14844

DECLARATION FOR THE RECORD OF DECISION

Groveland Wells Nos. 1 & 2, Operable Unit I
Groveland, Massachusetts

Statement of Purpose

This Decision Document presents the selected remedial action for this Site developed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and to the extent practicable, the National Contingency Plan (NCP), 40 CFR Part 300, 55 Federal Register 8666 (March 8, 1990).

The Commonwealth of Massachusetts has concurred with the selected remedy.

Statement of Basis

This decision is based on the Administrative Record which was developed in accordance with Section 113(k) of CERCLA and which is available for public review at the information repositories located at the Langley-Adams Public Library in Groveland, Massachusetts, and at the EPA offices at 90 Canal Street in Boston, Massachusetts. The attached index identifies the items which comprise the Administrative Record upon which the selection of a remedial action have been based.

Description of the Selected Remedy

Groundwater within the contaminated plume and throughout the Site would be restored to designated standards through the implementation of a series of actions. A groundwater extraction network of approximately six wells, located throughout the plume, would be sited to intercept contaminated groundwater along its entire width and depth including contamination in the shallow bedrock. The total estimated flow rate needed to intercept the plume is about 400 gallons per minute (gpm). The contaminated groundwater would be subject to an inorganics treatment process involving equalization/aeration, sedimentation and filtration. The resulting sludge would be disposed of off-site.

The filtered water would then be subjected to a process involving ultraviolet (UV) light and oxidation to destroy trichloroethene (TCE) and other volatile organics. The treated groundwater would be discharged to Johnson Creek near Groveland Well No. 2. The discharge structure will include measures to minimize potential erosion of the river bed and will be designed to ensure that it will not cause physical disruption of wetlands (if any) near the discharge point.

Institutional controls consisting of deed restrictions prohibiting installation and use of private wells in the plume until completion of groundwater remediation would be implemented. It is assumed that the granular carbon adsorption system at Station No. 1 would continue to operate, but that system is not part of the selected remedy.

During remedial design, the existing Mill Pond extraction system will be considered for use to supplement or replace one of the six new extraction wells proposed for this area. Treatability testing would be required during remedial design to confirm feasibility of the UV/Oxidation process and to derive design parameters. A background groundwater sampling program for inorganics is also planned during the remedial design phase of the remedy. Site inorganic concentrations will then be re-evaluated in comparison to these results. If it is determined through background groundwater sampling that certain inorganic levels represent background, then those inorganics will no longer be identified as Site related contaminants, and ARARs for those contaminants would not need to be met.

Sampling of monitoring wells around Groveland Well No. 1 would be conducted regularly to ensure that contaminated groundwater is not migrating toward the municipal supply well. Groundwater monitoring wells adjacent to the Chesterton property and Haverhill Municipal Landfill will be sampled on a regular basis to ensure that the remedial extraction system does not adversely spread the contamination originating from these properties. Additionally, sampling of the surface water and sediments in Johnson Creek and other nearby streams would be conducted on a semi-annual basis to identify any potential discharge of contaminated groundwater to surface water bodies.

Declaration

The selected remedy is protective of human health and the environment, attains Federal and State requirements that are applicable or relevant and appropriate for this remedial action and is cost-effective. The selected remedy utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable. The statutory preference for remedies that utilize treatment as a principal element to reduce the mobility, toxicity, or volume of hazardous substances is met by the selected remedy.

9/30/91
Date

Julie Belaga
Julie Belaga
Regional Administrator, EPA Region I

Groveland Wells 1 & 2
(Operable Unit I -
Management of Migration)

NPL Site Administrative Record

Index

Compiled: May 29, 1991
Updated: August 14, 1991
ROD Signed: September 30, 1991

Prepared for

Region I
Waste Management Division
U.S. Environmental Protection Agency

With Assistance from

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Introduction

This document is the Index to the Administrative Record for the September 30, 1991 Record of Decision (ROD) for the Groveland Wells Numbers 1 & 2 National Priorities List (NPL) site Operable Unit I - Management of Migration. Section I of the Index cites site-specific documents and Section II cites guidance documents used by EPA staff in selecting a response action at the site.

The Administrative Record is available for public review at EPA Region I's Office in Boston, Massachusetts, and at Langley-Adams Library 183 Main Street, Groveland, Massachusetts 01834. *This Index contains confidential documents that are available only for judicial review. Although not expressly listed in this index, all documents contained in the Administrative Record for the September 30, 1988 Record of Decision (Operable Unit II - Source Control) are incorporated by reference herein, and are expressly made a part of the Administrative Record for the present operable unit (Operable Unit I - Management of Migration).* Questions concerning the Administrative Record should be addressed to the EPA Region I site manager.

The Administrative Record is required by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA).

Section I

Site-Specific Documents

ADMINISTRATIVE RECORD INDEX

for the

Groveland Wells Numbers 1 & 2 NPL Site

(Operable Unit I - Management of Migration)

(ROD Signed: September 30, 1991)

3.0 Remedial Investigation (RI)

3.1 Correspondence

1. Letter from Robert J. Leger, EPA Region I to James R. Forrelli, NUS Corporation (February 17, 1989). Concerning transmittal of historical documents on the site.
2. Letter from Robert J. Leger, EPA Region I to David Roberts, Town of Groveland (June 13, 1989). Concerning an update on site progress and the request for a meeting with the Groveland Water and Sewer Commission.
3. Letter from Robert J. Leger, EPA Region I to Leo Downing, Town of Groveland (July 13, 1989). Concerning notification that the Remedial Investigation/Feasibility Study will begin in the summer and that a meeting has been scheduled with the Groveland Water and Sewer Commission.
4. Letter from Robert J. Leger, EPA Region I to Dick Sciacca, Town of Groveland (July 13, 1989). Concerning notification that the Remedial Investigation/ Feasibility Study will begin in the summer and that a meeting has been scheduled with the Groveland Water and Sewer Commission.
5. Letter from Robert J. Leger, EPA Region I to Kurt Anderson, Town of Groveland (July 13, 1989). Concerning notification that the Remedial Investigation/Feasibility Study will begin in the summer and that a meeting has been scheduled with the Groveland Water and Sewer Commission.
6. Letter from Robert J. Leger, EPA Region I to Janet Angelis, Town of Groveland (July 13, 1989). Concerning notification that the Remedial Investigation/ Feasibility Study will begin in the summer and that a meeting has been scheduled with the Groveland Water and Sewer Commission.
7. Letter from Robert J. Leger, EPA Region I to Carol Davies, Town of Groveland (July 13, 1989). Concerning notification that the Remedial Investigation/ Feasibility Study will begin in the summer and that a meeting has been scheduled with the Groveland Water and Sewer Commission.
8. Letter from Robert J. Leger, EPA Region I to F. John Osborne, Town of Groveland (July 13, 1989). Concerning notification that the Remedial Investigation/Feasibility Study will begin in the summer and that a meeting has been scheduled with the Groveland Water and Sewer Commission.
9. Letter from Robert J. Leger, EPA Region I to Joan Searl, Town of Groveland (July 13, 1989). Concerning notification that the Remedial Investigation/ Feasibility Study will begin in the summer and that a meeting has been scheduled with the Groveland Water and Sewer Commission.
10. Memorandum from Robert J. Leger, EPA Region I to Addressees (September 6, 1989). Concerning transmittal of the August 1989 "Final Work Plan," NUS Corporation.
11. Letter from Robert J. Leger, EPA Region I to Rosanna Sattler, Posternak, Blankstein & Lund (Attorney for Town of Groveland) (September 12, 1989). Concerning transmittal of the August 1989 "Final Work Plan - Supplemental Management of Migration," NUS Corporation.

