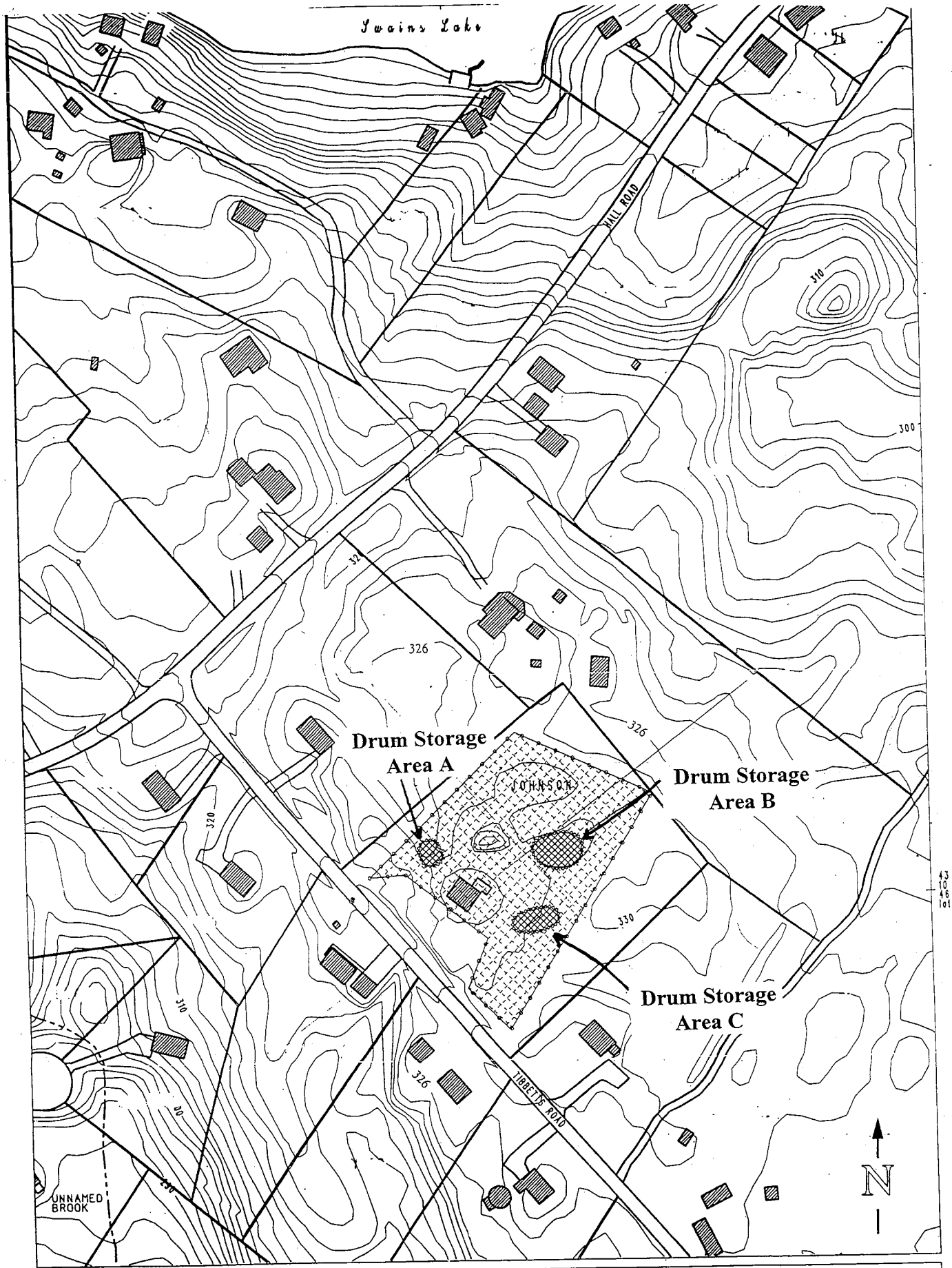


TIBBETTS ROAD SITE
BARRINGTON, NEW HAMPSHIRE

PUBLIC WATER SUPPLY SYSTEM

(AS OF JUNE 1992)

FIG. 2



Drum Storage Areas
Fence Line Restricted Area
Property Boundaries (Approximate from Tax Maps) Labeled by Owner

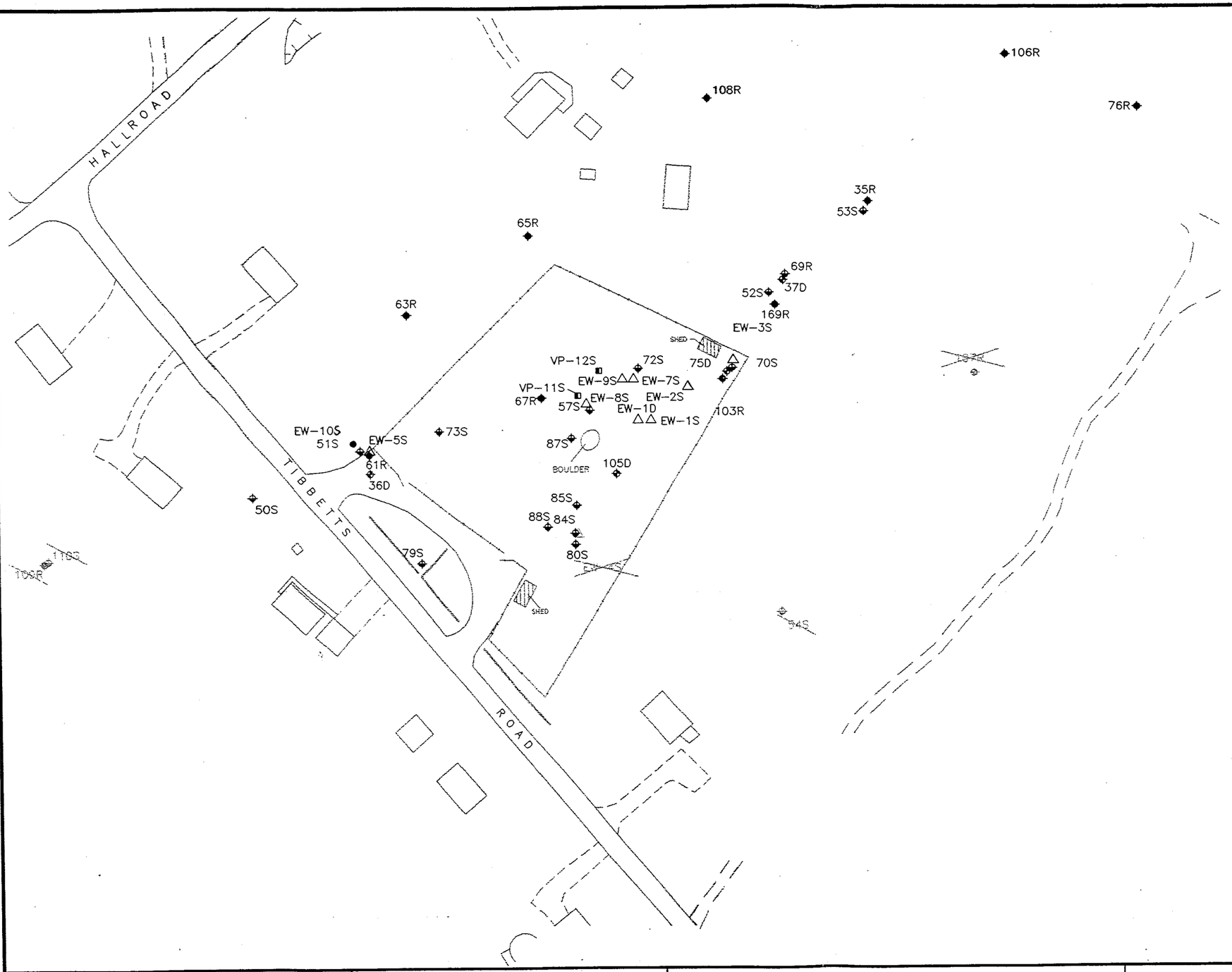
Scale 1 : 1,440 100 0 100 200 feet

Figure 3
SITE FEATURES AND SURROUNDING AREA

TIBBETTS ROAD, BARRINGTON, NH

Source base map: Eastern Topographics, June 19, 1990

RBOWMAN, 08/26/2003, 15:13:52 | XREFS: _BASE=_BASE_EXP2-100=_EXP2B | FILE: TIBB-256.DWG



EXPLANATION

- 53S — LOCATION AND DESIGNATION OF SHALLOW OVERBURDEN MONITORING WELL
- 37D — LOCATION AND DESIGNATION OF DEEP OVERBURDEN MONITORING WELL
- 103R — LOCATION AND DESIGNATION OF BEDROCK MONITORING WELL
- EW-2S △ — LOCATION AND DESIGNATION OF REMEDIAL SYSTEM EXTRACTION WELL
- VP-12S — LOCATION AND DESIGNATION OF REMEDIAL SYSTEM VACUUM PROBE
- PERIMETER FENCE SURROUNDING FORMER JOHNSON PROPERTY
- ROCK WALL
- 54S — LOCATION AND DESIGNATION OF ABANDONED MONITORING WELL
- LOCATION AND DESIGNATION OF DESTROYED WELL

NOTE: NOT ALL SITE MONITORING WELLS, EXTRACTION WELLS, OR VACUUM PROBES ARE SHOWN ON THIS DRAWING

0 100 FEET

NO.	DATE	REVISION DESCRIPTION	BY CKD

ARCADIS

MONITORING & EXTRACTION WELL LOCATION MAP

TIBBETTS ROAD SITE
BARRINGTON, NEW HAMPSHIRE

PROJECT MANAGER G. GORDON	DRAWING NUMBER TIBB-256.DWG
CHECKED BY G. GORDON	PROJECT NUMBER MA000644.0003
DRAWN BY R. BOWMAN	FIGURE NUMBER 4
DATE DRAWN 01/07/03	

TABLES

Table 1 - Chronology of Significant Site Events

DATE	EVENT
1945 - 1958	During this time frame, the property owner, Alexander Johnson, transports drums to the Site (his home) for storage and use. The drums contain wastes from industrial processes, primarily automobile production and painting.
1982	State of New Hampshire officials discover contamination problems at the Site following complaints from nearby residents. It appears that some or all of the contents of many of the drums stored at the Site have been discharged to the ground thereby releasing Volatile Organic Compounds (VOCs) into the groundwater. Monitoring of residential wells in the vicinity of the Site shows the presence of several VOCs including benzene, xylene, toluene, acetone, trichloroethylene (TCE), and 4-methyl-2-pentanone (MIBK) in the groundwater.
1984	State of New Hampshire requests EPA's assistance in removing drums and contaminated soils at the Site. EPA removes 337 drums containing solvents, PCBs, and other hazardous materials. Risk due to contaminated groundwater is also identified.
1985	The State and EPA conduct investigations into the extent of soil and groundwater contamination.
1986	EPA and the State excavate and remove 405 cubic yards of soil contaminated by solvents and PCBs from the Site. EPA incinerates four cubic yards of soil contaminated with dioxin at the Site. The Site is finalized for inclusion on the National Priorities List (NPL) on June 10, 1986.
1987 - 1988	EPA and the State construct a drinking water treatment plant and water distribution network to serve approximately 45 homes whose wells were contaminated or threatened by groundwater contamination from the Site. Drinking water will be supplied using water from nearby Swains Lake. The Swains Lake Village Water District is formed to assume responsibility for the operation and maintenance of the water supply system.
1992	EPA holds a public informational meeting on June 24, 1992, to discuss the results of the Remedial Investigation/Feasibility Study (RI/FS) and to present the Agency's proposed groundwater cleanup plan for the Site. After soliciting comments from the public, the cleanup plan for the Site is finalized in the Record of Decision (ROD) signed by EPA on September 29, 1992.
1993	The water supply system is expanded in 1993 through a removal action by EPA to include several additional nearby residences and a seasonal campground.
1994 - 1995	EPA, the State, and the Swains Lake Village Water District negotiate a Consent Decree with Ford Motor Company (Ford), the Potentially Responsible Party. Ford agrees to help improve and fund the drinking water supply system and conduct the groundwater cleanup at the Site.

DATE	EVENT
1995 - 1997	The vacuum enhanced recovery (VER) component of the cleanup plan identified in the ROD, for treating contamination in the overburden aquifer at the Site, is implemented by Ford. The original Johnson residence is demolished in September of 1995.
1998	The VER system is shut down and the asphalt cap over much of the Site is removed. The remedy as described in the ROD is amended on September 28, 1998, to reflect that groundwater treatment will consist of bioremediation and phytoremediation with some potential "hot spot" remediation using the existing VER system. Approximately 1,600 hybrid poplar trees are planted at the Site in May of 1998 as part of the phytoremediation component of the Amended ROD. The Preliminary Close Out Report is signed by EPA on September 29, 1998, signifying the completion of construction activities at the Site.
1998 - present	Monitoring of the groundwater continues to determine the effectiveness of bioremediation, phytoremediation, and VER treatment of "hot spots" in achieving the cleanup goals identified in the ROD and Amended ROD.

TABLE 2

INTERIM CLEANUP LEVELS FOR THE TIBBETTS ROAD SUPERFUND SITE

NON-CARCINOGENIC COMPOUNDS

Non-carcinogenic Contaminants of Concern (class)	Interim Cleanup Level (µg/l)	Basis	Target Endpoint of Toxicity	Hazard Quotient
1,2 Dichloroethene - (cis) (D) - (trans) (D)	70 100	MCLG	Blood	0.19 0.14
Ethylbenzene (D)	700	MCL	Kidney & Liver	0.19
4-Methyl-2-Pentanone (D)	1825	Risk	Kidney & Liver	1
Styrene (C)	100	MCL	Blood & Liver	0.014
Toluene (D)	1000	MCLG	Kidney & Liver	0.14
1,1,1 Trichloroethane (D)	200	MCLG	Liver	0.06
Xylene (D)	10000	MCLG	CNS-DBW	0.14
Naphthalene (D)	1460	Risk	DBW	1
Chromium (D)	100	MCLG	No effect	0.55
Manganese (D)	3650	Risk	CNS	1
Nickel (D)	100	MCLG	DBW	0.14
Vanadium (D)	256	Risk	No effect	1

HAZARD QUOTIENT SUMS

TOXIC ENDPOINT	TOTAL
Blood	0.344
Kidney	1.33
Liver	1.404
Decreased Body Weight (DBW)	1.28
Central Nervous System (CNS)	1.14

TABLE 2, continued INTERIM CLEANUP LEVELS FOR THE TIBBETTS ROAD SITE CARCINOGENIC COMPOUNDS			
Carcinogenic Contaminants of Concern (class)	Interim Cleanup Level (µg/l)	Basis	Level of Risk
Benzene (A)	5	MCL	1.7×10^{-6}
Tetrachloroethylene (B_2)	5	MCL	3.1×10^{-6}
Trichloroethylene (B_2)	5	MCL	6.4×10^{-7}
Styrene (C)	100	MCL	3.5×10^{-5}
Bis(2-ethylhexyl)phthalate (B_2)	4	MCL	6.6×10^{-7}
Arsenic (A)	50	MCL	8.8×10^{-4}
	Sum:		9.2×10^{-4}

1

2

[1] Standard exposure parameters from OSWER Directive 9285.6-03 for residential ingestion of potable water (i.e., adult of seventy kilogram body weight drinks two liters of water per day for 350 days for a thirty year duration) are the basis for calculation of risk-based cleanup level, hazard quotient, and level of risk.

[2] Toxicity values (i.e., RfD or CPF) used for calculation of risk-based cleanup level, hazard quotient, and level of risk are from either the on-line IRIS or FY 1997 HEAST.

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Table 3 Anticipated Compounds and Reaction to Permanganate

Chemical Compound	Current (as of June 2003) Concentration in Target Zone (169R area)	Cleanup Level	Ability of Permanganate to React / Anticipated Concentration Reduction
Benzene	3,300 to 3,700 ppb	5 ppb	Non-Reactive / No Concentration Reduction
cis-1,2-DCE	770 to 870 ppb	70 ppb	Fully Reactive / Complete Destruction
Ethylbenzene	750 to 880 ppb	700 ppb	Slightly Reactive / Some Concentration Reduction
4-Methyl-2-Pentanone	25,000 ppb	1,825 ppb	pH Dependant / Some Degradation Possible
Toluene	200 to 15,000 ppb	1,000 ppb	Moderately Reactive / Moderate Degradation
Trichloroethene	<500 ppb	5 ppb	Fully Reactive / Complete Destruction

TABLE 4: RECOMMENDATIONS AND FOLLOW-UP ACTIONS

Issue	Recommendations / Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness	
					Current	Future
Overburden aquifer not at cleanup levels	Continue monitoring groundwater to assess progress of bioremediation and phytoremediation	Ford	EPA & NHDES	Semi-Annually	No	No
Bedrock aquifer not at cleanup levels	Implement pilot test using in-situ oxidation technology and evaluate results	Ford	EPA & NHDES	Fall 2004	No	No
Bedrock aquifer not at cleanup levels	Continue groundwater monitoring and review monitoring program	Ford	EPA & NHDES	Semi-Annually	No	No
Vapor intrusion Pathway	Review current guidance and Site data to see what additional steps may need to be taken to investigate this potential exposure pathway	EPA, NHDES & Ford	EPA & NHDES	Fall 2004	Not currently known*	Not currently known*

* The risk associated with the vapor inhalation pathway will need to be further investigated to determine whether this has the potential to generate a risk outside of EPA's acceptable risk range and thereby impact the protectiveness of the remedy.