3.1 Correspondence (cont'd.)

12. Letter from Robert J. Leger, EPA Region I to Kurt Anderson, Town of Groveland (September 26, 1989). Concerning the results of surface water sampling from the area south of Salem Street.
13. Letter from James R. Forrelli, NUS Corporation to John Carlton, Groveland Fire Department (December 18, 1989). Concerning notification that sampling will be done at the site.
14. Letter from James R. Forrelli, NUS Corporation to William E. Sargent, Groveland Police Department (December 18, 1989). Concerning notification that sampling will be done at the site.
15. Telephone Notes Between Jay Naparstek, Commonwealth of Massachusetts Department of Environmental Protection and James R. Forrelli, NUS Corporation (February 2, 1990). Concerning sampling to begin at the site.
16. Telephone Notes Between Jay Falcone, M. Anthony Lally Associates, Inc. and James R. Forrelli, NUS Corporation (February 6, 1990). Concerning the schedule of sampling at the site and the Mill Pond system data.
17. Letter from Patricia Rogers, Town of Groveland to Merrill S. Hohman, EPA Region I (February 7, 1990). Concerning transmittal of the attached:
    A. Letter from David Roberts, Town of Groveland to Merrill S. Hohman, EPA Region I (January 22, 1990). Concerning restriction of development within the site.
    B. Letter from David Roberts, Town of Groveland to Leo Downing, Town of Groveland (November 28, 1989). Concerning the recommendation that the Town of Groveland not sell part of the Stanfield Pit to William Angelini and Woody Cammett.
18. Telephone Notes Between Jay Falcone, M. Anthony Lally Associates, Inc and James R. Forrelli, NUS Corporation (February 9, 1990). Concerning the schedule of sampling at the site.
19. Telephone Notes Between Dave Blanchard, M. Anthony Lally Associates, Inc. and James R. Forrelli, NUS Corporation (February 12, 1990). Concerning the schedule of sampling at the site.
20. Letter from Robert J. Leger, EPA Region I to Dan J. D'Orazio, Groveland Machine Co., Inc. (February 13, 1990). Concerning transmittal of samples collected at well locations NUS-1 and NUS-2.
21. Telephone Notes Between David P. Argyros, A.W. Chesterton Co. and James R. Forrelli, NUS Corporation (February 16, 1990). Concerning the sampling of monitoring wells at the site.
22. Telephone Notes Between William Sargent, Town of Groveland Police Department and James R. Forrelli, NUS Corporation (March 8, 1990). Concerning notification that the seven day pump test will start soon.
23. Telephone Notes Between Jay Naparstek, Commonwealth of Massachusetts Department of Environmental Protection and Becky Cleaver, NUS Corporation (May 25, 1990). Concerning well logs for intercept wells 1G and 2G.
24. Telephone Notes Between Dick Ferrick, Town of Groveland and Becky Cleaver, NUS Corporation (June 11, 1990). Concerning notification that the Mill Pond Extraction System has been shut down for at least two weeks.
25. Telephone Notes Between Richard Willey, EPA Region I and James R. Forrelli, NUS Corporation (June 21, 1990). Concerning the second round of sampling.
26. Letter from Jim Forrelli, NUS Corporation to Robert J. Leger, EPA Region I (August 20, 1990). Concerning the transmittal of the attached information to be discussed on the risk assessment.
27. Letter from Celina Harshman, Commonwealth of Massachusetts Division of Fisheries & Wildlife to Stephen S. Parker, NUS Corporation (August 21, 1990). Concerning rare species in the vicinity of the site.

3.1 Correspondence (cont'd.)

28. Telephone Notes Between Jeff Orient, NUS Corporation, James R. Forrelli and Steve Parker, NUS Corporation (August 23, 1990). Concerning division of the site for risk assessment purposes.
29. Telephone Notes Between Elaine McCoy, Town of Groveland and Steve Parker, NUS Corporation (September 4, 1990). Concerning records of private water wells in the town.
30. Letter from George D. Gardner, NUS Corporation to Diane Kelley, EPA Region I (September 27, 1990). Concerning transmittal of the September 1990 "Draft Risk Assessment Technical Memorandum," NUS Corporation.
31. Memorandum from Robert J. Leger, EPA Region I to attached list of Addressees (February 28, 1991). Concerning transmittal of the February 1991 "Supplemental Management of Migration Remedial Investigation Report," NUS Corporation.

3.2 Sampling and Analysis Data

1. "Well Data Base for the Groveland Wells Site," EPA Region I (March 7, 1989).
2. Memorandum from James R. Forrelli, NUS Corporation to Robert J. Leger, EPA Region I (July 5, 1989). Concerning transmittal of the attached preliminary tables reflecting changes to the work plan for the site.
3. Memorandum from James R. Forrelli, NUS Corporation to Robert J. Leger, EPA Region I (December 18, 1989). Concerning transmittal of the attached "Task Modification Request" which addresses the sampling during drilling at the site.
4. "Final Sampling and Analysis Plan," NUS Corporation (December 1989).
5. Memorandum from James R. Forrelli, NUS Corporation to Robert J. Leger, EPA Region I (January 29, 1990). Concerning transmittal of the attached results of field screening at the site.
6. Letter from John L. Falcone Jr., M. Anthony Lally Associates, Inc. to James R. Forrelli, NUS Corporation (February 7, 1990). Concerning transmittal of the attached Mill Pond Quarterly Discharge Monitoring Reports for April 1988 to December 1989.
7. Letter from Lucy Guzman, NUS Corporation to Karen Wedlock-Hunt, EPA Region I (February 23, 1990). Concerning data validation for water quality parameters.
8. Letter from James R. Forrelli, NUS Corporation to Robert J. Leger, EPA Region I (March 7, 1990). Concerning transmittal of the attached "Groveland Wells Site Groundwater Field Screening."
9. Telephone Notes Between Jay Naparstek, Commonwealth of Massachusetts Department of Environmental Protection and Becky Cleaver, NUS Corporation (May 10, 1990). Concerning sampling results from the site.
10. Letter from James R. Forrelli, NUS Corporation to Robert J. Leger, EPA Region I (May 16, 1990). Concerning the recommendation that a second round of groundwater samples be collected and the attached sampling tables.