APPENDIX A - DOCUMENTS REVIEWED

DOCUMENTS REVIEWED

Arcadis Geraghty & Miller, Inc. 1998. *Phytoremediation Installation Report, Tibbetts Road Site, Barrington, New Hampshire.* December 1998.

Arcadis Geraghty & Miller, Inc. 1998. *Summary of Spring 1998 Environmental Monitoring, Tibbetts Road Site, Barrington, New Hampshire.* December 1998.

Arcadis Geraghty & Miller, Inc. 1999. *Summary of Environmental Monitoring for 1999, Tibbetts Road Site, Barrington, New Hampshire.* April 2000.

Arcadis Geraghty & Miller, Inc. 2000. *Summary of Environmental Monitoring 2000, Tibbetts Road Site, Barrington, New Hampshire.* April 12, 2001.

Arcadis Geraghty & Miller, Inc. 2001. *Summary of Environmental Monitoring 2001, Tibbetts Road Site, Barrington, New Hampshire.* April 2002.

Arcadis Geraghty & Miller, Inc. 2002. *Summary of Environmental Monitoring 2002, Tibbetts Road Site, Barrington, New Hampshire.* 2003.

Arcadis Geraghty & Miller, Inc. 2002. *Vacuum Enhance Recovery (VER) System and Well 169R Pumping System Performance Report for the Year 2002, Tibbetts Road Site, Barrington, New Hampshire.* March 18, 2003.

Arcadis Geraghty & Miller, Inc. 2003. *In-Situ Oxidation Pilot Test Work Plan, Tibbetts Road Site, Barrington, New Hampshire.* August 26, 2003.

CDM Federal Program Corporation, 1992. *Remedial Investigation Report, Tibbetts Road Site, Barrington, New Hampshire.* June 1992.

Schnoor, Jerald L., Ground-Water Remediation Technologies Analysis Center, 1997. *Phytoremediation, TE-98-01.* October 1997.

USEPA, 1992. *Record of Decision, Tibbetts Road Superfund Site, Barrington, New Hampshire.* September 29, 1992.

USEPA. 1994. *Consent Decree Between the United States of America, the State of New Hampshire, and Ford Motor Company, (C.A. No.s C-91-120-S and C-91-194-S).* November 8, 1994.

USEPA. 1998. *Amended Record of Decision, Tibbetts Road Superfund Site, Barrington, New Hampshire.* September 28, 1998.

USEPA. 1998. *Preliminary Close Out Report, Tibbetts Road Superfund Site, Barrington, New Hampshire.* September 29, 1998.

USEPA. 2001. *Comprehensive Five-Year Review Guidance, EPA 540-R-01-007.* June 2001.

APPENDIX B - SUMMARY OF GROUNDWATER MONITORING RESULTS

TIBBETTS ROAD SITE
Summary of Groundwater Analytical Results

Well Designation	Sample Date	Volatile Organic Compounds (µg/L)									--Metals (µg/L)--	
		Benzene	cis-1,2-Dichloroethene	Ethylbenzene	4-Methyl-2-pentanone	Toluene	Tetrachloroethene	1,1,1-Trichloroethane	Trichloroethene	total Xylenes	Dissolved As	Dissolved Mn
	ICL:	5	70	700	1,825	1,000	5	200	5	10,000	50	3,650
EW1D	17-Apr-98	<100	140	600	980	2500	<100	<100	<100	3,100	3.7	<5.0
EW1D	27-Oct-98	11	7.2	24	180	78	<5	<5	<5	130	5.1	<5
EW1D	5-May-99	56	27	44	640	140	<5	<5	2.0J	150	9.3	19.0
EW1D	20-Dec-99	<5	<5	1.4J	<10	1.2BJ	<5	<5	<5	1.1J	7.7	5.6
EW1D	13-Jul-00	47D	26D	71D	540D	140D	<5	<5	<5	230D	<7	13.2
EW1D	5-Dec-00	<5	<5	1.6J	<10	<5	<5	<5	<5	3.1J	<7	<3
EW1D	24-Jul-01	<5	<5	<5	<10	<5	<5	<5	<5	<10	<10	10
EW1D	18-Dec-01	<5	<5	<5	<10	12	<5	<5	<5	<10	<10	<10
EW1D	9-Jul-02	12	15	12	51	13	<5	<5	<5	35	<10	<10
EW1S	8-Aug-96	<250	800	<250	<500	1,700	<250	<250	250	1,700		
EW1S	17-Sep-96	<200	310	56J	<400	1600	<200	<200	<200	940		
EW1S	14-Oct-96	9	110	<5	18	10	6	<5	<5	110		
EW1S	8-Jan-97	<10	<100	61	9J	11	30	10	10	430		
EW1S	21-Mar-97	<250	390	540	<500	2,900	<250	<250	<250	1,600		
EW1S	28-May-97	<100	<100	230	<200	2,100	22J	<100	<100	1,300		
EW1S	7-Oct-97	<5	11	7	<10	6	<5	<5	<5	88		
EW1S	21-Apr-98	<5	22	42	<10	<5	140	<5	5.8	150	28,000	16,000
EW1S	5-May-99	<5	38	2.3J	<10	31	10	<5	3.0J	8.7J	385	3,130
EW1S	20-Dec-99	<5	<5	1.5J	<10	2.3BJ	2.5J	<5	<5	<15	21	1,370
EW1S	13-Jul-00	<5	<5	<5	<10	<5	1.9J	<5	<5	<10	358	2,160
EW1S	5-Dec-00	<5	1.1J	<5	<10	<5	<5	<5	<5	<10	276	1,080
EW1S	24-Jul-01	<5	10	<5	<10	<5	<5	<5	<5	<10	2000	2,400
EW1S	18-Dec-01	<5	12	11	<10	9.4	<5	<5	<5	<10	870	1,100
EW1S	8-Jul-02	<5	<5	<5	<10	<5	<5	<5	<5	<10	250	850
EW2S	17-Sep-96	1J	4J	<5	<10	<5	3J	<5	3J	<5		
EW2S	14-Oct-96	5	10	<5	5J	<5	21	<5	7	<5		
EW2S	8-Jan-97	<5	<5	<5	<10	<5	<5	<5	<5	<10		
EW2S	21-Mar-97	<5	<5	<5	<10	<5	<5	<5	7	<5		
EW2S	20-Apr-98	<5	<5	<5	<10	<5	<5	<5	<5	<5	86	2,800
EW2S	5-May-99	<5	<5	1.5J	<10	6.7	<5	<5	<5	1.7J	46.5	248
EW2S	21-Dec-99	<5	<5	1.1J	<10	<10	<5	<5	<5	<10	22	63.7
EW2S Dup	21-Dec-99	<5	<5	<5	<10	<5	<5	<5	<5	<10	14.4	54.3
EW2S	13-Jul-00	<5	79D	57D	<10	240D	8.4D	<5	2.6DJ	130D	42.7	3,410
EW2S	5-Dec-00	6.4J	140	42	<10	49	1.5J	<5	<5	97	40.8	2,450
EW2S Dup	5-Dec-00	<5	130	28	<10	26	1.4J	<5	<5	56	38.6	2,330
EW2S	26-Jul-01	<5	23	<5	<10	<5	<5	<5	<5	<10	17	430
EW2S	18-Dec-01	<5	14	<5	<10	7.1	<5	<5	<5	<10	18	510
EW2S	8-Jul-02	<5	16	<5	<10	<5	<5	<5	<5	<10	<10	1900

TIBBETTS ROAD SITE
Summary of Groundwater Analytical Results

Well Designation	Sample Date	Volatile Organic Compounds (µg/L)									Metals (µg/L)	
		Benzene	cis-1,2-Dichloroethene	Ethylbenzene	4-Methyl-2-pentanone	Toluene	Tetrachloroethene	1,1,1-Trichloroethane	Trichloroethene	total Xylenes	Dissolved As	Dissolved Mn
	ICL:	5	70	700	1,825	1,000	5	200	5	10,000	50	3,650
EW3S	17-Sep-96	23	44	11	<10	4J	28	<5	32	7		
EW3S	14-Oct-96	4J	7	2J	<10	<5	6	<5	4J	<5		
EW3S	8-Jan-97	<5	<5	<5	<10	<5	<5	<5	<5	<10		
EW3S	21-Mar-97	<5	2J	<5	<10	9	<5	<5	4J	5		
EW3S	20-Apr-98	<5	<5	<5	<10	<5	5	<5	<5	<5	27	1600
EW3S	5-May-99	<5	<5	1.7J	<10	8.5	<5	<5	<5	2.2J	509	6,260
EW3S	21-Dec-99	<5	<5	<5	<10	<5	1.0J	<5	<5	<10	15.2	3,550
EW3S	13-Jul-00	<5	<5	<5	<10	1.8	<5	<5	<5	<10	9.7	2,140
EW3S	5-Dec-00	<5	<5	<5	<10	<5	<5	<5	<5	<10	7.3	262
EW3S	26-Jul-01	<5	<5	<5	<10	<5	<5	<5	<5	<10	<10	120
EW3S	18-Dec-01	<5	<5	<5	<10	5.6	<5	<5	<5	<10	170	7,000
EW3S	8-Jul-02	<5	<5	<5	<10	<5	<5	<5	<5	<10	<10	<10
EW4S	17-Sep-96	<5	1J	<5	<10	<5	<5	<5	<5	16		
EW4S	14-Oct-96	<5	<5	<5	<10	<5	<5	<5	<5	9		
EW4S	8-Jan-97	<5	<5	<5	5J	<5	<5	<5	<5	<5		
EW4S	20-Mar-97	<25	<25	<25	7J	<25	<25	<25	8J	<25		
EW4S	14-Aug-97	<5	<5	<5	<10	<5	<5	<5	<5	<5		
EW4S	20-Apr-98	<5	12	<5	<10	<5	<5	<5	<5	<5	520	3,000
EW5S	17-Sep-96	<25	<25	<25	<50	67	<25	<25	9J	440		
EW5S	14-Oct-96	<5	<5	140	<10	8	<5	<5	6	100		
EW5S	8-Jan-97	<5	<5	41	5J	380	<5	<5	<5	<10		
EW5S	21-Mar-97	<5	<5	2J	<10	7	<5	<5	<5	24		
EW5S	7-Oct-97	8	<5	120	<10	120	<5	<5	<5	320		
EW5S	21-Apr-98	<5	<5	<5	15	5.6	<5	<5	<5	<5	13,000	7,200
EW5S	5-May-99	5.0	<5	62	<10	4.2BJ	<5	<5	<5	180	4,080	2,080
EW5S	20-Dec-99	4.2J	<5	2.3J	<10	<5	<5	<5	<5	2.9J	3,220	3,860
EW5S	13-Jul-00	<5	<5	<5	<10	1.4J	<5	<5	<5	1.1J	191	4,270
EW5S	5-Dec-00	39	<5	170	<10	57	<5	<5	<5	360	352	6,840
EW5S	24-Jul-01	<25	<25	41	<50	780	<25	<25	<25	1200	120	3,700
EW5S	17-Dec-01	12	<50	5.2	<10	<5	<5	<5	<5	17	1,100	6,400
EW5S	13-Jun-02	<5	<5	64	<10	37	<5	<5	<5	160	**	**
EW5S	9-Jul-02	<5	<5	<5	<10	<5	<5	<5	<5	98	<10	3,900
EW5S	18-Dec-02	<5	<5	14	<10	58	<5	<5	<5	28	31	6,400
EW5S	5-Jun-03	<5	<5	6.7	<10	21	<5	<5	<5	19	<10	1000T
EW6S	15-Aug-96	0.71	22	2.7	---	3.9	---	---	4.4	1.3	**	**
EW6S	17-Sep-96	0.26	11	0.6	---	2.5	---	---	5.4	0.6	**	**
EW6S	14-Oct-96	0.34	11	0.51	---	2.4	---	---	6.7	0.49	**	**
EW6S	24-Jul-01	<5	130	7.4	<10	28	<5	<5	<5	36	11	2,000
EW6S	8-Jul-02	<10	230	98	<20	150	<10	<10	<10	240	39	1,300

TIBBETTS ROAD SITE
Summary of Groundwater Analytical Results

Well Designation	Sample Date	Volatile Organic Compounds (µg/L)									--Metals (µg/L)--	
		Benzene	cis-1,2-Dichloroethene	Ethylbenzene	4-Methyl-2-pentanone	Toluene	Tetrachloroethene	1,1,1-Trichloroethane	Trichloroethene	total Xylenes	Dissolved As	Dissolved Mn
	ICL:	5	70	700	1,825	1,000	5	200	5	10,000	50	3,650
EW7S	16-Apr-98	<5	<5	<5	<10	<5	<5	<5	<5	<10	<7	
EW7S	27-Oct-98	<5	6.4	<5	<10	<5	<5	<5	<5	<5	5.1	2,900
EW7S	5-May-99	<5	<5	<5	<10	5.2	<5	<5	<5	1.3J	<2	11,000
EW7S	20-Dec-99	<5	<5	<5	<10	<5	<5	<5	<5	<10	<7	2,840
EW7S	13-Jul-00	<5	1.1J	<5	<10	<5	<5	<5	<5	<10	<7	4,440
EW7S	5-Dec-00	<5	<5	<5	<10	<5	<5	<5	<5	<10	<7	2,900
EW7S	24-Jul-01	<5	<5	<5	<10	<5	<5	<5	<5	<10	<10	2,200
EW7S	18-Dec-01	<5	<5	<5	<10	14	<5	<5	<5	<10	---	2,900
EW7S	8-Jul-02	<5	<5	<5	<10	<5	<5	<5	<5	<10	<10	6,200
EW7S	19-Dec-02	<5	<5	<5	<10	<5	<5	<5	<5	<10	10	710
EW7S	6-Jun-03	<5	<5	<5	<10	<5	<5	<5	<5	<10	<10	850
EW8S	17-Sep-96	260J	11,000	600J	<2000	2500	<1000	<1000	5400	600J		
EW8S	14-Oct-96	340J	11,000	510	<1000	2400	<500	<500	6700	490J		
EW8S	08-Jan-97	160	2000	190	27	1500	36	<10	1100	1100		
EW8S	21-Mar-97	<120	860	690	<250	2,500	<120	<120	46J	9,500		
EW8S	28-May-97	180	<100	210	<200	1,800	23J	<100	1,200	500		
EW8S	14-Aug-97	160	2,900	240	<250	260	<120	<120	520	1,300		
EW8S	07-Oct-97	<100	1,400	<100	<200	<100	<100	<100	300	<100		
EW8S	20-Apr-98	<5	13	<5	<10	6.2	<5	<5	85	<5	470	830
EW8S	5-May-99	<5	18	<5	<5	4.1J	<10	<5	9.9	6.5J	805	2,920
EW8S	20-Dec-99	8.2	480	8.2	<10	28	3.2J	<5	190	340	35.6	10,000
EW8S	13-Jul-00	<30	1,600D	680D	<100	6,500D	<40	<10	63D	2200D	388.0	18,900
EW8S	5-Dec-00	<5	18	<5	<10	<5	<5	<5	<5	1.0J	30.1	2,380
EW8S	24-Jul-01	<5	9.5	<5	<10	<5	<5	<5	<5	<10	170	730
EW8S	18-Dec-01	<50	950E	15	<10	150	<50	<5	5.4	69	220	5,800
EW8S	8-Jul-02	<5	16	<5	<10	<5	<5	<5	<5	<10	<10	34
EW9S	17-Sep-96	1600J	2600J	1400J	<10000	18,000	<5000	<5000	<5000	5100		
EW9S	14-Oct-96	2900	6200	1800	1500J	27,000	<1200	<1200	<1200	8,400		
EW9S	8-Jan-97	620	3200	56	760	590	360	<120	<120	<120		
EW9S	21-Mar-97	<5	13	<5	<10	<5	14	<5	3J	<5		
EW9S	28-May-97	1,300	<200	1,300	1,800	4,200	<200	<200	150J	2,900		
EW9S	14-Aug-97	820	2,300	900	1,300	2,700	<120	<120	<120	1,900		
EW9S	7-Oct-97	210	630	220	<200	2,100	<100	<100	<100	640		
EW9S	20-Apr-98	<5	<5	<5	<10	<5	<5	<5	<5	<5	19,000	17,000
EW9S	5-May-99	<5	2.5J	9.0	<10	85	<5	<5	6.7	32	242	3,040
EW9S	20-Dec-99	<5	<5	<5	<10	<5	<5	<5	<5	<10	21.7	1,640
EW9S	13-Jul-00	<5	<5	<5	<10	2.6J	<5	<5	<5	<10	15.2	366
EW9S	5-Dec-00	<5	<5	<5	<10	<5	<5	<5	<5	<10	13.3	2,060
EW9S	24-Jul-01	<5	<5	<5	<10	<5	<5	<5	<5	<10	24	160
EW9S	18-Dec-01	<5	<5	<5	<10	7.5	<5	<5	<5	<10	1,600	10,000