The record cited as entry number 11 contains confidential business information and is withheld as CONFIDENTIAL.

11. "Work Plan Amendment Memorandum - Second Round Sampling," NUS Corporation (June 1990).
12. Comments Dated July 9, 1990 from Robert J. Leger, EPA Region I on the June 1990 "Work Plan Amendment Memorandum - Second Round Sampling," NUS Corporation.

3.2 Sampling and Analysis Data (cont'd.)

13. Cross-Reference: "Draft Pumping Test Technical Memorandum," NUS Corporation (August 1990) [Filed and cited as entry number 1 in 3.4 Interim Deliverables].
14. Letter from James R. Forrelli, NUS Corporation to Robert J. Leger, EPA Region I (September 7, 1990). Concerning transmittal of the attached Memorandum from James R. Forrelli, NUS Corporation to Robert J. Leger, EPA Region I (August 30, 1990) regarding proposed groundwater modeling at the site.
15. Letter from Madeline Snow, Commonwealth of Massachusetts Department of Environmental Protection to Thomas Quinlan, Valley Manufactured Products Company, Inc. (October 17, 1990). Concerning the proposed revision of the monitoring and reporting program being implemented for the Mill Pond intercept system.
16. Memorandum from James R. Forrelli, NUS Corporation to Robert J. Leger, EPA Region I (November 26, 1990). Concerning transmittal of the attached "Draft Groundwater Model Objectives Supplemental MOM RI/FS."
17. Memorandum from Robert J. Leger, EPA Region I to James R. Forrelli, NUS Corporation (December 13, 1990). Concerning the calibration/validation process for the "Groundwater Model Objectives Supplemental MOM RI/FS."
18. "Draft Work Plan Amendment No. 3 - Supplemental MOM RI/FS Groundwater Modeling," NUS Corporation (December 1990).
19. Comments Dated December 10, 1990 from Robert J. Leger, EPA Region I on the December 1990 "Draft Work Plan Amendment No. 3 - Supplemental MOM RI/FS Groundwater Modeling," NUS Corporation.
20. Letter from Rosanna Sattler, Posternak, Blankstein & Lund (Attorney for Town of Groveland) to Jay Naparstek, Commonwealth of Massachusetts Department of Environmental Protection (January 8, 1991). Concerning transmittal of the attached pumping data for Wells 1 and 2 for the Town of Groveland from 1974 through 1980.
21. Letter from James R. Forrelli, NUS Corporation to Robert J. Leger, EPA Region I (January 14, 1991). Concerning the requested information on the "Groundwater Model Objectives Supplemental MOM RI/FS" and the following attachments:
    A. "Meeting Summary - Computer Modeling Supplemental MOM RI/FS," NUS Corporation (December 20, 1990).
    B. Memorandum from Richard Willey, EPA Region I to Robert J. Leger, EPA Region I (December 24, 1990).
22. Letter from David P. Argyros, A.W. Chesterton Co. to Robert J. Leger, EPA Region I (January 24, 1991). Concerning the transmittal of the attached 1989 and 1990 environmental sampling results for the Chesterton-Pandel site.
23. Letter from James R. Forrelli, NUS Corporation to Robert J. Leger, EPA Region I (May 15, 1991). Concerning the attached RAS samples case number list, SAS chain of custody records, and field chain of custody records.
24. Memorandum from Pei-Fung Hurst, EPA Office of Research and Development to Robert J. Leger, EPA Region I (August 19, 1991). Concerning the carcinogenic assessment for 1,1-Dichloroethane.

3.2 Sampling and Analysis Data (cont'd.)

25. Memorandum from James R. Forrelli, NUS Corporation to Robert J. Leger, EPA Region I (August 28, 1991). Concerning transmittal of the attached results of surface water samples taken from the site in June 1991 and the accompanying "Data Validation Sheets."
26. Letter from James R. Forrelli, NUS Corporation to Robert J. Leger, EPA Region I (September 23, 1991). Concerning the analytical results for the residential well and surface water discharge samples and the attached "Table A: Comparison of Chemical Concentrations to Available Federal SDWA MCLs and Ambient Water Quality Criteria (ug/L)."
27. Chain of Custody Records, EPA Region I.
28. "Groveland Groundwater Modeling Results of Flowpath Model."
29. "Draft - Averaged TCE Concentration (ug/l)."
30. "Draft - Summary of Stream Aquifer Interactions in the Model Calibration and Validation Runs."
31. "Draft - Distribution of Residual Error in Drawdown."
32. "Draft - Flowpath Logbook for Data Set GL."
33. "Draft - Flowpath Logbook for Data Set GL P1."
34. "Draft - Calculation of Residual Error."
35. "Draft - Distribution of Residual Error in Water Elevation, No Pumping."
36. "Draft - Distribution of Residual Error in Water Elevation, Pumping."
37. "Draft - Summary of the Simulated Pumping and Infiltration Conditions."
38. "Draft - Map A: Bottom of Aquifer," NUS Corporation.
39. "Draft - Map B: Hydraulic Conductivity Distribution," NUS Corporation.
40. "Draft - Map C: Constant Head Conditions," NUS Corporation.
41. "Draft - Map D: Surface Water Conditions," NUS Corporation.
42. "Draft - Map E: Stream-Aquifer Interactions," NUS Corporation.
43. "Draft - Map F: Surface Recharge Areas," NUS Corporation.
44. "Average TCE Concentration (ug/l)."
45. "Simulation Domain and Boundary Conditions," NUS Corporation.
46. Site Sampling Maps, NUS Corporation.

Additional Sampling and Analysis Data for the Remedial Investigation (RI) may be reviewed, by appointment only, at EPA Region I, Boston, Massachusetts.

3.4 Interim Deliverables

Report

1. "Draft Pumping Test Technical Memorandum," NUS Corporation (August 1990).
2. "Draft Risk Assessment Technical Memorandum," NUS Corporation (September 1990).
3. "Draft Technical Memorandum #BIO-90-10," EPA Region I (October 18, 1990). Concerning RPB II analysis of Merrimack River Tributaries.

Comments

The record cited as entry number 4 is CONFIDENTIAL and available only for judicial review.

4. Comments Dated August 27, 1990 from Virginia de Lima, United States Department of the Interior on the August 1990 "Draft Pumping Test Technical Memorandum," NUS Corporation.

3.4 Interim Deliverables (cont'd.)

5. Comments Dated August 31, 1990 from EPA Region I on the August 1990 "Draft Pumping Test Technical Memorandum," NUS Corporation.
6. Comments Dated October 15, 1990 from Robert J. Leger, EPA Region I on the September 1990 "Draft Risk Assessment Technical Memorandum," NUS Corporation.

Responses to Comments

7. Response Dated September 6, 1990 from Jeff Orient, NUS Corporation to the Comments Dated August 31, 1990 from EPA Region I.

3.6 Remedial Investigation (RI) Reports

Report

1. "Remedial Investigation for the Groveland Wells Site - Groveland, Massachusetts - Volume I," NUS Corporation (June 1985).
2. "Remedial Investigation for the Groveland Wells Site - Groveland, Massachusetts - Volume II - Appendices," NUS Corporation (June 1985).
3. "Draft Supplemental Management of Migration Remedial Investigation Report," NUS Corporation (November 1990).
4. "Draft Supplemental Management of Migration Remedial Investigation Report - Appendices," NUS Corporation (November 1990).
5. "Supplemental Management of Migration Remedial Investigation Report," NUS Corporation (February 1991).
6. "Supplemental Management of Migration Remedial Investigation Report - Appendices," NUS Corporation (February 1991).

Comments

7. Comments Dated December 6, 1990 from Kenneth Finkelstein, United States Department of the Interior National Oceanic and Atmospheric Administration on the November 1990 "Draft Supplemental Management of Migration Remedial Investigation Report," NUS Corporation.
8. Comments Dated December 13, 1990 from Cyndi Perry, United States Department of the Interior Fish and Wildlife Service on the November 1990 "Draft Supplemental Management of Migration Remedial Investigation Report," NUS Corporation.
9. Comments Dated December 14, 1990 from Jay Naparstek, Commonwealth of Massachusetts Department of Environmental Protection on the November 1990 "Draft Supplemental Management of Migration Remedial Investigation Report," NUS Corporation.
10. Comments Dated December 17, 1990 from Robert J. Leger, EPA Region I on the November 1990 "Draft Supplemental Management of Migration Remedial Investigation Report," NUS Corporation.
11. Comments Dated March 29, 1991 from Cyndi Perry, United States Department of the Interior Fish and Wildlife Service on the February 1991 "Supplemental Management of Migration Remedial Investigation Report," NUS Corporation.
12. Letter from Martin C. Pentz, Nutter, McClennen & Fish (Attorney for Valley Manufactured Products Company, Inc. and Groveland Resources Corporation) to Mark Lowe, EPA Region I (June 3, 1991). Concerning the attached "Preliminary Comments on EPA Supplemental MOM RI: Source of Station No. 1 Contamination," Peter J. Riordan.

3.7 Work Plans and Progress Reports

Report

1. "Final Work Plan," NUS Corporation (August 1989).
2. Cross Reference: "Work Plan Amendment Memorandum - Second Round Sampling," NUS Corporation (June 1990) [Filed and cited as entry number 11 in 3.2 Sampling and Analysis Data].
3. Cross-Reference: "Draft Work Plan Amendment No. 3 - Supplemental MOM RI/FS Groundwater Modeling," NUS Corporation (December 1990) [Filed and cited as entry number 18 in 3.2 Sampling and Analysis Data].

Comments

4. Cross Reference: Comments Dated July 9, 1990 from Robert J. Leger, EPA Region I on the June 1990 "Work Plan Amendment Memorandum - Second Round Sampling," NUS Corporation [Filed and cited as entry number 12 in 3.2 Sampling and Analysis Data].

4.0 Feasibility Study (FS)

4.1 Correspondence

1. Memorandum from Robert J. Leger, EPA Region I to attached list of Addressees (July 15, 1991). Concerning the transmittal of the July 1991 "Supplemental Management of Migration Feasibility Study Report," NUS Corporation and the July 1991 Proposed Plan.

4.5 Applicable or Relevant and Appropriate Requirements (ARARs)

1. Cross-Reference: Comments Dated April 18, 1991 from Charles Tuttle, Commonwealth of Massachusetts Office of Environmental Affairs on Applicable or Relevant and Appropriate Requirements (ARARs) and the February 1991 "Draft Supplemental Management of Migration Feasibility Study Report," NUS Corporation [Filed and cited as entry number 7 in 4.6 Feasibility Study (FS) Reports].
2. Cross-Reference: Response Dated May 20, 1991 from Robert J. Leger, EPA Region I on the April 18, 1991 Comments from Charles Tuttle, Commonwealth of Massachusetts Office of Environmental Affairs [Filed and cited as entry number 9 in 4.6 Feasibility Study (FS) Reports].

4.6 Feasibility Study (FS) Reports

Report

1. "Feasibility Study for the Groveland Wells Site - Groveland, Massachusetts - Volume I, NUS Corporation (August 1986).
2. "Feasibility Study for the Groveland Wells Site - Groveland, Massachusetts - Volume II - Appendices, NUS Corporation (August 1986).
3. "Supplemental Management of Migration Feasibility Study Report," NUS Corporation (July 1991).
4. "Supplemental Management of Migration Feasibility Study Report - Appendices," NUS Corporation (July 1991).

4.6 Feasibility Study (FS) Reports (cont'd.)

Comments

5. Comments Dated March 20, 1991 from Kenneth Finkelstein, U.S. Department of Commerce National Ocean and Atmospheric Administration on the February 1991 "Draft Supplemental Management of Migration Feasibility Study Report," NUS Corporation.
6. Comments Dated April 2, 1991 from Cyndi Perry, U.S. Department of Labor Fish and Wildlife Service on the February 1991 "Draft Supplemental Management of Migration Feasibility Study Report," NUS Corporation.
7. Comments Dated April 18, 1991 from Charles Tuttle, Commonwealth of Massachusetts Office of Environmental Affairs on Applicable or Relevant and Appropriate Requirements (ARARs) and the February 1991 "Draft Supplemental Management of Migration Feasibility Study Report," NUS Corporation.
8. Comments Dated May 30, 1991 from Cyndi Perry, U.S. Department of the Interior Fish and Wildlife Service on the Draft Proposed Plan for the site.