TIBBETTS ROAD SITE
Summary of Groundwater Analytical Results

Well Designation	Sample Date	Volatile Organic Compounds (µg/L)									Metals (µg/L)	
		Benzene	cis-1,2-Dichloroethene	Ethylbenzene	4-Methyl-2-pentanone	Toluene	Tetrachloroethene	1,1,1-Trichloroethane	Trichloroethene	total Xylenes	Dissolved As	Dissolved Mn
	ICL:	5	70	700	1,825	1,000	5	200	5	10,000	50	3,650
EW9S	8-Jul-02	<5	<5	<5	<10	<5	<5	<5	<5	<10	<10	130
EW10S	21-Mar-97	<500	<500	570	<1000	13,000	<500	<500	<500	7,100		
EW10S	28-May-97	<200	<200	890	<400	6,400	<200	<200	<200	4,500		
EW10S	14-Aug-97	<50	<50	170	<100	850	<50	<50	<50	800		
EW10S	5-May-99	3.7J	<5	230E	<10	510BE	<5	<5	1.1J	540	47,500	38,700
EW10S	20-Dec-99	6.9	<5	940	<10	6,500B	<5	<5	3.3J	3,800	2,880	12,000
EW10S	13-Jul-00	<6	<8	460D	<20	1,600DE	<8	<5	<5	1,400D	4,880	7,190
EW10S	4-Dec-00	<5	<12	480	<40	3,500E	<8	<5	<5	1800	5,580	9,960
EW10S	24-Jul-01	<100	<100	680	<200	4,700E	<100	<5	100	3,600	190	15,000
EW10S	18-Dec-01	<50	<5	710E	<10	5.3	<50	<5	<50	240	430	8,600
EW10S	13-Jun-02	<25	<25	110	<50	700	<25	<25	<25	740	**	**
EW10S	9-Jul-02	<50	<50	440	<100	1600	<50	<50	<50	1800	60	8,800
EW10S	19-Dec-02	<5	<5	46	<10	110	<5	<5	<5	580E	130	12,000
EW10S (2DL)	19-Dec-02	<10	<10	37D	<20	88D	<10	<10	<10	410D	**	**
EW10S	5-Jun-03	<10	<10	88	<20	180	<10	<10	<10	340	43T	4,600T
32R	01-Jan-85	---	**	**	---	---	---	---	---	---	**	**
32R	01-Jun-90	---	**	**	---	---	---	---	---	---	**	**
33R	01-Jan-85	---	**	**	---	---	---	---	2J	---	**	**
33R	01-Jun-90	---	**	**	---	---	---	---	---	---	**	**
34R	01-Jan-85	---	---	**	---	---	---	---	---	---	**	**
34R	01-Jun-90	---	---	**	---	---	---	---	---	---	**	**
35R	01-Jan-85	12	---	**	---	---	---	---	110	4J	**	**
35R	01-Jun-90	19	---	**	140	---	---	---	4J	---	**	**
35R	01-Jun-91	52	---	**	320B	---	---	---	12J	---	**	**
35R	24-May-94	290	26	---	790	---	<10	---	25	---	31	**
35R	08-Jan-97	17	4J	<5	120	<5	<5	<5	1J	<5	NA	NA
35R	21-Mar-97	<5	3J	5	23	3J	<5	<5	5	6	NA	NA
35R	21-Apr-98	130	<25	<25	1000	<25	<25	<25	<50	<25	30	870
35R	06-May-99	120	9.6	1.6J	180	<5	1.2J	<5	12	<5	27.0	<1
35R	21-Dec-99	92	10	1.8J	<10	<5	1.8J	<5	18	<15	19.3	886
35R	16-Feb-00	53	8.7	<5	<10	<5	2.1J	<5	19	<15	NA	NA
35R	13-Jul-00	75	8.2	<5	24	<5	1.7J	<5	13	<15	24.5	872
35R	06-Dec-00	78	8.3	<5	<10	<5	2.3J	<5	19	<10	26.3	924
35R	26-Jul-01	60	12	<5	<25	<5	<5	<5	22	<10	24	970
35R	19-Dec-01	140	28	5.4	33	58	<5	<5	20	13	23	1,100
35R	10-Jul-02	30	8.2	<5	<10	<5	<5	<5	12	<10	25	900
35R	20-Dec-02	50	16	<5	<10	<5	<5	<5	22	<10	20	1100

TIBBETTS ROAD SITE
Summary of Groundwater Analytical Results

Well Designation	Sample Date	Volatile Organic Compounds (µg/L)								--Metals (µg/L)--	
		Benzene	cis-1,2-Dichloroethene	Ethylbenzene	4-Methyl-2-pentanone	Toluene	Tetrachloroethene	1,1,1-Trichloroethane	Trichloroethene	total Xylenes	Dissolved As	Dissolved Mn
	ICL:	5	70	700	1,825	1,000	5	200	5	10,000	50	3,650
35R	16-Jan-03	40	11	<5	<10	<5	<5	<5	20	<10	23	960
35R	12-Mar-03	31	12	<5	<10	<5	<5	<5	20	<10	22	960
35R	04-Jun-03	44	10	<5	<10	<5	<5	<5	20	<10	21T	950T
36D	01-Jan-85	---	**	---	---	---	---	---	2J	---	**	**
36D	15-Jun-90	---	**	---	---	---	---	---	---	---	**	**
36D	01-Oct-90	---	**	---	---	---	---	---	4J	---	31	44J
36D	01-Jun-95	<10	<10	<10	<20	12	<10	<10	1J	3J	20.6	---
36D	02-Apr-96	<5	<5	<5	<10	<5	<5	<5	<5	<5	5.7	<5
36D	24-Jul-01	<5	<5	<5	<10	<5	<5	<5	<5	10	14	76
36D	08-Jul-02	<5	<5	<5	<10	<5	<5	<5	<5	<10	<10	<10
37D	01-Jan-85	620	**	58.0	87,000	430	6J	---	200	270	**	**
37D	19-Jun-90	1,000J	**	---	2,300	---	---	---	150J	---	52.5J	9,610
37D	10-Oct-90	3,100J	270	1,500	3,800	2,600	210	---	630	3,100	44	6,010J
37D	01-May-91	2,300	950	1,100	750	840	38J	---	160	2,200	26.8	5,590
37D	24-May-94	290	26	---	790	---	<10	---	25	---	31	**
37D	25-May-95	98	---	190	28	41	130	---	330	6J	31.1	4,500
37D	23-Aug-95	28	100	68	---	---	91	---	320	---	NA	NA
37D	03-Apr-96	< 10	89	33	<20	<10	47	<10	< 10	<10	26	4,000
37D	12-Aug-96	<20	52	<20	<40	<20	35	<20	120	<20	NA	NA
37D	08-Jan-97	<5	39	10	<10	<5	38	<5	87	<10	NA	NA
37D	21-Mar-97	< 25	43	14J	<50	<25	36	<25	97	<25	NA	NA
37D	21-Apr-98	< 25	7.8	<5	<10	<5	7.6	<5	14	<5	360	3,100
37D	06-May-99	<5	3.4J	<5	<10	<10	2.2J	<5	5.4	<10	107	<1
37D	21-Dec-99	<5	1.0J	<5	<10	<5	1.5J	<5	2.3J	15	33.4	1,820
37D	13-Jul-00	<5	<5	<5	<10	<5	2.2J	<5	2.2J	<10	91.7	2,220
37D	6-Dec-00	<5	1.9J	<5	<10	<5	1.9J	<5	2.0J	<10	19.2	1,740
37D	26-Jul-01	<5	<5	<5	<10	<5	7	<5	<5	<10	38	2,500
37D	19-Dec-01	35	10	<5	220	150	<5	<5	<5	<10	24	2,800
37D	10-Jul-02	<5	<5	<5	<10	<5	<5	<5	<5	<10	41	3,000
37D	19-Dec-02	<5	<5	<5	<10	<5	<5	<5	<5	<10	42	2,600
37D	5-Jun-03	<5	<5	<5	<10	<5	<5	<5	<5	<10	44T	2,800T
38D	01-Jan-85	2J	**	7J	---	17	---	---	---	58	**	**
38D	15-Jun-90	---	**	---	---	---	---	---	---	---	**	**
38D	01-Oct-90	---	**	---	---	---	---	---	---	---	26	446J
49S	01-Jan-85	2J	**	5J	---	20.0	---	---	---	52.0	**	**
49S	15-Jun-90	---	**	---	---	---	---	---	---	---	**	**
49S	10-Oct-90	---	**	---	---	---	---	---	---	---	25	1,090

TIBBETTS ROAD SITE
Summary of Groundwater Analytical Results

Well Designation	Sample Date	Volatile Organic Compounds (µg/L)									Metals (µg/L)	
		Benzene	cis-1,2-Dichloroethene	Ethylbenzene	4-Methyl-2-pentanone	Toluene	Tetrachloroethene	1,1,1-Trichloroethane	Trichloroethene	total Xylenes	Dissolved As	Dissolved Mn
	ICL:	5	70	700	1,825	1,000	5	200	5	10,000	50	3,650
50S	01-Jan-85	6J	**	---	---	22.0	---	---	---	52.0	**	**
50S	15-Jun-90	41J	2J	360EJ	---	330EJ	---	---	---	760EJ	**	**
50S	10-Oct-90	2,200	**	**	940	**	3,200	**	**	**	**	**
50S	10-Oct-90	140J	**	940	---	2,200	---	---	---	3,200	185	12,400J
50S	08-Feb-94	22	---	490	---	62	<10	---	<10	>1,400	41	**
50S	03-Jun-95	21J	---	370	---	7J	<40	---	<40	720	300	6,130
50S	28-Nov-95	32	<25	670	<50	240	<25	<25	<25	1,700	NA	NA
50S	02-Apr-96	< 200	< 200	780	<400	<200	< 200	<200	< 200	2,200	320	7,900
50S	07-Aug-96	<50	<50	300	<100	<50	<50	<50	<50	680	NA	NA
50S	08-Jan-97	16	<5	230	4J	3J	<5	<5	<5	360	NA	NA
50S	21-Mar-97	44J	< 100	620	<200	34J	< 100	<100	< 100	1,200	NA	NA
50S	21-Apr-98	<25	<25	310	<50	<25	< 25	<25	50	590	370	7100
50S	06-May-99	12	<5	200	<10	12	<5	<5	<5	210	141	187
50S	21-Dec-99	10	<5	200	<10	<5	<5	<5	<5	300	398	5990
50S	12-Jul-00	6.8	<5	320	<10	4.3J	<5	<5	<5	440	445	8640
50S	6-Dec-00	4.0J	<5	110	<10	<5	1.9J	<5	2.0J	<5	486	8540
50S	24-Jul-01	7.4	<5	160	<10	<5	<5	<5	<5	190	490	11,000
50S	18-Dec-01	5.6	<5	85	<10	<5	<5	<5	<5	160	1,400	9,400
50S	08-Jul-02	9.3	<5	85	<10	<5	<5	<5	<5	190	420	11,000
50S	18-Dec-02	<5	<5	<5	<10	<5	<5	<5	<5	<10	200	6,600
50S	02-Jun-03	<5	<5	<5	<10	<5	<5	<5	<5	<10	570T	6,700T
51S	01-Jan-85	120	**	---	210	1,000	---	---	---	4,800	**	**
51S	19-Jun-90	---	**	---	10,000J	---	---	---	---	---	50.8J	6,680
51S	10-Oct-90	28J	**	450	---	2,500	---	---	---	2,200	165	3,710J
51S	30-May-95	<1,000	<1,000	3,400	850J	18,000	<1,000	<1,000	<1,000	12,000	139	7,410
51S	28-Nov-95	<25	<25	270	<50	580	<25	<25	<25	2,000	NA	NA
51S	10-Apr-96	< 250	< 250	4,000	<500	7,800	< 250	< 250	< 250	23,000	140	5,700
51S	14-Aug-96	<500	<500	2,300	<1000	17,000	<500	<500	<500	11,000	NA	NA
51S	08-Jan-97	< 500	< 500	1,300	<100	15,000	< 500	< 500	< 500	11,000	NA	NA
51S	20-Mar-97	< 2,500	< 2,500	1,600J	< 5,000	12,000	< 2,500	< 2,500	< 2,500	10,000	110	5,000
51S	21-Apr-98	< 100	< 100	370	<200	440	< 100	< 100	< 100	2,100	150	6,600
51S	26-Oct-98	<100	<100	<100	<200	380	<100	<100	<100	3100	250	6,400
51S	06-May-99	1.5J	<5	73	<10	130	<5	<5	<5	400	307	9,510
51S	20-Dec-99	<5	<5	870	<10	140B	<5	<5	<5	4300	249	9,440
51S	13-Jul-00	<12	<16	790D	<40	960D	<16	<5	<10	7000D	151	6,400
51S	6-Dec-00	14	<6.4	830	<16	190	<6.4	<5	<5	3300	198	9,020
51S	24-Jul-01	<100	<100	980	<100	780	<100	<5	<100	7100	300	10,000
51S	18-Dec-01	<10	<5	230E	<10	7.7	<10	<5	<10	58	380	10,000
51S	08-Jul-02	<5	<5	5.7	<10	<5	<5	<5	<5	100	17	4,100
51S	18-Dec-02	<5	<5	33	<10	<5	<5	<5	<5	70	57	6,600

TIBBETTS ROAD SITE
Summary of Groundwater Analytical Results

Well Designation	Sample Date	Volatile Organic Compounds (µg/L)									Metals (µg/L)	
		Benzene	cis-1,2-Dichloroethene	Ethylbenzene	4-Methyl-2-pentanone	Toluene	Tetrachloroethene	1,1,1-Trichloroethane	Trichloroethene	total Xylenes	Dissolved As	Dissolved Mn
	ICL:	5	70	700	1,825	1,000	5	200	5	10,000	50	3,650
51S	02-Jun-03	<5	<5	36	<10	<5	<5	<5	<5	490D	54T	5,600T
52S	01-Jan-85	1,700	**	---	47,000	5,200	18J	---	84J	750	**	**
52S	01-Jan-85	1,700	**	---	96,000	8,100	---	---	---	1,500	**	**
52S	15-Jun-90	960J	**	---	---	12,000J	---	---	310J	---	30.1J	12,600
52S	10-Oct-90	1,100	200J	880	---	4,600	130J	---	300	2,000	150	18,600J
52S	01-May-91	200	180	110	---	880	---	---	29J	290	63.6	8,910
52S	24-May-94	3.8	1.6	4.3	---	---	3.2	---	4.2	3.9	---	**
52S	30-May-95	2J	8J	2J	---	---	10	---	20	---	---	1,430
52S	28-Nov-95	<5	<5	<5	<10	<5	<5	<5	<5	<5	NA	NA
52S	03-Apr-96	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	150
52S	13-Aug-96	<5	<5	<5	<10	<5	<5	<5	<5	<5	NA	NA
52S	08-Jan-97	<5	<5	<5	<10	<5	<5	<5	<5	<10	NA	NA
52S	21-Mar-97	<5	<5	<5	<10	2J	<5	<5	<5	<5	NA	NA
52S	21-Apr-98	<5	<5	<5	<10	<5	<5	<5	<5	<5	2.7	97
52S	06-May-99	<5	<5	<5	<10	2.6BJ	<5	<5	<5	<15	120	166
52S	21-Dec-99	<5	<5	<5	<10	<5	<5	<5	<5	<15	6.2	124
52S	13-Jul-00	<5	2.7J	<5	<10	<5	1.8J	<5	<5	<5	13.7	7,120
52S	6-Dec-00	<5	<5	<5	6.1J	<5	<5	<5	<5	<15	<7	156
52S	26-Jul-01	<5	<5	<5	<10	<5	<5	<5	<5	<10	51	3,400
52S	19-Dec-01	110	22	9	610E	430E	<10	<5	<10	37	410	9,600
52S	13-Jun-02	<5	<5	<5	<10	<5	<5	<5	<5	<10	**	**
52S	10-Jul-02	<5	<5	<5	<10	<5	<5	<5	<5	<10	<10	99
52S	18-Dec-02	<5	5.1	<5	<10	<5	<5	<5	<5	<10	<10	1100
52S	4-Jun-03	<5	<5	<5	<10	<5	<5	<5	<5	<10	<10	50T
53S	01-Jan-85	2J	**	---	19	8J	---	---	---	36	**	**
53S	15-Jun-90	---	**	---	---	---	---	---	---	---	**	**
53S	01-Oct-90	---	**	---	---	---	8	---	10	---	17	536J
53S	01-May-91	---	**	---	---	---	---	---	---	---	3.6	48
53S	24-May-94	---	---	---	---	---	3.3	---	1.4	---	---	**
53S	08-Apr-96	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	33
53S	13-Aug-96	<5	<5	<5	<10	<5	<5	<5	<5	<5	NA	NA
53S	08-Jan-97	<5	<5	<5	<10	<5	<5	<5	<5	<10	NA	NA
53S	21-Mar-97	<5	<5	<5	<10	<5	<5	<5	7	<5	NA	NA
53S	21-Apr-98	<5	<5	<5	<10	<5	<5	<5	<5	<5	<20	37
53S	06-May-99	3.1J	<5	<5	<10	<5	<5	<5	<5	<15	<2	<1
53S	21-Dec-99	1.1J	<5	3.4J	<10	1.5J	<5	<5	2.3J	3J	<2	93.2
53S	13-Jul-00	<5	<5	<5	<10	<5	<5	<5	<5	<10	<7	164
53S	6-Dec-00	<5	<5	<5	<10	<5	<5	<5	<5	<10	<7	125
53S	26-Jul-01	<5	<5	<5	<10	<5	<5	<5	<5	<10	<10	130
53S	10-Jul-02	<5	<5	<5	<10	<5	<5	<5	<5	<10	<10	59

TIBBETTS ROAD SITE
Summary of Groundwater Analytical Results

Well Designation	Sample Date	Volatile Organic Compounds (µg/L)									Metals (µg/L)	
		Benzene	cis-1,2-Dichloroethene	Ethylbenzene	4-Methyl-2-pentanone	Toluene	Tetrachloroethene	1,1,1-Trichloroethane	Trichloroethene	total Xylenes	Dissolved As	Dissolved Mn
	ICL:	5	70	700	1,825	1,000	5	200	5	10,000	50	3,650
54S	01-Jan-85	---	**	---	---	1J	---	---	---	---	**	**
54S	15-Jun-90	---	**	---	---	---	---	---	---	---	**	**
54S	01-Oct-90	---	**	---	---	---	---	---	---	---	18	760J
54S	28-Nov-95	<5	<5	<5	<10	<5	<5	<5	<5	<5	NA	NA
54S	10-Apr-96	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	67
54S	08-Aug-96	<5	<5	<5	<10	7	<5	<5	<5	7	NA	NA
57S	01-Jan-84	244	**	1,319	250	18,655	---	---	10,361	10,790	**	**
57S	01-Jan-84	---	**	1,989	NA	37,322	---	---	13,091	11,287	**	**
57S	01-Jan-85	1,900	**	4,700	21,000	140,000	110J	---	27,000	28,000	**	**
57S	19-Jun-90	170J	**	---	---	---	---	---	---	---	55.0J	19,900
57S	01-Oct-90	160	4,000	1,700	---	7,700	---	---	7,800	5,400	97	16,100J
57S	14-Feb-92	**	**	**	**	**	**	**	**	**	0.086	**
57S	14-Feb-92	**	**	**	**	**	**	**	**	**	---	**
57S	08-Feb-94	<500	18,000	1,800	---	28,000	<500	<500	3,200	8,400	120	**
57S	28-May-95	100J	15,000	760	---	250J	<500	<500	7,200	220J	113	14,000
57S	29-Nov-95	<500	9,400	<500	<1000	<500	<500	<500	3,800	<500	NA	NA
57S	08-Apr-96	< 250	6,900	350	<500	1,200	< 250	< 250	2,700	290	1,300	16,000
57S	07-Aug-96	<500	1,900	<500	<1000	<500	<500	<500	<500	<500	190	13,000
57S	08-Jan-97	21J	1,300	200	<100	<50	< 50	<50	2,000	770	NA	NA
57S	20-Mar-97	< 2,500	< 2,500	2,200J	< 5,000	37,000	< 2,500	< 2,500	8,700	12,000	160	18,000
57S	21-Apr-98	<1,000	1,400	2,400	<1,000	28,000	<1,000	<2,000	6,500	6,300	170	19,000
57S	04-May-99	200	1,500E	1,300E	<800	7,000E	160	<80	3,700E	7,300E	310	18,200
57S Dup	04-May-99	180	1,400E	1,100E	<10	5,900E	140	<5	3,000E	5,800E	289	29,400
57S	14-Jul-99	<120	2,900	1900	<400	9,500	<160	<40	330	3,500		
57S Dup	14-Jul-99	12	1600D	880E	<10	1,200E	24	<5	200D	3,000E		
57S	20-Dec-99	1.5J	250	210	<10	82B	1.5J	<5	22	240	122	27,800
57S Dup	20-Dec-99	1.6J	250	180	<10	46	2.0J	<5	23	140	248	27,500
57S	13-Jul-00	<12	670	1,700	<40	2,200	<16	<5	85	3800	126	44,500
57S	6-Dec-00	<12	450	340	<40	980	<16	<5	<10	1000	80.1	25,000
57SDup	6-Dec-00	<5	490	250	<200	730	<5	<5	<5	740	69.4	31,000
57S	24-Jul-01	<25	440	760	<50	58	<25	<25	<25	1300	66	23,000
57S	17-Dec-01	<1200	6100E	4400D	<2500	33000D	<1200	<1200	<1200	20000D	300	23,000
57S	13-Jun-02	<25	960D	790D	<10	2500D	<25	<25	<25	2900	**	**
57S	8-Jul-02	<20	230	84	<40	510	<20	<20	<20	380	11	11,000
57SDup	8-Jul-02	<20	260	97	<40	580	<20	<20	<20	440	14	11,000
57S	17-Dec-02	<20	570	620	<40	97	<20	<20	<20	1500	110	12,000
57SDup (157S)	17-Dec-02	<20	580	640	<40	98	<20	<20	<20	1600	110	12,000
57S	06-Jun-03	<10	140	180	<20	22	<10	<10	<10	340	33T	6,900T
57SDup (257S)	06-Jun-03	<5	120	170	<10	18	<5	<5	<5	320	35T	7,100T

TIBBETTS ROAD SITE
Summary of Groundwater Analytical Results

Well Designation	Sample Date	Volatile Organic Compounds (µg/L)									Metals (µg/L)	
		Benzene	cis-1,2-Dichloroethene	Ethylbenzene	4-Methyl-2-pentanone	Toluene	Tetrachloroethene	1,1,1-Trichloroethane	Trichloroethene	total Xylenes	Dissolved As	Dissolved Mn
	ICL:	5	70	700	1,825	1,000	5	200	5	10,000	50	3,650
58S	01-Jan-84	---	**	---	---	---	---	---	---	---	**	**
58S	01-Jan-84	---	**	---	---	---	---	---	---	---	**	**
58S	01-Jan-85	---	**	---	---	---	---	---	---	---	**	**
58S	15-Jun-90	---	**	---	---	---	---	---	---	---	---	2,200
58S	10-Oct-90	---	**	---	---	---	---	---	---	---	20	856J
58S	06-Jun-95	<10	---	---	---	---	<10	---	10	---	---	8.0B
59R	01-Jan-84	---	---	**	---	---	---	---	---	---	**	**
59R	01-Jan-84	---	---	**	---	---	---	---	---	---	**	**
59R	01-Jan-85	---	---	**	---	---	---	---	---	---	**	**
59R	01-Jun-90	---	---	**	---	---	---	---	---	---	**	**
60S	01-Jan-84	702.5	**	1,500	3,440	6,500	---	---	26.4	4,000	**	**
60S	01-Jan-84	741	**	3,346	NA	49,169	---	---	636	15,556	**	**
61R	01-Jan-84	---	**	**	20.5	5.3	---	---	---	---	**	**
61R	01-Jan-84	---	**	**	---	29.1	---	---	---	---	**	**
61R	01-Jan-85	---	**	**	---	---	---	---	16	---	**	**
61R	01-Jun-90	2J	**	**	---	---	---	---	5.0	---	**	**
61R	02-Jun-95	2J	2J	---	---	---	<10	---	28	2J	26	134
61R	01-Apr-96	<5	<5	<5	<10	<5	<5	<5	17	<5	26	170
61R	26-Oct-98	<5	<5	<5	<10	<5	<5	<5	10	<5	8.9	180
61R	24-Jul-01	<5	<5	<5	<10	<5	<5	<5	13	<10	80	490
61R	09-Jul-02	<5	<5	<5	<10	<5	<5	<5	<5	<10	<10	<10
62S	01-Jan-84	---	**	---	5.4	---	---	27.8	---	---	**	**
62S	01-Jan-84	---	**	---	---	---	---	18.5	---	---	**	**
62S	01-Jan-85	4J	**	---	---	---	---	---	22	---	**	**
62S	15-Jun-90	---	**	---	---	---	---	---	21J	---	24.7J	7,800
62S	10-Oct-90	---	**	---	---	---	---	---	---	---	---	254J
63R	01-Jan-84	11.8	---	**	---	5	---	---	23.1	---	**	**
63R	01-Jan-84	33.5	---	**	---	---	---	---	77.5	---	**	**
63R	01-Jan-85	14	---	**	2J	2J	---	---	310	---	**	**
63R	01-Jun-90	14	---	**	---	---	---	---	45	---	**	**
63R	24-Jul-01	<5	<5	<5	<10	<5	<5	<5	24	<10	27	340
63R	09-Jul-02	5.5	<5	<5	<10	<5	<5	<5	33	<10	22	310
63R	20-Dec-02	<5	<5	<5	<10	<5	<5	<5	25	<10	22	310
63R	06-Jun-03	<5	<5	<5	<10	<5	<5	<5	30	<10	25T	350T
64S	01-Jan-84	---	**	---	---	---	---	---	---	---	**	**

TIBBETTS ROAD SITE
Summary of Groundwater Analytical Results

Well Designation	Sample Date	Volatile Organic Compounds (µg/L)								--Metals (µg/L)--	
		Benzene	cis-1,2-Dichloroethene	Ethylbenzene	4-Methyl-2-pentanone	Toluene	Tetrachloroethene	1,1,1-Trichloroethane	Trichloroethene	total Xylenes	Dissolved As	Dissolved Mn
	ICL:	5	70	700	1,825	1,000	5	200	5	10,000	50	3,650
64S	01-Jan-84	---	**	---	---	---	---	---	---	---	**	**
64S	01-Jan-85	---	**	---	---	---	---	---	---	---	**	**
64S	01-Jun-90	**	**	**	**	**	**	**	**	**	---	1,890
64S	01-Jun-90	---	**	---	---	---	---	---	---	---	**	**
64S	10-Oct-90	---	**	---	---	---	---	---	---	---	---	441J
65R	01-Jan-84	122.6	7.2	**	130	24.8	---	14.1	327.2	---	**	**
65R	01-Jan-84	226	---	**	NA	---	---	---	629	---	**	**
65R	01-Jan-85	200	---	**	210	2J	2J	---	650	---	**	**
65R	01-Jun-90	39	---	**	43	4J	---	---	110	---	**	**
65R	13-Aug-96	140	95	<5	130	<5	<5	<5	72	6	17	1,300
65R	26-Jul-01	6.1	5.8	<5	<10	<5	<5	<5	9.4	<10	<10	1,000
65R	10-Jul-02	<5	7.2	<5	<10	<5	<5	<5	9.4	<5	<10	280
65R	20-Dec-02	64	30	<5	<10	<5	<5	<5	12	<10	15	680
65R	05-Jun-03	22	24	<5	<10	<5	<5	<5	13	<10	13T	770T
67R	01-Jan-84	---	---	**	---	---	---	---	6.4	---	**	**
67R	01-Jan-84	6	---	**	---	---	---	---	5	---	**	**
67R	01-Jan-85	2J	---	**	3J	---	---	---	26	---	**	**
67R	01-Jun-90	3J	---	**	---	---	---	---	9	---	**	**
67R	14-Feb-92	**	**	**	**	**	**	**	**	**	18	**
67R	14-Feb-92	**	**	**	**	**	**	**	**	**	13	**
67R	29-May-95	3J	---	---	14	6J	<10	---	5J	2J	---	53
67R	05-Apr-96	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	26
67R	24-Jul-01	<5	5.3	<5	<10	<5	<5	<5	15	<10	<0.10	370
67R	09-Jul-02	<5	6.0	<5	<10	<5	<5	<5	19	<10	<10	350
67R	17-Dec-02	<5	<5	<5	<10	<5	<5	<5	12	<10	<10	320
67R	9-Jun-03	<5	<5	<5	<10	<5	<5	<5	15	<10	<10	300T
68S	01-Jan-84	575.2	**	130	19,000	2,270	---	---	771.6	1,046	**	**
68S	01-Jan-84	2,573	**	---	NA	11,938	---	---	---	---	**	**
69R	01-Jan-84	500	**	**	10,000	3,300	10.6	---	3,000	500	**	**
69R	01-Jan-84	473	**	**	NA	893	---	---	1,415	---	**	**
69R	19-Jun-90	490J	**	**	5,500	---	---	---	---	---	31.6J	3,880
69R	01-Oct-90	2,800	1,000J	**	41,000J	5,400	---	220J	650J	---	80	2,880J
69R	01-Jun-91	4,000	1,700J	**	53,000B	9,000	---	---	---	2,900	**	**
69R	24-May-94	3,500	1,100	310	>10,000	4,600	<100	---	<100	1,300	114	**
69R	31-May-95	2,700J	<4,000	<4,000	51,000	7,300	<4,000	<4,000	<4,000	---	135	5,330
69R	05-Apr-96	2,100	1,100	<100	<200	1,900	< 100	<100	< 100	230	960	6,600
69R	14-Aug-96	4,100	1,300	360	<250	690	<120	<120	<120	1,800	160	7,500