Responses to Comments

9. Response Dated May 20, 1991 from Robert J. Leger, EPA Region I on the April 18, 1991 Comments from Charles Tuttle, Commonwealth of Massachusetts Office of Environmental Affairs.
10. Response Dated September 17, 1991 from Richard Cavagnero, EPA Region I on the March 20, 1991 Comments from Kenneth Finkelstein, U.S. Department of Commerce National Ocean and Atmospheric Administration [This letter is addressed to John Lindsay as a representative of the U.S. Department of Commerce National Ocean and Atmospheric Administration].
11. Response Dated September 17, 1991 from Richard Cavagnero, EPA Region I on the April 2, 1991 and May 30, 1991 Comments from Cyndi Perry, U.S. Department of Labor Fish and Wildlife Service.

4.9 Proposed Plans for Selected Remedial Action

1. "EPA Proposes Cleanup Plan to Address Groundwater Contamination at the Groveland Wells Nos. 1 and 2 Site," EPA Region I (July 1991).

5.0 Record of Decision (ROD)

5.1 Correspondence

1. Letter from Earl L. Sweetser, Town of Groveland to Robert J. Leger, EPA Region I (July 25, 1991). Concerning the request to extend the public comment period on the Proposed Plan for thirty days.
2. Letter from Martin C. Pentz, Nutter, McClennen & Fish (Attorney for Valley Manufactured Products Company, Inc. and Groveland Resources Corporation) to Robert J. Leger and Mark Lowe, EPA Region I (July 30, 1991). Concerning the request to extend the public comment period on the Proposed Plan until August 30, 1991.
3. Letter from Martin C. Pentz, Nutter, McClennen & Fish (Attorney for Valley Manufactured Products Company, Inc. and Groveland Resources Corporation) to Robert J. Leger, EPA Region I (September 9, 1991). Concerning the confirmation that comments on the Proposed Plan will be considered timely if received before 10:00 a.m. on September 10, 1991.

5.1 Correspondence (cont'd.)

4. Telephone Notes Between Robert J. Leger, EPA Region I and Steve Roble, Commonwealth of Massachusetts Division of Fish and Wildlife (September 17, 1991). Concerning the Commonwealth of Massachusetts Division of Fish and Wildlife's position on how the remedy described in the Proposed Plan will affect rare and endangered species.
5. Cross-Reference: Memorandum from M. Gretchen Muench, EPA Region I to Robert J. Leger, EPA Region I (September 20, 1991). Concerning Applicable or Relevant and Appropriate Requirements (ARARs) for inclusion into the Record of Decision and notification that the Commonwealth of Massachusetts will concur with the selected remedy [Filed and cited as entry number 2 in 5.2 Applicable or Relevant and Appropriate Requirements (ARARs)].
6. Telephone Notes Between Robert J. Leger, EPA Region I and Michael Amaral, U.S. Department of Labor Fish and Wildlife Service (September 27, 1991). Concerning the two federally listed endangered species and the effect the remedy described in the Proposed Plan will have on them.

5.2 Applicable or Relevant and Appropriate Requirements (ARARs)

1. Letter from Helen Waldorf, Commonwealth of Massachusetts Department of Environmental Protection to Robert J. Leger, EPA Region I (September 9, 1991) and the attached April 18, 1991 Letter from Charles Tuttle, Commonwealth of Massachusetts Office of Environmental Affairs to Robert J. Leger, EPA Region I. Concerning the identification of Applicable or Relevant and Appropriate Requirements (ARARs) for inclusion into the Record of Decision.
2. Memorandum from M. Gretchen Muench, EPA Region I to Robert J. Leger, EPA Region I (September 20, 1991). Concerning Applicable or Relevant and Appropriate Requirements (ARARs) for inclusion into the Record of Decision and notification that the Commonwealth of Massachusetts will concur with the selected remedy.

5.3 Responsiveness Summary

1. Cross-Reference: Responsiveness Summary is an attachment to the September 30, 1991 "Record of Decision," EPA Region I [Filed and cited as entry number 1 in 5.4 Record of Decision (ROD)].

The following citations indicate documents received by EPA Region I during the formal public comment period.

2. Comments Dated July 13, 1991 from Gverin E. Carlson on the July 1991 Proposed Plan.
3. Comments Dated July 31, 1991 from Linda M. Loreth, A. W. Chesterton Co. on the July 1991 Proposed Plan.
4. Comments from Kurt Goodwin on the July 1991 Proposed Plan (Received September 6, 1991).
5. Comments Dated September 6, 1991 from Rosanna Sattler, Posternak, Blankstein & Lund (Attorney for Town of Groveland) on the July 1991 Proposed Plan and the attached handwritten notes.
6. Comments Dated September 9, 1991 from Suzanne K. Condon and William C. Strohsnitter, Commonwealth of Massachusetts Office of Health and Human Services on the July 1991 Proposed Plan.

5.3 Responsiveness Summary (cont'd.)

7. Letter from Martin C. Pentz, Nutter, McClennen & Fish (Attorney for Valley Manufactured Products Company, Inc. and Groveland Resources Corporation) to Robert J. Leger, EPA Region I (September 10, 1991). Concerning the following attached comments on the July 1991 Proposed Plan:
   A. "Comments on EPA Management of Migration Proposed Plan for the Groveland Wells Nos. 1 and 2 Site," Valley Manufactured Products Company, Inc. and Groveland Resources Corporation (September 10, 1991).
   B. "Comments on EPA Management of Migration Proposed Plan for the Groveland Wells Nos. 1 and 2 Site - Appendices: Volume 1 of 2," Valley Manufactured Products Company, Inc. and Groveland Resources Corporation (September 10, 1991).
   C. "Comments on EPA Management of Migration Proposed Plan for the Groveland Wells Nos. 1 and 2 Site - Appendices: Volume 2 of 2," Valley Manufactured Products Company, Inc. and Groveland Resources Corporation (September 10, 1991).

5.4 Record of Decision (ROD)

1. "Record of Decision," EPA Region I (September 30, 1991).

9.0 State Coordination

9.1 Correspondence

1. Cross-Reference: Comments Dated September 9, 1991 from Suzanne K. Condon and William C. Strohsnitter, Commonwealth of Massachusetts Office of Health and Human Services on the July 1991 Proposed Plan [Filed and cited as entry number 6 in 5.3 Responsiveness Summary].
2. Cross-Reference: Telephone Notes Between Robert J. Leger, EPA Region I and Steve Roble, Commonwealth of Massachusetts Division of Fish and Wildlife (September 17, 1991). Concerning the Commonwealth of Massachusetts Division of Fish and Wildlife's position on how the remedy described in the Proposed Plan will affect rare and endangered species [Filed and cited as entry number 4 in 5.1 Correspondence].

13.0 Community Relations

13.1 Correspondence

The list of addressees cited as an attachment to the record below is withheld as CONFIDENTIAL and is available only for judicial review.

1. Letter from Merrill S. Hohman, EPA Region I to the attached list of Addressees (March 19, 1991). Concerning notification that their property overlies the contaminant plume and that they are encouraged to participate in the selection of a remedy.

13.3 News Clippings/Press Releases

News Clippings

1. "EPA Study Done, Cleanup Can Begin," Daily News - Newburyport, MA (April 4, 1991).
2. "EPA: Well Cleanup Could Take Decade," The Haverhill Gazette - Haverhill, MA (April 4, 1991).
3. "The United States Environmental Protection Agency Invites Public Comment on the Feasibility Study and Proposed Plan for the Groveland Wells Nos. 1 and 2 Superfund Site in Groveland, Massachusetts and Announces the Availability of the Site Administrative Record," The Haverhill Gazette - Haverhill, MA (July 1, 1991).
4. "The U.S. Environmental Protection Agency Announces an Extension to the Comment Period for the Proposed Cleanup Plan at Groveland Wells Nos. 1 and 2 Superfund Site," The Haverhill Gazette - Haverhill, MA (August 15, 1991).

Press Releases

5. "Environmental News - EPA To Begin Investigation At The Groveland Wells Superfund Site," EPA Region I (November 22, 1989).
6. "Environmental News - EPA To Discuss Results of Groundwater Investigation for the Groveland Wells Nos. 1 & 2 Superfund Site at Upcoming Public Meeting," EPA Region I (March 22, 1991).
7. "Environmental News - EPA Proposes Groundwater $8.6 Million Cleanup Plan for the Groveland Wells Nos. 1 & 2 Superfund Site," EPA Region I (July 2, 1991).
8. "Environmental News - Additional Sampling Added to EPA Proposed Cleanup at Groveland Wells Nos. 1 & 2 Superfund Site," EPA Region I (July 16, 1991).

13.4 Public Meetings

1. "Management of Migration Remedial Investigation Public Meeting Summary - Groveland Wells Nos. 1 and 2 - April 3, 1991."
2. Public Meeting Agenda, EPA Region I Public Meeting for the Groveland Wells Nos. 1 and 2 Site (April 3, 1991). Concerning the Supplemental Management of Migration Remedial Investigation.
3. EPA Region I Attendance List, Supplemental Management of Migration Remedial Investigation Public Meeting (April 3, 1991).
4. "Supplemental Management of Migration Feasibility Study/Proposed Plan Public Meeting Summary - Groveland Wells Nos. 1 and 2 - July 9, 1991."
5. Public Meeting Agenda, EPA Region I Public Meeting for the Groveland Wells Nos. 1 and 2 Site (July 9, 1991). Concerning the Supplemental Management of Migration Feasibility Study and Proposed Plan.
6. EPA Region I Attendance List, Supplemental Management of Migration Feasibility Study and Proposed Plan Public Meeting (July 9, 1991).
7. Transcript, Public Hearing on the July 1991 Proposed Plan (July 31, 1991).
8. Public Meeting Agenda, Commonwealth of Massachusetts Office of Health and Human Services Public Meeting for the Groveland Wells Nos. 1 and 2 Site (September 16, 1991). Concerning the health assessment process and health concerns associated with the site. The following are attachments:
    - A. "A Fact Sheet on the ATSDR Health Assessment Process," Commonwealth of Massachusetts Office of Health and Human Services.
    - B. "The Health Assessment Process," Commonwealth of Massachusetts Office of Health and Human Services.

13.5 Fact Sheets

1. "EPA Announces the Results of Remedial Investigation and Risk Assessment Studies," EPA Region I (March 1991).

16.0 Natural Resource Trustee

16.1 Correspondence

1. Cross-Reference: Comments Dated March 20, 1991 from Kenneth Finkelstein, U.S. Department of Commerce National Ocean and Atmospheric Administration on the February 1991 "Draft Supplemental Management of Migration Feasibility Study Report," NUS Corporation [Filed and cited as entry number 5 in 4.6 Feasibility Study (FS)].
2. Cross-Reference: Comments Dated April 2, 1991 from Cyndi Perry, U.S. Department of Labor Fish and Wildlife Service on the February 1991 "Draft Supplemental Management of Migration Feasibility Study Report," NUS Corporation [Filed and cited as entry number 6 in 4.6 Feasibility Study (FS)].
3. Cross-Reference: Response Dated September 17, 1991 from Richard Cavagnero, EPA Region I on the March 20, 1991 Comments from Kenneth Finkelstein, U.S. Department of Commerce National Ocean and Atmospheric Administration [This letter is addressed to John Lindsay as a representative of the U.S. Department of Commerce National Ocean and Atmospheric Administration] [Filed and cited as entry number 10 in 4.6 Feasibility Study (FS)].
4. Cross-Reference: Response Dated September 17, 1991 from Richard Cavagnero, EPA Region I on the April 2, 1991 and May 30, 1991 Comments from Cyndi Perry, U.S. Department of Labor Fish and Wildlife Service [Filed and cited as entry number 11 in 4.6 Feasibility Study (FS)].
5. Cross-Reference: Telephone Notes Between Robert J. Leger, EPA Region I and Michael Amaral, U.S. Department of Labor Fish and Wildlife Service (September 27, 1991). Concerning the two federally listed endangered species and the effect the remedy described in the Proposed Plan will have on them [Filed and cited as entry number 6 in 5.1 Correspondence].

17.0 Site Management Records

17.2 Access Records

1. Letter from James R. Forrelli, NUS Corporation to Robert J. Leger, EPA Region I (September 15, 1989). Concerning the attached "Properties Requiring Access for Fieldwork."

The maps associated with the record cited as entry number 2 are oversized and may be reviewed, by appointment only, at EPA Region I in Boston, Massachusetts.