TIBBETTS ROAD SITE
Summary of Groundwater Analytical Results

Well Designation	Sample Date	Volatile Organic Compounds (µg/L)									Metals (µg/L)	
		Benzene	cis-1,2-Dichloroethene	Ethylbenzene	4-Methyl-2-pentanone	Toluene	Tetrachloroethene	1,1,1-Trichloroethane	Trichloroethene	total Xylenes	Dissolved As	Dissolved Mn
	ICL:	5	70	700	1,825	1,000	5	200	5	10,000	50	3,650
69R	08-Jan-97	5,200	1,200	290	<250	400	< 120	<120	< 120	1,400	NA	NA
69R	21-Mar-97	6,300	1,800	790	<500	740	< 250	< 250	170J	3,500	NA	NA
69R	10-Jun-97	4,700	1,400	410J	76,000	16,000	<1200	<1200	<1200	1,600	22	4,900
69R	24-Jul-97	4,100	920J	660J	61,000	17,000	<1200	<1200	<1200	2,800	83	5,100
69R	21-Apr-98	3,600	720	500	26,000	12,000	<500	<500	<1,000	1,700	120	4,600
69R	01-Jul-99	3,500	960	260	<400	19,000	<160	<40	<100	1,300	NA	NA
69R	16-Feb-00	3,300	990	390	<160	7,500	<64	<16	<40	1,800	NA	NA
69R	13-Jul-00	4,100D	690D	610D	32,000D	13000D	<40	<10	<25	2,200D	245	6,470
69R	06-Dec-00	4,800	1,200	640	9700	13,000	<80	<20	<50	2,900	234	4,760
69R	26-Jul-01	2,500	920	190	2800	490	<100	<100	<100	670	240	8,100
69R	19-Dec-01	3,100	780	260	610	290	<100	<100	<100	500	130	9,000
69R	10-Jul-02	4400E	1,600	540	280	120	<100	<200	<100	2,200	140	4,400
69R-D	10-Jul-02	4400D	1500D	560D	<400	<200	<200	<200	<200	2300D	**	**
69R	18-Dec-02	4,000	1,100	740	<400	<200	<200	<200	<200	2,600	140	5,400
69R	16-Jan-03	4,000	1,000	500	730	2,200	<200	<200	<200	1,600	140	4,800
69R	17-Feb-03	3,200	880	550	<200	500	<100	<100	<100	2,000	140	5,800
69R	12-Mar-03	3,000	860	420	<200	340	<100	<100	<100	1,600	150	4,900
69R	4-Jun-03	3,700	870	750	<200	200	<100	<100	<100	2,200	130T	4,900T
70S	01-May-91	**	**	7	**	87	1J	**	4J	23	17.6J	6,890
70S	08-Feb-94	630	420	660	---	3,700	180	---	430	1,300	14	**
70S	27-May-95	260	460	700	---	320	310	---	500	900	79.4	14,200
70S	23-Aug-95	---	7	1J	---	---	10	---	15	2J	NA	NA
70S	29-Nov-95	<5	<5	<5	<10	<5	<5	<5	<5	<5	NA	NA
70S	04-Apr-96	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	700
70S	07-Aug-96	<5	<5	<5	<10	<5	<5	<5	<5	<5	NA	NA
70S	08-Jan-97	<5	<5	<5	<10	<5	<5	<5	<5	<10	NA	NA
70S	21-Mar-97	<5	<5	<5	<10	<5	<5	<5	<5	<5	NA	NA
70S	15-Apr-98	<5	<5	<5	<10	<5	<5	<5	<5	<10	<20	230
70S	27-Oct-98	<5	<5	<5	<10	<5	<5	<5	<5	<5	18	370
70S	04-May-99	<5	<5	<5	<10	<5	<5	<5	<5	15	309	607
70S	21-Dec-99	<5	<5	<5	<10	1.6BJ	<5	<5	<5	1.3J	<2	1,060
70S	13-Jul-00	2.3J	<5	<5	16	4J	<5	<5	<5	<10	15	1,010
70S	06-Dec-00	<5	<5	<5	<10	<5	<5	<5	<5	<10	<7	133
70S	26-Jul-01	<5	<5	<5	<10	6.3	<5	<5	<5	<10	<10	230
70S	18-Dec-01	<5	<5	<5	<10	<5	<5	<5	<5	<10	18	830
70S	08-Jul-02	<5	<5	<5	<10	<5	<5	<5	<5	<10	<10	3,500
71S	01-May-91	---	**	---	---	2BJ	---	---	130	---	17.5	1,470
71S	14-Feb-92	**	**	**	**	**	**	**	**	**	0.006	**
71S	14-Feb-92	**	**	**	**	**	**	**	**	**	---	**

TIBBETTS ROAD SITE
Summary of Groundwater Analytical Results

Well Designation	Sample Date	Volatile Organic Compounds (µg/L)									--Metals (µg/L)--	
		Benzene	cis-1,2-Dichloroethene	Ethylbenzene	4-Methyl-2-pentanone	Toluene	Tetrachloroethene	1,1,1-Trichloroethane	Trichloroethene	total Xylenes	Dissolved As	Dissolved Mn
	ICL:	5	70	700	1,825	1,000	5	200	5	10,000	50	3,650
71S	29-Nov-95	<5	<5	<5	<10	<5	<5	<5	<5	<5	**	**
71S	09-Jul-02	<5	<5	<5	<10	<5	<5	<5	<5	<10	<10	2500
72S	01-May-91	---	**	980	---	5,100	150J	---	---	2,800	84.9	15,600
72S	14-Feb-92	**	**	**	**	**	**	**	**	**	0.21	**
72S	08-Feb-94	<25	520	1,200	---	760	310	---	<25	2,300	64	**
72S	28-May-95	80J	1,600	3,200	---	2,300	52J	---	<200	6,200	92.2	29,600
72S	29-Nov-95	<200	820	1,500	<400	6,300	<200	<200	<200	3,500	**	**
72S	01-Apr-96	< 100	590	660	290	870	< 100	<100	< 100	730	250	26,000
72S	07-Aug-96	<25	130	140	<50	<25	<25	<25	<25	72	**	**
72S	08-Jan-97	<5	6	<5	<10	1J	4J	<5	<5	2J	**	**
72S	21-Mar-97	<5	5	<5	<10	<5	3J	<5	<5	9	**	**
72S	20-Apr-98	530	<500	<500	23,000	<500	<500	<500	<1,000	<500	34	2,900
72S	04-May-99	<5	170	290E	<10	5.8	55	<5	10	400	452	16,600
72S	20-Dec-99	<5	260	8.4	<10	<5	14	<5	1.8J	28	139	16,600
72S	13-Jul-00	<5	220D	60D	<10	3.3DJ	34D	<5	4DJ	68D	147	16,600
72S	06-Dec-00	<5	19	<5	<10	<5	13	<5	<5	2.6J	137	15,300
72S	24-Jul-01	<5	8	<5	<10	<5	12	<5	<5	<10	140	13,000
72S	18-Dec-01	<5	<5	<5	<10	10	5.8	<5	<5	<10	200	16,000
72S	08-Jul-02	<5	<5	<5	<10	<5	10	<5	<5	<5	13	11,000
72S	19-Dec-02	<5	<5	<5	<10	<5	8.4	<5	<5	<10	210	15,000
72S	06-Jun-03	<5	<5	<5	<10	<5	<5	<5	<5	<10	57T	11,000T
73S	01-May-91	---	**	1J	---	7	---	---	14	7	5	1,320
73S	14-Feb-92	**	**	**	**	**	**	**	**	**	---	**
73S	14-Feb-92	**	**	**	**	**	**	**	**	**	6	**
73S	14-Feb-92	**	**	**	**	**	**	**	**	**	9	**
73S	08-Feb-94	---	10	---	---	---	---	---	90	---	11	**
73S	08-Jan-97	<5	<5	<5	<10	<5	<5	<5	<5	<10	**	**
73S	20-Apr-98	<5	57	<5	<10	<5	<5	<5	170	<5	<20	81
73S	04-May-99	<5	140	<5	<10	<5	<5	<5	210E	<15	12.4	1,480
73S	20-Dec-99	<5	94	<5	<10	<5	<5	<5	100	<15	<2	88.2
73S	13-Jul-00	<5	110	<5	<10	<5	<5	<5	100	<10	<7	96.6
73S	05-Dec-00	<5	110	<5	<10	<5	<5	<5	110	<10	<7	373
73S	24-Jul-01	<5	63	<5	<10	<5	<5	<5	64	<10	26	1,200
73S	18-Dec-01	<5	16	<5	<10	<5	<5	<5	26	<10	<10	310
73S	08-Jul-02	<5	20	<5	<10	<5	<5	<5	21	<10	<10	42
73S	17-Dec-02	<5	<5	<5	<10	<5	<5	<5	5.1	<10	<10	34
73S	09-Jun-03	<5	<5	<5	<10	<5	<5	<5	5.9	<10	<10	20T
74S	01-May-91	---	**	---	---	---	---	22	---	---	10.2	474

TIBBETTS ROAD SITE
Summary of Groundwater Analytical Results

Well Designation	Sample Date	Volatile Organic Compounds (µg/L)									Metals (µg/L)	
		Benzene	cis-1,2-Dichloroethene	Ethylbenzene	4-Methyl-2-pentanone	Toluene	Tetrachloroethene	1,1,1-Trichloroethane	Trichloroethene	total Xylenes	Dissolved As	Dissolved Mn
	ICL:	5	70	700	1,825	1,000	5	200	5	10,000	50	3,650
75D	01-May-91	**	**	**	**	**	**	**	**	**	26.1	2,220
75D	01-Jun-91	2,900	**	**	74,000B	3,300	---	---	---	2,100J	**	**
75D	24-May-95	5J	---	3J	---	4J	89	---	69	---	20.9	1,210
75D	23-Aug-95	4J	61	3J	---	2J	79	---	62	2J	**	**
75D	29-Nov-95	45	150	<5	<10	<5	120	<5	100	7	**	**
75D	09-Apr-96	<5	34	<5	<10	<5	110	<5	110	<5	12	1,500
75D	26-Jul-01	<5	32	<5	<10	<5	41	<5	<5	<10	11	580
75D	08-Jul-02	<5	<5	<5	<10	<5	13	<5	<5	<10	10	810
75D	17-Dec-02	<5	<5	<5	<10	<5	12	<5	<5	<10	<10	980
75D	03-Jun-03	<5	5.9	<5	<5	<5	19	<5	<5	<5	12	1,600
76R	01-May-91	---	**	**	---	3J	---	---	2J	---	3.8J	97.7
76R	26-Jul-01	<5	<5	<5	<10	<5	<5	<5	<5	<10	56	1,400
76R	10-Jul-02	<5	<5	<5	<10	<5	<5	<10	<5	<10	<10	49
77S	01-May-91	**	**	**	**	**	**	**	**	**	19.3	509
77S	01-May-91	---	**	---	---	---	---	---	---	---	**	**
77S	24-May-94	---	---	---	---	---	---	---	---	---	---	**
78R	01-May-91	---	**	**	---	3J	---	---	---	---	18.4	106
79S	01-May-91	15	**	1J	---	3J	53	---	53	140	5.8J	3,880
79S	08-Feb-94	---	---	---	---	---	---	---	---	---	5	**
79S	17-Apr-98	<5	<5	<5	<10	<5	<5	<5	<5	<10	<2	2,500
79S	26-Oct-98	<5	<5	<5	<10	<5	<5	<5	<5	<5	<2	1,200
79S	04-May-99	<5	<5	7.1	<10	73	1.2J	<5	6.6	27	2.0	220
79S	21-Dec-99	<5	<5	1.6J	<10	<5	<5	<5	<5	1.1J	<2	2,250
79S	13-Jul-00	<5	<5	<5	<10	1.2J	<5	<5	1.2J	<10	<7	2,800
79S	05-Dec-00	<5	<5	<5	<10	<5	<5	<5	<5	2.4J	<7	2,860
79S	24-Jul-01	<5	<5	<5	<10	<5	<5	<5	<5	<10	<10	3,800
79S	18-Dec-01	<5	<5	<5	<10	<5	<5	<5	<5	<10	<10	5,000
79S	08-Jul-02	<5	<5	<5	<10	<5	<5	<5	<5	<10	<10	3,800
80S	01-Jan-84	980	**	1,827	1,135	18,732	125	---	214	8,218	**	**
80S	01-Jan-84	1,468	**	1,945	**	31,703	---	---	---	18,841	**	**
80S	01-Jan-85	4,100	**	3,700	29,000	98,000	34J	---	1,100	29,000	**	**
80S	01-May-91	590	**	1,400	---	18,000	---	---	210J	6,700	21.9	6,370
80S	13-Feb-92	**	**	**	**	**	**	**	**	**	88	**
80S	13-Feb-92	**	**	**	**	**	**	**	**	**	9	**
80S	08-Feb-94	78	260	350	---	27	34	---	25	>700	114	**

TIBBETTS ROAD SITE
Summary of Groundwater Analytical Results

Well Designation	Sample Date	Volatile Organic Compounds (µg/L)									--Metals (µg/L)--	
		Benzene	cis-1,2-Dichloroethene	Ethylbenzene	4-Methyl-2-pentanone	Toluene	Tetrachloroethene	1,1,1-Trichloroethane	Trichloroethene	total Xylenes	Dissolved As	Dissolved Mn
	ICL:	5	70	700	1,825	1,000	5	200	5	10,000	50	3,650
80S	07-Aug-96	<5	<5	<5	<10	<5	<5	<5	<5	<5	**	**
81R	01-May-91	---	**	**	---	22	---	---	---	---	11.2	148
82S	01-May-91	1J	**	---	---	---	---	---	---	---	22.1	297
83S	01-May-91	---	**	---	---	---	---	---	---	---	32.7	3,290
84S	27-May-95	150J	390J	820J	760J	12,000	<1,000	<1,000	<1,000	2,400	446	17,400
84S	23-Aug-95	130J	500	1,200	---	7,400	<250	<250	<250	---	**	**
84S	29-Nov-95	<5	67	47	<10	16	6	<5	6	47	**	**
84S	02-Apr-96	< 50	---	200	---	53	< 50	---	< 50	470	160	3,600
84S	07-Aug-96	<5	26	<5	<10	<5	<5	<5	<5	<5	**	**
84S	08-Jan-97	<5	<5	<5	<10	<5	<5	<5	<5	<5	**	**
84S	20-Mar-97	<5	<5	3J	<10	1J	<5	<5	<5	3J	170	1,800
84S	16-Apr-98	5.3	<5	3J	<10	1J	<5	<5	<5	9.3	160	2,300
84S	26-Oct-98	<5	<5	<5	<10	<5	<5	<5	<5	<5	200	5,600
84S	04-May-99	1.6J	5.5	5.0	<10	2.2J	<5	<5	<5	7.8J	279	3,890
84S	20-Dec-99	1.7J	12	8.7	<10	4.6BJ	<5	<5	<5	10J	421	6,220
84S	13-Jul-00	7	18	7.5	<10	44	<5	<5	<5	44	372	4,280
84S	05-Dec-00	2.9J	9.1	6.8	<10	<5	<5	<5	<5	9.4J	637	6,120
84S	24-Jul-01	6.4	16	7.4	<10	7.4	<5	<5	<5	35	340	4,200
84S	18-Dec-01	<5	9.7	7.2	<10	<5	<5	<5	<5	15	350	3,000
84S	09-Jul-02	<5	8.9	<5	<10	<5	<5	<5	<5	<10	170	4,100
85S	24-Jul-01	<5	<5	<5	<10	<5	<5	<5	<5	<10	<10	1,700
85S	09-Jul-02	<5	<5	<5	<10	<5	<5	<5	<5	<10	14	4,300
87S	08-Feb-94	---	---	---	---	---	---	---	---	---	10	**
87S	20-Dec-99	<5	<5	<5	<10	<5	<5	<5	<5	<15	7	198
87S	05-Dec-00	<5	<5	<5	<10	<5	<5	<5	<5	<10	<7	115
87S	24-Jul-01	<5	<5	<5	<10	<5	<5	<5	<5	<10	<10	420
87S	09-Jul-02	<5	<5	<5	<10	<5	<5	<5	<5	<10	<10	1400
88S	07-Aug-96	<5	<5	<5	<10	<5	<5	<5	<5	<5	**	**
88S	24-Jul-01	<5	<5	<5	<10	<5	<5	<5	<5	<10	<10	510
88S	09-Jul-02	<5	<5	<5	<10	<5	<5	<5	<5	<10	<10	1,200
103R	27-May-95	750J	<2,000	2,000	22,000	900J	<2,000	<2,000	<2,000	---	19.3	1,450
103R	01-Apr-96	<5,000	<5,000	<5,000	26,000	<5,000	<5,000	<5,000	<5,000	<5000	42	2,600
103R	13-Apr-00	400D	46D	9.2D	410D	3.2J	<5	<5	2.1J	17D	**	**
103R	13-Jul-00	400D	110D	32D	2,200D	520D	<5	<5	<5	100D	57.5	2,670