2. Memorandum from James R. Forrelli, NUS Corporation to Robert J. Leger, EPA Region I (September 21, 1989). Concerning transmittal of the attached property maps.
3. Memorandum from James R. Forrelli, NUS Corporation to Robert J. Leger, EPA Region I (September 27, 1989). Concerning transmittal of the attached draft list of property owners.
4. Letter from James R. Forrelli, NUS Corporation to Robert J. Leger, EPA Region I (October 18, 1989). Concerning the attached memorandum identifying specific properties where the monitoring wells will be drilled.
5. List of property owners and their addresses (October 18, 1989).

17.2 Access Records (cont'd.)

6. Letter from Merrill S. Hohman, EPA Region I to Benny Budrewicz (October 18, 1989). Concerning a request for property access and the attached Telephone Notes Between Benny Budrewicz and James R. Forrelli, NUS Corporation (December 14, 1989).
7. Letter from Merrill S. Hohman, EPA Region I to Frank and Charlotte Parker (October 18, 1989). Concerning a request for property access.
8. Letter from Robert J. Leger, EPA Region I to James R. Forrelli, NUS Corporation (December 6, 1989). Concerning attached list of people who have returned the "Consent for Access to Property."
9. Letter from Merrill S. Hohman, EPA Region I to Melita Hutchings (December 19, 1989). Concerning a request for property access.
10. Letter from Merrill S. Hohman, EPA Region I to Richard Madison. Concerning a request for property access and the attached "Consent for Access to Property" signed December 20, 1989.

The record cited as entry number 11 is CONFIDENTIAL and available only for judicial review.

11. Memorandum from Gregory M. Kennan, EPA Region I to File (January 19, 1990). Concerning use of unilateral Administrative Orders for access to residential property.
12. Telephone Notes Between Mrs. William Dennis and Becky Cleaver, NUS Corporation (July 2, 1990). Concerning sampling that was done on her property.
13. 32 Registered Mail receipts.

17.7 Reference Documents

The record cited as entry number 1 may be reviewed, by appointment only, at EPA Region I, Boston, Massachusetts.

1. "Technology Evaluation Report: SITE Program Demonstration of the Ultrox International Ultraviolet Radiation/Oxidation Technology," EPA Headquarters (January 1990).
2. "Groveland By-Laws Article 13, Section 1700, Aquifer Protection," Received from NUS Corporation September 5, 1990.
3. Letter from James R. Forrelli, NUS Corporation to Robert J. Leger, EPA Region I (July 31, 1991). Concerning the attached groundwater extraction and treatment system example.

Section II

Guidance Documents

GUIDANCE DOCUMENTS

EPA guidance documents may be reviewed at EPA Region I, Boston, Massachusetts.

General EPA Guidance Documents

1. "Protection of Wetlands (Executive Order 11990), Appendix D," Federal Register (Vol. 42), 1977.

2. U.S. Environmental Protection Agency. Guidance Manual for Minimizing Pollution from Waste Disposal Sites (EPA/600/2-78/142), August 1978.

3. "National Oil and Hazardous Substances Pollution Contingency Plan," Code of Federal Regulations (Title 40, Part 300), 1985.

4. "National Oil and Hazardous Substances Pollution Contingency Plan," Federal Register (Vol. 55, No. 46), March 8, 1990.

5. U.S. Environmental Protection Agency. Office of Emergency and Remedial Response. Community Relations in Superfund: A Handbook (Interim Version) (EPA/HW-6), September 1983.

6. U.S. Environmental Protection Agency. Office of Ground-Water Protection. Ground-Water Protection Strategy (EPA/440/6-84/002), August 1984.

7. U.S. Environmental Protection Agency. Office of Solid Waste and Emergency Response. Guidance on Remedial Investigations under CERCLA (Comprehensive Environmental Response, Compensation, and Liability Act) (EPA/540/G-85/002), June 1985.

8. U.S. Environmental Protection Agency. Office of Solid Waste and Emergency Response. Guidance on Feasibility Studies under CERCLA (Comprehensive Environmental Response, Compensation, and Liability Act) (EPA/540/G-85/003), June 1985.

9. U.S. Environmental Protection Agency. Office of Waste Programs Enforcement. Endangerment Assessment Handbook, August 1985.

10. Memorandum from J. Winston Porter, U.S. Environmental Protection Agency Office of Solid Waste and Emergency Response to Addressees ("Regional Administrators, Regions I-X; Directors, Environmental Services Division, Regions I-X; Regional Counsels, Regions I-X, Director, Waste Management Division, Regions I, IV, V, VII, and VIII; Director, Emergency and Remedial Response Division, Region II; Director, Hazardous Waste Management Division, Region III; Director, Air and Waste Management Division, Regions II and VI; Director, Toxics and Waste Management Division, Region IX; Director, Hazardous and Waste Division, Region X") (OSWER Directive 9850.0-1), November 22, 1985 (discussing endangerment assessment guidance).

11. U.S. Environmental Protection Agency and Michigan Department of Natural Resources. Field Screening for Organic Contaminants in Samples from Hazardous Waste Sites, April 2, 1986.

12. U.S. Environmental Protection Agency. Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended October 17, 1986.

13. U.S. Environmental Protection Agency. Office of Emergency and Remedial Response. Superfund Public Health Evaluation Manual (EPA/540/1-86/060, OSWER Directive 9285.4-1), October 1986.

14. U.S. Environmental Protection Agency. Office of Emergency and Remedial Response. Draft Guidance on Remedial Actions for Contaminated Groundwater at Superfund Sites (OSWER Directive 9283.1-2), October 1986.

15. U.S. Environmental Protection Agency. Office of Water Regulations and Standards. Quality Criteria for Water 1986 (EPA/440/5-86/001), May 1, 1987.

16. U.S. Environmental Protection Agency. Office of Emergency and Remedial Response. Draft Guidance on Conducting Remedial Investigations and Feasibility Studies under CERCLA (Comprehensive Environmental Response, Compensation, and Liability Act), March 1988.

17. U.S. Environmental Protection Agency. Office of Emergency and Remedial Response. Interim Final Guidance on Conducting Remedial Investigations and Feasibility Studies under CERCLA (Comprehensive Environmental Response, Compensation, and Liability Act), October 1988.

18. U.S. Environmental Protection Agency. Office of Emergency and Remedial Response. Superfund Exposure Assessment Manual (EPA/540/1-88/001, OSWER Directive 9285.5-1), April 1988.

19. U.S. Environmental Protection Agency. Office of Emergency and Remedial Response. Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA (Comprehensive Environmental Response, Compensation, and Liability Act) (Interim Final) (EPA/540/G-89/004, OSWER Directive 9355.3-01), October 1988.