TIBBETTS ROAD SITE
Summary of Groundwater Analytical Results

Well Designation	Sample Date	Volatile Organic Compounds (µg/L)								--Metals (µg/L)--	
		Benzene	cis-1,2-Dichloroethene	Ethylbenzene	4-Methyl-2-pentanone	Toluene	Tetrachloroethene	1,1,1-Trichloroethane	Trichloroethene	total Xylenes	Dissolved As	Dissolved Mn
	ICL:	5	70	700	1,825	1,000	5	200	5	10,000	50	3,650
103R	12-Dec-00	260E	110	15	1,100E	120	<5	<5	1.3J	24	39.8	1,970
103R	26-Jul-01	320	160	38	880E	140	<10	<10	<10	78	73	4,100
103R-Dilution	26-Jul-01	280D	140D	32D	840D	120D	<20	<10	<20	69D	**	**
103R	19-Dec-01	170	62	11	310	20	<10	<10	<10	<20	510	4,600
103R	09-Jul-02	210	82	11	220	<10	<10	<10	<10	<20	52	2,000
103R	19-Dec-02	130	51	7.9	35	<5	<5	<5	<5	<10	36	1,600
103R	16-Jan-03	170	60	10	35	<5	<5	<5	<5	<5	41	1,700
103R	13-Mar-03	78	40	5	<10	<5	<5	<5	<5	<10	32	1,600
103R	3-Jun-03	100	37	5.3	28	<5	<5	<5	<5	<10	21T	1,600T
105D	28-May-95	<10	---	---	---	---	<10	---	<10	---	---	13.0B
105D	05-Apr-96	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	<5
105D	24-Jul-01	<5	<5	<5	<10	<5	<5	<5	<5	<10	11	---
105D	09-Jul-02	<5	<5	<5	<10	<5	<5	<5	<5	<10	<10	15
106R	08-Jun-95	13	---	---	---	---	<10	---	1J	---	8.1B	13.0B
106R	23-Aug-95	10	---	---	---	---	---	---	2J	---	**	**
106R	28-Nov-95	13	8	<5	<10	<5	<5	<5	7	<5	**	**
106R	02-Apr-96	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	21
106R	06-May-99	11	1.0J	<5	<10	1.6BJ	<5	<5	1.7J	<10	7.6	<1
106R	16-Feb-00	4.2J	<5	<5	<10	<5	<5	<5	<5	<15	**	**
106R	26-Jul-01	15	<5	<5	<10	<5	<5	<5	<5	<10	<10	82
106R	10-Jul-02	15	<5	<5	<10	<5	<5	<5	<5	<10	<10	14
106R	20-Dec-02	16	<5	<5	<10	<5	<5	<5	<5	<10	<10	110
106R	03-Jun-03	14	<5	<5	<10	<5	<5	<5	<5	<10	<10	100T
107R	06-Jun-95	<10	---	---	---	---	<10	---	<10	---	**	**
107R	23-Aug-95	---	---	---	---	---	---	---	---	---	**	**
107R	09-Apr-96	<5	<5	<5	<10	<5	<5	<5	<5	<5	14	360
108R	07-Jun-95	<10	---	---	---	---	2J	---	<10	---	39.9	22
108R	09-Apr-96	<5	<5	<5	<10	<5	<5	<5	<5	<5	15	120
108R	04-Jun-03	<5	<5	<5	<10	<5	<5	<5	<5	<10	25T	76T
109R	05-Jun-95	<10	---	---	---	---	<10	---	<10	---	35	48
109R	09-Apr-96	<5	<5	<5	<10	<5	<5	<5	<5	<5	24	18
110S	07-Jun-95	<10	---	---	---	---	<10	---	<10	---	---	79
110S	23-Aug-95	---	---	---	---	---	---	---	---	---	**	**
110S	10-Apr-96	<5	<5	<5	<10	<5	<5	<5	<5	28	<5	20
110S	14-Aug-96	<5	<5	<5	<10	<5	<5	<5	<5	<5	**	**

TIBBETTS ROAD SITE
Summary of Groundwater Analytical Results

Well Designation	Sample Date	Volatile Organic Compounds (µg/L)									Metals (µg/L)	
		Benzene	cis-1,2-Dichloroethene	Ethylbenzene	4-Methyl-2-pentanone	Toluene	Tetrachloroethene	1,1,1-Trichloroethane	Trichloroethene	total Xylenes	Dissolved As	Dissolved Mn
	ICL:	5	70	700	1,825	1,000	5	200	5	10,000	50	3,650
169R	08-Oct-01	5,600D	1,500D	1,200D	34,000D	30,000D	<1000	<1000	<1000	5,000D	**	**
169R	19-Dec-01	3,800	<1000	<1000	62,000	18,000	<1000	<1000	<1000	<2000	55	5,200
169R	10-Jul-02	4,300	1,400	<1000	39,000	18,000	<1000	<1000	<1000	2,100	66	5,600
169R	19-Dec-02	2,100	620	570	12,000	9,100	<500	<500	<500	2,100	60	4,200
169RDup (269R)	19-Dec-02	2,600	720	670	16,000	11,000	<500	<500	<500	2,400	69	4,700
169R	16-Jan-03	2,200	580	610	1,000	10,000	<500	<500	<500	2,200	63	4,500
169R	17-Feb-03	2,400	680	680	15,000	9,600	<500	<500	<500	2,600	77	5,100
169R	12-Mar-03	2,100	710	590	15,000	9,100	<500	<500	<500	2,200	72	4,700
169R	4-Jun-03	3,300	800	880	26,000	15,000	<500	<500	<500	3,500	80T	5,300T
169RDup (269R)	4-Jun-03	3,300	770	880	25,000	15,000	<500	<500	<500	3,700	77T	5,200T

ICL Interim Groundwater Cleanup Level.
--- Below reporting limit. Reporting limit is less than the Interim Groundwater Cleanup Level (ICL) established by the USEPA (1992).
** Data not available or not sampled.
J Estimated concentration.
B Constituent was detected in the associated method blank.
D Identifies all compounds identified in analysis at the secondary dilution factor.
E Identifies compounds whose concentrations exceed the calibration range of the instrument for that specific analysis.
T Total (unfiltered) Concentration
< 10 Value is below reporting limit.

NA Not analyzed.
µg/L Micrograms per liter.
Dup Duplicate Sample

APPENDIX C - MANN-KENDALL TEST FOR TRENDS

Mann-Kendall Testing for Tibbetts Road Site

ARCADIS tested for increasing or decreasing trends in chemical concentrations in groundwater sampled from individual wells at the Tibbetts Road Site, using the non-parametric Mann-Kendall test for trends (Gilbert 1987). The objective of this effort was to determine whether concentrations measured within each well have changed since 1998 (since implementation of the phytoremediation/bioremediation remedy) to a statistically detectable degree, to the extent allowed by the available data and statistical methods employed.

The Mann-Kendall trend testing was performed on the data from 23 groundwater monitoring wells. A summary of the results is presented on Table 1. Testing of data obtained from some wells was not performed. The wells excluded from the testing and the reason for their exclusion are noted on Table 2. The majority of the wells excluded had never exhibited concentrations above the Interim Cleanup Levels (ICLs) or had never detected any volatile organic compounds, had a sample set of one to three samples or were only sampled prior to the period of 1998-2003 and have either been destroyed or closed.

In general, the purpose of trend analysis is to determine if chemical concentrations have been changing over time or are relatively stable. By examining changes that are outside of the range of normal sampling variability, it is possible to show if, for example, chemical concentrations have been decreasing since the implementation of a treatment program. In addition, if trend analyses show that chemical concentrations are stable or decreasing during the monitoring period, it is reasonable to assume that such trends will continue in the future.

Statistical methods for trend analysis provide unbiased procedures to differentiate real changes in chemical concentrations over time from the variability that is inherent in any sampling program. Chemical concentrations detected in a well are expected to vary simply because chemicals in groundwater are not perfectly mixed and as a result of sampling and analysis induced variations. Due to the nature of random variations, concentrations may appear to be systematically changing when in fact they are not. For example, three draws from a deck of cards might yield results of two, six and eight. Based on these observations one might conclude that the values of the cards are increasing over time. In fact, there is no real trend and the observed result is simply due to random chance, unlikely to be replicated and not indicative of any trends in the values of the cards in the deck as a whole. Statistical analyses provide a way to separate these random variations from true changes in chemical concentrations over time. A statistically significant trend is defined as a trend that is most likely due to real changes in chemical concentrations over time rather than random variations.

The Mann-Kendall test is a preferred method of detecting trends because it allows for missing values and the data need not conform to a particular statistical distribution (Gilbert, 1987). This test also allows the use of trace concentrations and values below the detection limit. Because the Mann-Kendall test considers the relative magnitude of the

observations rather than the absolute values of the data, results below the detection limit are assigned an appropriate proxy concentration and are not treated as missing data. The Mann-Kendall test can be viewed as a non-parametric test for zero slope of time-ordered data, in that it tests whether concentrations are significantly increasing or decreasing over time.

The methods described by Gilbert (1987) were used to calculate the Mann-Kendall statistics. In short, the differences between time-ordered observations were assigned a value of one if the values increased over time, a value of negative one if the values decreased over time, and a value of zero if there was no change. These values were then summed to yield the S-statistic and the ratio of this sum to its variance yielded a Z-statistic. The Z-statistic was used to derive a p-value for testing the null hypothesis (H_o: there is no trend). The p-value is defined as the probability that the observed trends could be due to random variations. A positive Z-value indicates an increasing trend and a negative Z-value indicates a decreasing trend. The application of the Mann-Kendall test to the available groundwater data for the Tibbetts Road Site required *a priori* decisions regarding treatment of detection limits because analytical detection limits for most chemicals changed over the course of the sampling program. Variable detection limits could lead to an erroneous finding of a trend where none exists. To guard against this possibility, each chemical concentration in a given well that was less than the highest non-detect concentration was classified as non-detect. Non-detect results were assigned a common value of one-half the minimum detected concentration. Mann-Kendall statistics were calculated for all chemicals detected one or more times in a given well.

The results of the Mann-Kendall tests are presented in Table 1 and include frequencies of detection, Mann-Kendall S-statistics, Mann-Kendall Z-statistics, p-values, and conclusions at both the 0.05 and 0.10 α (alpha) levels[1]. The less rigorous α level of 0.10 was included along with the more customary α level of 0.05, because trends for a number of chemicals at a number of wells were marginally significant (i.e., $0.05 < p < 0.10$). Wells with p-values greater than 0.05 (or 0.10) were determined to have no significant trend (i.e., neither increasing nor decreasing). Wells with p-values less than 0.05 (or 0.10) and negative Mann-Kendall Z-statistics were determined to have significantly decreasing trends. Wells with p-values less than 0.05 (or 0.10) and positive Mann-Kendall Z-statistics were determined to have increasing trends.

The results of the Mann-Kendall tests show no increasing trends in any of the monitored organic compounds (Table 1). Decreasing trends were most frequently observed in one or more of the BTEX compounds (benzene, toluene, ethylbenzene, xylene). In addition, decreasing trends were observed for other organic chemicals, including 4-methyl-2-pentanone, cis-1,2-dichloroethene, and trichloroethene. In most cases, concentrations of dissolved metals (arsenic and manganese) were either stable or decreasing. However, at

[1] •, or alpha, refers to the critical significance level of a statistical test. An • level denotes the probability that the observed results could occur by chance if in fact no difference exists, in this case it refers to the probability of reporting a significant trend when no trend exists.

well 169R an increasing trend in dissolved arsenic concentration was detected at the 0.05 α level. In addition, wells 75D and 35R were had increasing trends in dissolved manganese at the 0.10 α level.

There were no measured concentrations greater than the Interim Cleanup Levels (ICLs) for a large proportion of wells in which no trends were observed. In many other wells, several rounds of samples have been collected since the last detection of a concentration above a chemical specific ICL (Table 1). During the last sampling event, the overwhelming majority of concentrations in the monitoring wells were below the ICL. For wells with VOCs above the ICL, the concentration was only greater than ten times the ICL in wells 69R and 169R. Concentrations of manganese were found to be increasing in two wells (75D and 35R) and the arsenic concentration increased in one well (169R), however, these concentrations were below ICLs except for arsenic in 169R. Current site knowledge suggests that relatively higher concentrations of dissolved arsenic and manganese as a result of VOC biodegradation induced negative redox conditions. As biodegradation of VOCs reaches completion and groundwater conditions return to the naturally aerobic/positive redox state, arsenic and manganese concentrations are expected to decrease. Therefore, little change in the dissolved arsenic and manganese concentrations are expected until that time.

The lack of detectable trends in many wells is largely attributable to data limitations. For example, relatively small sample sizes were reported for wells 61R, 63R, 65R, 67R, and EW6S (Table 1, $n \leq 6$). Because the power of any statistical test is directly related to sample size, trends are more difficult to detect with smaller sample sizes. In addition, the frequency of detection for the monitored compounds was generally low at wells 106R, 65R, 75S, 75D, 84S, EW2S, EW3S, and EW5S. For these wells, the detection of a trend is unlikely because most of the observations were assigned the same value (i.e., non-detects were assigned a proxy concentration below the lowest detected concentration (Gilbert, 1987). However, as most of the results were below the detection limit, the concentration of the monitored compounds in these wells was low throughout the monitoring period. More importantly, there were few, if any, concentrations greater than the ICLs for a large proportion of the wells in which no trend was observed.

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Table 1 Summary of Mann-Kendall Trend Tests
Tibbetts Road Site, Barrington, New Hampshire
Based on Samples Collected from January 1998 to June 2003

Location	Chemical	Detection Frequency [a]	Detections Above ICL [a]	Sample Size	Mann-Kendall S-statistic	Mann-Kendall Z-statistic	p-value	Trend at • = 0.05	Trend at • = 0.10	Date of Last Detection Above ICL	Samples Since Last Detection Above ICL [b]	Factor Above ICL in Most Recent Sample [b]
103R	Benzene	10 / 10	10 / 10	10	-35	-3.1	0.0022	**Decreasing**	**Decreasing**	06/03/2003	None	20
103R	cis-1,2-Dichloroethene	10 / 10	4 / 10	10	-22	-1.9	0.056	No Trend	**Decreasing**	07/09/2002	4	BICL
103R	Ethylbenzene	10 / 10	0 / 10	10	-24	-2.1	0.039	**Decreasing**	**Decreasing**	NDA	NA	BICL
103R	4-Methyl-2-pentanone	9 / 10	1 / 10	10	-36	-3.1	0.0017	**Decreasing**	**Decreasing**	07/13/2000	8	BICL
103R	Toluene	5 / 10	0 / 10	10	-20	-1.9	0.053	No Trend	**Decreasing**	NDA	NA	ND
103R	Trichloroethene	2 / 10	0 / 10	10	0	0	1	No Trend	No Trend	NDA	NA	ND
103R	total Xylenes	4 / 10	0 / 10	10	-16	-1.7	0.095	No Trend	**Decreasing**	NDA	NA	ND
103R	Dissolved Arsenic	9 / 9	4 / 9	9	-20	-1.7	0.089	No Trend	**Decreasing**	07/09/2002	4	BICL
103R	Dissolved Manganese	9 / 9	2 / 9	9	-19	-1.6	0.10	No Trend	No Trend	12/19/2001	5	BICL
106R	Benzene	6 / 6	5 / 6	6	6	0.96	0.34	No Trend	No Trend	06/03/2003	None	2.8
106R	cis-1,2-Dichloroethene	1 / 6	0 / 6	6	0	0	1	No Trend	No Trend	NDA	NA	ND
106R	Toluene	1 / 6	0 / 6	6	0	0	1	No Trend	No Trend	NDA	NA	ND
106R	Trichloroethene	1 / 6	0 / 6	6	0	0	1	No Trend	No Trend	NDA	NA	ND
106R	Dissolved Arsenic	1 / 5	0 / 5	5	0	0	1	No Trend	No Trend	NDA	NA	ND
106R	Dissolved Manganese	4 / 5	0 / 5	5	6	0.94	0.35	No Trend	No Trend	NDA	NA	BICL
169R	Benzene	10 / 10	10 / 10	10	-14	-1.2	0.24	No Trend	No Trend	06/04/2003	None	660
169R	cis-1,2-Dichloroethene	9 / 10	9 / 10	10	-15	-1.8	0.068	No Trend	**Decreasing**	06/04/2003	None	11
169R	Ethylbenzene	8 / 10	3 / 10	10	-9	-1.4	0.16	No Trend	No Trend	06/04/2003	None	1.3
169R	4-Methyl-2-pentanone	10 / 10	9 / 10	10	-10	-0.81	0.42	No Trend	No Trend	06/04/2003	None	14
169R	Toluene	10 / 10	10 / 10	10	-17	-1.5	0.14	No Trend	No Trend	06/04/2003	None	15
169R	total Xylenes	9 / 10	0 / 10	10	17	1.5	0.15	No Trend	No Trend	NDA	NA	BICL
169R	Dissolved Arsenic	9 / 9	9 / 9	9	25	2.2	0.030	***Increasing***	***Increasing***	06/04/2003	None	1.6
169R	Dissolved Manganese	9 / 9	9 / 9	9	4	0.27	0.79	No Trend	No Trend	06/04/2003	None	1.4
35R	Benzene	13 / 13	13 / 13	13	-44	-2.3	0.0087	**Decreasing**	**Decreasing**	06/04/2003	None	8.8
35R	cis-1,2-Dichloroethene	12 / 13	0 / 13	13	2	0.13	0.89	No Trend	No Trend	NDA	NA	BICL
35R	Ethylbenzene	3 / 13	0 / 13	13	0	0	1	No Trend	No Trend	NDA	NA	ND
35R	4-Methyl-2-pentanone	4 / 13	0 / 13	13	-23	-1.8	0.066	No Trend	**Decreasing**	NDA	NA	ND
35R	Toluene	1 / 13	0 / 13	13	2	0.13	0.89	No Trend	No Trend	NDA	NA	ND
35R	Tetrachloroethene	5 / 13	0 / 13	13	0	0	1	No Trend	No Trend	NDA	NA	ND
35R	Trichloroethene	12 / 13	12 / 13	13	0	0	1	No Trend	No Trend	06/04/2003	None	4.0
35R	total Xylenes	1 / 13	0 / 13	13	0	0	1	No Trend	No Trend	NDA	NA	ND
35R	Dissolved Arsenic	12 / 12	0 / 12	12	-33	-2.0	0.050	No Trend	**Decreasing**	NDA	NA	BICL
35R	Dissolved Manganese	11 / 12	0 / 12	12	32	1.9	0.058	No Trend	***Increasing***	NDA	NA	BICL

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Table 1 Summary of Mann-Kendall Trend Tests
Tibbetts Road Site, Barrington, New Hampshire
Based on Samples Collected from January 1998 to June 2003

Location	Chemical	Detection Frequency [a]	Detections Above ICL [a]	Sample Size	Mann-Kendall S-statistic	Mann-Kendall Z-statistic	p-value	Trend at • = 0.05	Trend at • = 0.10	Date of Last Detection Above ICL	Samples Since Last Detection Above ICL [b]	Factor Above ICL in Most Recent Sample [b]
50S	Benzene	7 / 10	6 / 10	10	0	0	1	No Trend	No Trend	07/08/2002	2	ND
50S	Ethylbenzene	8 / 10	0 / 10	10	-34	-3.0	0.0028	**Decreasing**	**Decreasing**	NDA	NA	ND
50S	Toluene	2 / 10	0 / 10	10	0	0	1	No Trend	No Trend	NDA	NA	ND
50S	Tetrachloroethene	1 / 10	0 / 10	10	0	0	1	No Trend	No Trend	NDA	NA	ND
50S	Trichloroethene	1 / 10	0 / 10	10	0	0	1	No Trend	No Trend	NDA	NA	ND
50S	total Xylenes	7 / 10	0 / 10	10	-27	-2.4	0.018	**Decreasing**	**Decreasing**	NDA	NA	ND
50S	Dissolved Arsenic	10 / 10	10 / 10	10	19	1.6	0.11	No Trend	No Trend	06/02/2003	None	11
50S	Dissolved Manganese	10 / 10	9 / 10	10	12	0.99	0.32	No Trend	No Trend	06/02/2003	None	1.8
51S	Benzene	2 / 11	1 / 11	11	0	0	1	No Trend	No Trend	12/06/2000	5	ND
51S	Ethylbenzene	10 / 11	4 / 11	11	-9	-0.66	0.51	No Trend	No Trend	07/24/2001	4	BICL
51S	Toluene	8 / 11	0 / 11	11	-28	-2.1	0.034	**Decreasing**	**Decreasing**	NDA	NA	ND
51S	total Xylenes	11 / 11	0 / 11	11	-9	-0.62	0.53	No Trend	No Trend	NDA	NA	BICL
51S	Dissolved Arsenic	11 / 11	10 / 11	11	-13	-0.93	0.35	No Trend	No Trend	06/02/2003	None	1.1
51S	Dissolved Manganese	11 / 11	11 / 11	11	-6	-0.39	0.69	No Trend	No Trend	06/02/2003	None	1.5
57S	Benzene	5 / 19	3 / 19	19	0	0	1	No Trend	No Trend	07/14/1999	None	ND
57S	cis-1,2-Dichloroethene	19 / 19	19 / 19	19	-67	-2.3	0.020	**Decreasing**	**Decreasing**	06/06/2003	None	1.9
57S	Ethylbenzene	19 / 19	9 / 19	19	-69	-2.4	0.017	**Decreasing**	**Decreasing**	06/13/2002	NA	BICL
57S	Toluene	19 / 19	8 / 19	19	-84	-2.9	0.0035	**Decreasing**	**Decreasing**	06/13/2002	NA	BICL
57S	Tetrachloroethene	5 / 19	3 / 19	19	0	0	1	No Trend	No Trend	07/14/1999	None	ND
57S	Trichloroethene	8 / 19	8 / 19	19	-50	-2.7	0.0063	**Decreasing**	**Decreasing**	07/13/2000	None	ND
57S	total Xylenes	19 / 19	1 / 19	19	-62	-2.1	0.032	**Decreasing**	**Decreasing**	12/17/2001	NA	BICL
57S	Dissolved Arsenic	16 / 16	12 / 16	16	-62	-2.1	0.032	**Decreasing**	**Decreasing**	12/17/2002	NA	BICL
57S	Dissolved Manganese	16 / 16	16 / 16	16	-63	-2.2	0.029	**Decreasing**	**Decreasing**	06/06/2003	None	1.9
61R	Trichloroethene	2 / 3	2 / 3	3	-1	0	1	No Trend	No Trend	07/24/2001	1	ND
61R	Dissolved Arsenic	2 / 3	1 / 3	3	0	0	1	No Trend	No Trend	07/24/2001	1	ND
61R	Dissolved Manganese	2 / 3	0 / 3	3	-1	0	1	No Trend	No Trend	NDA	NA	ND
63R	Benzene	1 / 4	1 / 4	4	-1	0	1	No Trend	No Trend	07/09/2002	2	ND
63R	Trichloroethene	4 / 4	4 / 4	4	2	0.34	0.73	No Trend	No Trend	06/06/2003	None	6.0
63R	Dissolved Arsenic	4 / 4	0 / 4	4	-1	0	1	No Trend	No Trend	NDA	NA	BICL
63R	Dissolved Manganese	4 / 4	0 / 4	4	1	0	1	No Trend	No Trend	NDA	NA	BICL
65R	Benzene	3 / 4	3 / 4	4	2	0.34	0.73	No Trend	No Trend	06/05/2003	None	4.4
65R	cis-1,2-Dichloroethene	4 / 4	0 / 4	4	4	1.0	0.31	No Trend	No Trend	NDA	NA	BICL
65R	Trichloroethene	4 / 4	4 / 4	4	5	1.4	0.15	No Trend	No Trend	06/05/2003	None	2.6
65R	Dissolved Arsenic	2 / 4	0 / 4	4	3	0.72	0.47	No Trend	No Trend	NDA	NA	BICL
65R	Dissolved Manganese	4 / 4	0 / 4	4	0	0	1	No Trend	No Trend	NDA	NA	BICL

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Table 1 Summary of Mann-Kendall Trend Tests
Tibbetts Road Site, Barrington, New Hampshire
Based on Samples Collected from January 1998 to June 2003

Location	Chemical	Detection Frequency [a]	Detections Above ICL [a]	Sample Size	Mann-Kendall S-statistic	Mann-Kendall Z-statistic	p-value	Trend at • = 0.05	Trend at • = 0.10	Date of Last Detection Above ICL	Samples Since Last Detection Above ICL [b]	Factor Above ICL in Most Recent Sample [b]
67R	cis-1,2-Dichloroethene	2 / 4	0 / 4	4	-3	-0.72	0.47	No Trend	No Trend	NDA	NA	ND
67R	Trichloroethene	4 / 4	4 / 4	4	-1	0	1	No Trend	No Trend	06/09/2003	None	3.0
67R	Dissolved Manganese	4 / 4	0 / 4	4	-6	-1.7	0.089	No Trend	**Decreasing**	NDA	NA	BICL
69R	Benzene	14 / 14	14 / 14	14	-9	-0.44	0.66	No Trend	No Trend	06/04/2003	None	740
69R	cis-1,2-Dichloroethene	14 / 14	14 / 14	14	4	0.16	0.87	No Trend	No Trend	06/04/2003	None	12
69R	Ethylbenzene	13 / 14	2 / 14	14	27	1.5	0.14	No Trend	No Trend	06/04/2003	None	1.1
69R	4-Methyl-2-pentanone	7 / 14	4 / 14	14	-33	-2.0	0.050	No Trend	**Decreasing**	07/26/2001	8	ND
69R	Toluene	12 / 14	6 / 14	14	-43	-2.3	0.020	**Decreasing**	**Decreasing**	01/16/2003	3	BICL
69R	total Xylenes	14 / 14	0 / 14	14	10	0.47	0.62	No Trend	No Trend	NDA	NA	BICL
69R	Dissolved Arsenic	11 / 11	11 / 11	11	-8	-0.39	0.70	No Trend	No Trend	06/04/2003	None	2.6
69R	Dissolved Manganese	11 / 11	11 / 11	11	2	0.55	0.96	No Trend	No Trend	06/04/2003	None	1.3
72S	Benzene	1 / 10	1 / 10	10	-9	-1.4	0.16	No Trend	No Trend	04/20/1998	9	ND
72S	cis-1,2-Dichloroethene	5 / 10	3 / 10	10	0	0	1	No Trend	No Trend	07/13/2000	6	ND
72S	Ethylbenzene	3 / 10	0 / 10	10	0	0	1	No Trend	No Trend	NDA	NA	ND
72S	4-Methyl-2-pentanone	1 / 10	1 / 10	10	-9	-1.4	0.16	No Trend	No Trend	04/20/1998	9	ND
72S	Toluene	3 / 10	0 / 10	10	0	0	1	No Trend	No Trend	NDA	NA	ND
72S	Tetrachloroethene	8 / 10	8 / 10	10	0	0	1	No Trend	No Trend	12/19/2002	1	ND
72S	Trichloroethene	3 / 10	1 / 10	10	0	0	1	No Trend	No Trend	05/04/1999	8	ND
72S	total Xylenes	4 / 10	0 / 10	10	0	0	1	No Trend	No Trend	NDA	NA	ND
72S	Dissolved Arsenic	10 / 10	8 / 10	10	-1	0	1	No Trend	No Trend	06/06/2003	None	1.1
72S	Dissolved Manganese	10 / 10	9 / 10	10	-15	-1.3	0.20	No Trend	No Trend	06/06/2003	None	3.0
73S	cis-1,2-Dichloroethene	8 / 10	4 / 10	10	-27	-2.3	0.019	**Decreasing**	**Decreasing**	12/05/2000	5	ND
73S	Trichloroethene	10 / 10	9 / 10	10	-36	-3.1	0.0017	**Decreasing**	**Decreasing**	06/09/2003	None	1.2
73S	Dissolved Arsenic	2 / 10	0 / 10	10	1	0	1	No Trend	No Trend	NDA	NA	ND
73S	Dissolved Manganese	10 / 10	0 / 10	10	-17	-1.4	0.15	No Trend	No Trend	NDA	NA	BICL
75D	cis-1,2-Dichloroethene	2 / 4	0 / 4	4	-1	0	1	No Trend	No Trend	NDA	NA	BICL
75D	Tetrachloroethene	4 / 4	4 / 4	4	-2	-0.34	0.73	No Trend	No Trend	06/03/2003	None	3.8
75D	Dissolved Arsenic	3 / 4	0 / 4	4	0	0	1	No Trend	No Trend	NDA	NA	BICL
75D	Dissolved Manganese	4 / 4	0 / 4	4	6	1.7	0.089	No Trend	*Increasing*	NDA	NA	BICL
84S	Benzene	6 / 9	3 / 9	9	-3	-0.25	0.80	No Trend	No Trend	07/24/2001	2	ND
84S	cis-1,2-Dichloroethene	7 / 9	0 / 9	9	13	1.3	0.21	No Trend	No Trend	NDA	NA	BICL
84S	Ethylbenzene	7 / 9	0 / 9	9	5	0.43	0.67	No Trend	No Trend	NDA	NA	ND
84S	Toluene	5 / 9	0 / 9	9	3	0.29	0.77	No Trend	No Trend	NDA	NA	ND
84S	total Xylenes	7 / 9	0 / 9	9	8	0.81	0.42	No Trend	No Trend	NDA	NA	ND
84S	Dissolved Arsenic	9 / 9	9 / 9	9	8	0.73	0.47	No Trend	No Trend	07/09/2002	None	3.4
84S	Dissolved Manganese	9 / 9	7 / 9	9	-2	-0.10	0.92	No Trend	No Trend	07/09/2002	None	1.1

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Table 1 Summary of Mann-Kendall Trend Tests
Tibbetts Road Site, Barrington, New Hampshire
Based on Samples Collected from January 1998 to June 2003

Location	Chemical	Detection Frequency [a]	Detections Above ICL [a]	Sample Size	Mann-Kendall S-statistic	Mann-Kendall Z-statistic	p-value	Trend at • = 0.05	Trend at • = 0.10	Date of Last Detection Above ICL	Samples Since Last Detection Above ICL [b]	Factor Above ICL in Most Recent Sample [b]
EW10S	Benzene	2 / 10	1 / 10	10	0	0	1	No Trend	No Trend	12/20/1999	8	ND
EW10S	Ethylbenzene	10 / 10	2 / 10	10	-17	-1.4	0.15	No Trend	No Trend	12/18/2001	4	BICL
EW10S	Toluene	10 / 10	5 / 10	10	-14	-1.2	0.24	No Trend	No Trend	07/09/2002	2	BICL
EW10S	Trichloroethene	2 / 10	0 / 10	10	0	0	1	No Trend	No Trend	NDA	NA	ND
EW10S	total Xylenes	10 / 10	0 / 10	10	-12	-0.99	0.32	No Trend	No Trend	NDA	NA	BICL
EW10S	Dissolved Arsenic	9 / 9	8 / 9	9	-26	-2.2	0.025	**Decreasing**	**Decreasing**	12/19/2002	1	BICL
EW10S	Dissolved Manganese	9 / 9	9 / 9	9	-13	-1.1	0.28	No Trend	No Trend	06/05/2003	None	1.3
EW1D	Benzene	4 / 9	4 / 9	9	0	0	1	No Trend	No Trend	07/09/2002	None	2.4
EW1D	cis-1,2-Dichloroethene	5 / 9	1 / 9	9	-14	-1.4	0.15	No Trend	No Trend	04/17/1998	8	BICL
EW1D	Ethylbenzene	7 / 9	0 / 9	9	-14	-1.4	0.15	No Trend	No Trend	NDA	NA	BICL
EW1D	4-Methyl-2-pentanone	5 / 9	0 / 9	9	-16	-1.6	0.10	No Trend	No Trend	NDA	NA	BICL
EW1D	Toluene	7 / 9	1 / 9	9	-12	-1.2	0.24	No Trend	No Trend	04/17/1998	8	BICL
EW1D	Trichloroethene	1 / 9	0 / 9	9	0	0	1	No Trend	No Trend	NDA	NA	ND
EW1D	total Xylenes	7 / 9	0 / 9	9	-14	-1.4	0.15	No Trend	No Trend	NDA	NA	BICL
EW1D	Dissolved Arsenic	4 / 9	0 / 9	9	0	0	1	No Trend	No Trend	NDA	NA	ND
EW1D	Dissolved Manganese	4 / 9	0 / 9	9	-3	-0.25	0.80	No Trend	No Trend	NDA	NA	ND
EW2S	Benzene	1 / 10	1 / 10	10	2	0.18	0.86	No Trend	No Trend	12/05/2000	3	ND
EW2S	cis-1,2-Dichloroethene	6 / 10	3 / 10	10	16	1.4	0.16	No Trend	No Trend	12/05/2000	3	BICL
EW2S	Ethylbenzene	5 / 10	0 / 10	10	1	0	1	No Trend	No Trend	NDA	NA	ND
EW2S	Toluene	5 / 10	0 / 10	10	1	0	1	No Trend	No Trend	NDA	NA	ND
EW2S	Tetrachloroethene	3 / 10	1 / 10	10	-1	0	1	No Trend	No Trend	07/13/2000	4	ND
EW2S	Trichloroethene	1 / 10	0 / 10	10	0	0	1	No Trend	No Trend	NDA	NA	ND
EW2S	total Xylenes	4 / 10	0 / 10	10	1	0	1	No Trend	No Trend	NDA	NA	ND
EW2S	Dissolved Arsenic	9 / 10	1 / 10	10	-25	-2.2	0.030	**Decreasing**	**Decreasing**	04/20/1998	7	ND
EW2S	Dissolved Manganese	10 / 10	0 / 10	10	1	0	1	No Trend	No Trend	NDA	NA	BICL
EW3S	Ethylbenzene	1 / 8	0 / 8	8	0	0	1	No Trend	No Trend	NDA	NA	ND
EW3S	Toluene	3 / 8	0 / 8	8	-1	0	1	No Trend	No Trend	NDA	NA	ND
EW3S	Tetrachloroethene	2 / 8	0 / 8	8	-7	-1.3	0.19	No Trend	No Trend	NDA	NA	ND
EW3S	total Xylenes	1 / 8	0 / 8	8	0	0	1	No Trend	No Trend	NDA	NA	ND
EW3S	Dissolved Arsenic	6 / 8	2 / 8	8	-10	-1.2	0.23	No Trend	No Trend	12/18/2001	1	ND
EW3S	Dissolved Manganese	7 / 8	2 / 8	8	-10	-1.1	0.27	No Trend	No Trend	12/18/2001	1	ND

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Table 1 Summary of Mann-Kendall Trend Tests
Tibbetts Road Site, Barrington, New Hampshire
Based on Samples Collected from January 1998 to June 2003

Location	Chemical	Detection Frequency [a]	Detections Above ICL [a]	Sample Size	Mann-Kendall S-statistic	Mann-Kendall Z-statistic	p-value	Trend at • = 0.05	Trend at • = 0.10	Date of Last Detection Above ICL	Samples Since Last Detection Above ICL [b]	Factor Above ICL in Most Recent Sample [b]
EW5S	Benzene	4 / 11	2 / 11	11	-2	-0.16	0.87	No Trend	No Trend	12/17/2001	4	ND
EW5S	Ethylbenzene	8 / 11	0 / 11	11	5	0.32	0.75	No Trend	No Trend	NDA	NA	BICL
EW5S	4-Methyl-2-pentanone	1 / 11	0 / 11	11	0	0	1	No Trend	No Trend	NDA	NA	ND
EW5S	Toluene	8 / 11	0 / 11	11	11	0.82	0.41	No Trend	No Trend	NDA	NA	BICL
EW5S	total Xylenes	10 / 11	0 / 11	11	6	0.39	0.69	No Trend	No Trend	NDA	NA	BICL
EW5S	Dissolved Arsenic	8 / 10	7 / 10	10	-34	-2.6	0.010	**Decreasing**	**Decreasing**	12/17/2001	3	ND
EW5S	Dissolved Manganese	10 / 10	8 / 10	10	-6	-0.39	0.70	No Trend	No Trend	12/18/2002	1	BICL
EW6S	cis-1,2-Dichloroethene	2 / 2	2 / 2	2	1	0	1	No Trend	No Trend	07/08/2002	None	3.3
EW6S	Ethylbenzene	2 / 2	0 / 2	2	1	0	1	No Trend	No Trend	NDA	NA	BICL
EW6S	Toluene	2 / 2	0 / 2	2	1	0	1	No Trend	No Trend	NDA	NA	BICL
EW6S	total Xylenes	2 / 2	0 / 2	2	1	0	1	No Trend	No Trend	NDA	NA	BICL
EW6S	Dissolved Arsenic	2 / 2	0 / 2	2	1	0	1	No Trend	No Trend	NDA	NA	BICL
EW6S	Dissolved Manganese	2 / 2	0 / 2	2	-1	0	1	No Trend	No Trend	NDA	NA	BICL
EW8S	cis-1,2-Dichloroethene	8 / 8	3 / 8	8	1	0	1	No Trend	No Trend	12/18/2001	1	BICL
EW8S	Ethylbenzene	3 / 8	0 / 8	8	2	0.14	0.89	No Trend	No Trend	NDA	NA	ND
EW8S	Toluene	5 / 8	1 / 8	8	-2	-0.13284	0.89	No Trend	No Trend	07/13/2000	4	ND
EW8S	Tetrachloroethene	1 / 8	0 / 8	8	0	0	1	No Trend	No Trend	NDA	NA	ND
EW8S	Trichloroethene	5 / 8	5 / 8	8	-15	-1.78	0.07	No Trend	**Decreasing**	12/18/2001	1	ND
EW8S	total Xylenes	5 / 8	0 / 8	8	0	0.00	1.00	No Trend	No Trend	NDA	NA	ND
EW8S	Dissolved Arsenic	7 / 8	5 / 8	8	-14	-1.6	0.11	No Trend	No Trend	12/18/2001	1	ND
EW8S	Dissolved Manganese	8 / 8	3 / 8	8	-6	-0.6	0.54	No Trend	No Trend	12/18/2001	1	BICL

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Location	Chemical	Detection Frequency [a]	Detections Above ICL [a]	Sample Size	Mann-Kendall S-statistic	Mann-Kendall Z-statistic	p-value	Trend at • = 0.05	Trend at • = 0.10	Date of Last Detection Above ICL	Samples Since Last Detection Above ICL [b]	Factor Above ICL in Most Recent Sample [b]
EW9S	cis-1,2-Dichloroethene	1 / 8	0 / 8	8	0	0	1	No Trend	No Trend	NDA	NA	ND
EW9S	Toluene	3 / 8	0 / 8	8	-1	0	1	No Trend	No Trend	NDA	NA	ND
EW9S	Trichloroethene	1 / 8	1 / 8	8	-5	-0.87	0.38	No Trend	No Trend	05/05/1999	6	ND
EW9S	total Xylenes	1 / 8	0 / 8	8	-5	-0.87	0.38	No Trend	No Trend	NDA	NA	ND
EW9S	Dissolved Arsenic	7 / 8	3 / 8	8	-12	-1.4	0.17	No Trend	No Trend	12/18/2001	1	ND
EW9S	Dissolved Manganese	8 / 8	2 / 8	8	-14	-1.6	0.11	No Trend	No Trend	12/18/2001	1	BICL

Notes:
a. Including duplicate samples
b. Duplicate samples were averaged for this calculation
ICL = Interim groundwater cleanup level, micrograms per liter

Benzene	5
cis-1,2-Dichloroethene	70
Ethylbenzene	700
4-Methyl-2-pentanone	1825
Toluene	1000
Tetrachloroethene	5
1,1,1-Trichloroethane	200
Trichloroethene	5
total Xylenes	10000
Dissolved Arsenic	50
Dissolved Manganese	3650

ND = Not detected
NDA = No detections above the ICL
BICL = Detected at a concentration below the ICL
NA = Not applicable
p-value = probabilty of a statistically significant trend
• = critical probabilty value

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Table 2

Tibbetts Road, Barrington, NH

Wells excluded from Mann-Kendall Trend Analysis

Well Designation	Sample Dates	Reason for exclusion from Mann-Kendall Trend Analysis
EW-1S	1996 - 2002	No VOCs detected above ICLs since 1997
EW-7S	1998 - 2003	No VOCs detected above ICLs
32R	1985 & 1990	Only 2 samples taken.
33R	1985 & 1990	Only 2 samples taken, No VOC's ever detected
34R	1985 & 1990	Only 2 samples taken. No VOCs ever detected
36D	1985 - 2002	No VOCs ever detected above ICLs
37D	1985 - 2003	No VOCs detected above ICLs since 1997
38D	1985 & 1990	Only 3 samples taken, no VOCs detected above ICLs
49S	1985 & 1990	Only 3 samples taken. No VOCs detected above ICLs
52S	1985 - 2003	No VOCs detected above ICLs in the last 2 years and only 1 compound detected since 1991
53S	1985 - 2002	No VOCs detected above ICLs since 1997
54S	1985 - 1996	No VOCs detected above ICLs
58S	1985 - 1995	No VOCs detected above ICLs
59R	1984 - 1990	No VOCs detected.
60S	1984	Only 2 samples taken
62S	1984 - 1990	Only 5 samples taken.
64S	1984 - 1990	No VOCs detected
68S	1984	Only 2 samples taken.
70S	1991 - 2002	No VOCs detected above ICLs since 1995 and most non detect
71S	1991 - 2002	No VOCs detected above ICLs after 1991.
74S	1991	Only one sample taken.
76R	1991 - 2002	Only 3 samples taken VOCs only detected in 1991
77S	1991 - 1994	Only 3 samples, no VOCs ever detected
78R	1991	Only one sample taken no VOCs detected.
79S	1991 - 2002	No VOCs detected since 1999.
80S	1984 - 1996	No VOCs detected above ICLs after 1994. No sampling during time of analysis
81R	1991	Only one sample taken No VOCs detected above ICLs
82S	1991	Only one sample taken, no VOCs detected
83S	1991	Only one sample taken, no VOCs detected
85S	2001 - 2002	Only 2 samples taken no VOCs detected
87S	1994 - 2002	No VOCs detected
88S	1996 - 2002	No VOCs detected
105D	1995 - 2002	No VOCs detected
107R	1995 - 1996	Only 3 samples taken. No VOCs detected
109R	1995 - 1996	Only 2 samples taken. No VOCs detected above ICLs

APPENDIX D - SITE INSPECTION REPORT

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 1
1 Congress Street, Suite 1100
BOSTON, MA 02114-2023

Memorandum

Date: March 27, 2003

Subj: Tibbetts Road Superfund Site, Start of Five-year Review

From: Neil Handler, RPM,
NH/RI Superfund Section

To: File

Background

The Tibbetts Road Superfund Site (the Site) is located in a rural residential neighborhood in the Town of Barrington, New Hampshire approximately eight miles west of the City of Dover. The approximately two acre Site is the former residence of the late Alexander Johnson. The surrounding neighborhood has six occupied residential homes within 100 feet of the Site boundary and is located approximately 900 feet south of Swains Lake. From 1945 to 1958, Mr. Johnson transported drums containing wastes from industrial processes (e.g., primarily automobile production and painting) to the Site for storage and use. During initial site investigations in the early 1980's it was apparent that many of the drums had discharged a portion, or all, of their contents to the ground surface.

There have been a number of removal actions completed since the mid 1980's to address the presence of contamination at the Site. These removal actions have included the demolition of the former existing residence, removal of 337 drums containing solvents, PCBs, and other hazardous substances, and excavation and treatment of approximately 400 cubic yards of contaminated soil. In 1987, EPA and the State of New Hampshire constructed a drinking water treatment plant and water distribution network to serve approximately 45 homes whose wells were contaminated or threatened by groundwater contamination from the Site. During the early 1990's, EPA completed the Remedial Investigation/Feasibility Study for the Site. After soliciting comments from the public on the proposed cleanup plan EPA finalized the Record of Decision (ROD) on September 29, 1992.

In 1994, EPA, the State of New Hampshire, and the Swain's Lake Village Water District entered into a Consent Decree with Ford Motor Company, the generator of contaminants transported to and disposed of at the Site. Treatment of contaminated soil and groundwater in the overburden aquifer at the Site was initiated by Ford in 1995 through the implementation of the vacuum extraction component of the cleanup plan identified in the ROD. Treatment continued through 1997 removing a significant amount of contamination from the subsurface.

At the time the vacuum extraction system was shut down in 1997, contaminant removal rates had decreased to the point where there was limited progress being made towards achieving the cleanup levels identified in the ROD. After evaluating the available alternatives, EPA selected bioremediation and phytoremediation as the primary means of treating the remaining contamination found in the groundwater beneath the Site. In addition, the existing vacuum extraction system was to be used to selectively treat a small number of hot spots remaining at the Site. The groundwater remedy as described in the ROD was amended on September 28, 1998, to reflect the changes discussed above. As part of the implementation of the Amended ROD, Ford removed the impermeable cap covering the Site and planted approximately 1,400 hybrid poplar trees at the Site in 1998. Since that time the vacuum extraction system has been operated on a seasonal basis (i.e., from May to November), the trees are inspected and maintained (e.g., fertilizing, pruning, replacement of dead trees, and initially irrigated) on a regular basis, and monitoring of the groundwater in the overburden and bedrock continues in order to determine the progress towards the cleanup goals identified in the Amended ROD.

Initiation of the Five-Year Review

A Five-Year Review is required by CERCLA and the National Contingency Plan to assess the threat to public health and the environment 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. A Five-Year Review, which is being completed for the Site, is being conducted as a matter of EPA policy since the proposed remedial action for the Site, upon completion, will not leave hazardous substances, pollutants, or contaminants on site above levels that allow for unlimited use and unrestricted exposure, but the action requires five years or more to complete. This review, which is the first Five-Year Review for the Site, has been triggered by construction completion. Based on the Preliminary Close Out Report, the date of construction completion for the Site has been identified as September 29, 1998.

On March 24, 2003, an inspection was held at the Site to initiate the start of the Five-Year Review. Persons attending the inspection included: Debra Stake (Project Manager, Arcadis G&M, Inc., Fords'Consultant), Glen Gordon (Senior Engineer, Arcadis G&M, Inc.), Tom Andrews (NHDES Project Manager), and Neil Handler (EPA Project Manager). During the inspection conditions at the Site were reviewed. One to two feet of snow still covered most of the Site and the hybrid poplar trees are currently dormant. This is the fifth growing season for the poplar trees and many of them which were three to five feet tall when planted, have reached a height of well over twenty feet. Based upon the current height of the trees it is believed that the

root system of most of the trees are well established in and below the overburden water table. Looking at the groundwater monitoring results at the Site over the past several years it appears that phytoremediation and bioremediation may be close to achieving the cleanup objectives identified in the Amended ROD for much of the Site. This will be discussed further in the Five-Year Review.

The Amended ROD also calls for the use of a vacuum enhanced recovery system to treat shallow as well as deeper contamination in the groundwater beneath the Site. This system is being used for hot spot remediation at two primary locations on a seasonal basis. The system, although not yet operational for the year, was inspected to insure that the heater in the treatment building was still working properly and that there was no evidence of vandalism. Glen Gordon indicated that Arcadis was planning to start the treatment system in early May. At least one of the hot spot areas still appears to be well above the cleanup levels identified in the Amended ROD. A further discussion of the conditions in this area and the potential recommendations for addressing the remaining contamination will be included as part of the Five-Year Review.

United States
Environmental Protection Agency
New England Region

www.epa.gov/ne

Office of the Regional Administrator
1 Congress Street
Boston, MA 02114

Connecticut Maine Massachusetts New Hampshire Rhode Island Vermont

EPA New England

Environmental News

Contact: Neil Handler, EPA Site Manager, 617-918-1334
Alice Kaufman, EPA Community Affairs, 617-918-1064

For Immediate Release: October 30, 2003 03-10-42

EPA COMPLETES REVIEW OF CLEANUP PROGRESS AT TIBBETTS ROAD SUPERFUND SITE

Boston--The United States Environmental Protection Agency completed a review of the cleanup remedy at the Tibbetts Road Superfund Site in Barrington, New Hampshire, confirming that progress is being made in the cleanup of the site and that the soil and groundwater remedies already in place at the site continue to be protective of human health and the environment.

The study, or five-year review, was a comprehensive evaluation of the actions taken to date by EPA, the state of New Hampshire, Ford Motor Company, and the Swains Lake Village Water District to address the soil and groundwater contamination at and around the site.

Actions taken at the site include the:

- installation of an alternate water supply for approximately 50 residences,
- enactment of a local ordinance restricting the use of groundwater near the site,
- removal and disposal of several hundred drums,
- treatment of contaminated groundwater and soil,
- planting more than 1,600 poplar trees to help control the flow of contaminated groundwater, and
- long-term monitoring of groundwater conditions beneath and around the site.

From around 1944 to 1958, drums containing wastes from industrial processes, primarily automobile production and painting, were brought to the Tibbetts Road Superfund site for storage and use by the property owner. Many of the drums were later found to have leaked and released their contents, primarily thinners, solvents, PCBs and other hazardous materials on to the ground and into the groundwater, posing a threat to the local drinking water supply. In 1984, EPA removed several hundred deteriorating drums and in 1986, EPA designated the two-acre site a Superfund site.

EPA issued a cleanup decision for the site, called a Record of Decision, in 1992 which required that contaminated groundwater, both shallow and deep, be extracted and treated. From 1995 -1997 EPA operated a vacuum extraction system at the site to treat groundwater and soil. During this time,

approximately 800 pounds of contaminants were removed. The system was shut down in 1997 because it was not longer needed.

EPA amended the Record of Decision in 1998 to address the remaining groundwater contamination through bioremediation and phytoremediation. Approximately 1,600 hybrid poplar trees were planted at the site in 1998. Poplar trees are known for their ability to take up large amounts of groundwater, thereby reducing the rate at which groundwater and contaminants can flow away from the site. Bioremediation, or the use of naturally occurring organisms to break down contaminants, will help to reduce the remaining contamination found in the groundwater beneath the site. A groundwater monitoring program is in place to determine the effectiveness of bioremediation and phytoremediation in achieving the cleanup levels identified in the Record of Decision.

The results of the five-year review have shown that the cleanup remedy is functioning as intended and that there has been a reduction in the overall level of contamination at the site. The levels of volatile organic contaminants (VOCs) found in the shallow groundwater, which historically has shown some of the highest concentrations, are now at or approaching the cleanup levels identified in the Record of Decision. A small portion of the weathered bedrock located to the northeast of the site has shown less progress in achieving the required cleanup levels and EPA is currently evaluating potential methods for accelerating the cleanup of this area.

The five year review report, as well as additional information about cleanup activities at the site can be found on EPAs website at: www.epa.gov/ne/superfund/sites/tibbetts. EPA technical reports and documents are also available for public review in the site information repository located at the Barrington Public Library, 39 Province Lane in Barrington, NH.

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