20. U.S. Environmental Protection Agency. Office of Emergency and Remedial Response. Guidance on Remedial Actions for Contaminated Ground Water at Superfund Sites (EPA/540/G-88/003, OSWER Directive 9283.1-2), December 1988.

21. U.S. Environmental Protection Agency. Risk Reduction Engineering Laboratory. Technology Evaluation Report: SITE Program Demonstration Test Terra Vac In Situ Vacuum Extraction System - Volume I (EPA/540/5-89.003a) (April 1989).

22. Memorandum from Henry L. Longest II and Gerald Emison, EPA Headquarters to Addressees ("Regional Waste Management Division Directors; Regional Superfund Branch Chiefs; Regional Air Division Directors; Regional Air Branch Chiefs; OERR Division Directors; OAQPS Division Directors"), June 15, 1989 (discussing control of air emissions from air strippers).

23. U.S. Environmental Protection Agency. Office of Solid Waste and Emergency Response. Land Disposal Restrictions: Summary of Requirements, June 1989.

24. U.S. Environmental Protection Agency. Risk Assessment Work Group, Region I. Supplemental Risk Assessment Guidance for the Superfund Program (Draft Final) (EPA/901/5-89/001), June 1989.

25. Memorandum from Louis F. Gitto, U.S. Environmental Protection Agency Air, Pesticides, and Toxic Management Division, Region I to Merrill S. Hohman, Waste Management Division, Region I (OSWER Directive 9355.0-28), July 12, 1989 (discussing air stripper control guidance).

26. U.S. Environmental Protection Agency. Office of Solid Waste and Emergency Response. Risk Assessment Guidance for Superfund, Human Health Evaluation Manual Part A, July 1989.

27. U.S. Environmental Protection Agency. Office of Emergency and Remedial Response. Risk Assessment Guidance for Superfund - Volume I: Human Health Evaluation Manual (Part A - Interim Final) (EPA/540/1-89/002), December 1989.

28. "National Oil and Hazardous Substances Pollution Contingency Plan," Federal Register (Vol. 55, No. 46), March 8, 1990, p. 8666.

29. U.S. Environmental Protection Agency. Office of Solid Waste and Emergency Response. The Feasibility Study: Detailed Analysis of Remedial Action Alternatives (OSWER Directive 9355.3-01FS4), March 1990.

30. "A Field Evaluation of the UV/Oxidation Technology to Treat Contaminated Groundwater," HMC, March/April 1990.

31. "Control Technology: A Field Demonstration of the UV/Oxidation Technology to Treat Groundwater Contaminated with VOCs," Journal of the Air & Waste Management Association (Vol. 40, No. 4), April 1990, pp. 540-47.

REGION I

MANAGEMENT OF MIGRATION RECORD OF DECISION SUMMARY

GROVELAND WELLS NOS. 1 & 2 SITE

SEPTEMBER, 1991

GROVELAND WELLS NOS. 1 & 2 SITE

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APPENDICES

MANAGEMENT OF MIGRATION RECORD OF DECISION SUMMARY

In this Management of Migration Record of Decision ("Management of Migration ROD"), the United States Environmental Protection Agency ("EPA") presents a selected remedial action for the management of contaminant migration at the Groveland Wells Nos. 1 & 2 Site (the "Groveland Wells Site" or the "Site") located in Groveland, Massachusetts. This remedial action was chosen in accordance with the Comprehensive Environmental Response, Compensation and Liability Act of 1980 ("CERCLA"), as amended by the Superfund Amendments and Reauthorization Act of 1986 ("SARA"), 42 U.S.C. §§ 9601 et seq. This decision is based on the administrative record for this Site.

I. SITE NAME, LOCATION AND DESCRIPTION

The Groveland Wells Site is located mostly within the Town of Groveland, Essex County, Massachusetts and encompasses approximately 850 acres (Figure 1). The Site is bounded to the west by Washington Street and the former Haverhill Municipal Landfill; to the south by Salem Street; to the east by School Street; and to the north by the Merrimack River. The Site is divided by Center Street and contains a variety of private residences, industries, small businesses and religious and community institutions. A large, active sand and gravel operation is located in the central area of the Site.

Johnson Creek flows north through the Site and discharges to the Merrimack River at its northern edge (Figure 2). A portion of Johnson Creek is dammed at the lower end of Mill Pond. Argilla Brook flows northwest through the Site and discharges to Johnson Creek. Brindle Brook is a small tributary to Johnson Creek that flows northwestward through the southeast corner of the Site area, eventually joining with Johnson Creek near Center Street. There are certain limited wetland areas at the Site, located mostly next to Mill Pond, Argilla Brook, Johnson Creek, Brindle Brook and isolated areas east of Johnson Creek. A portion of the Site lies within the 100-year floodplain delineated by the Federal Emergency Management Agency. Areas outside the 100-year floodplain but within the approximate limits of the contaminant plume are shown in Figure 3.

One of the Town of Groveland's current municipal water supply wells, Station No. 1, and a former municipal supply well, Station No. 2, are located within the Site boundaries. The Site encompasses the approximate limits of the stratified drift aquifer that serves as the source of water for the current and former municipal supply wells. Groundwater generally flows to the north through the Site toward the Merrimack River. The overall groundwater flow pattern is from higher elevations located to the south, east, and west, toward the valley that forms much of the Site, then north following the trend of the valley toward its outlet (Figures 4, 5 and 6).

Trichloroethene ("TCE"), a volatile organic compound ("VOC"), was first discovered in the Town of Groveland's municipal supply wells in 1979 at a level of approximately 120 micrograms per liter ("ug/L"). (The current Safe Drinking Water Act maximum contaminant level for TCE is 5 ug/L). The discovery of TCE in the groundwater supply resulted in the closure of the wells, temporary water rationing, and development of alternate water supplies. A new supply well, Station No. 3, was installed near the Merrimack River in the northern part of the Town to serve as the main municipal supply well (Figure 1).

The Groveland Wells Site was placed on the National Priorities List ("NPL") in December 1982. The Haverhill Municipal Landfill originally was part of the Groveland Wells Site. However, since that time it separately has been listed on the NPL and is no longer part of the Groveland Wells Site.

A more complete description of the Site can be found in the Supplemental Management of Migration Remedial Investigation ("Supplemental MOM RI") at pages 1-2 through 1-8.

II. SITE HISTORY AND ENFORCEMENT ACTIVITIES

This section of the Management of Migration ROD discusses the Site history and enforcement activities undertaken to date. A more detailed description of the Site history can be found in the Supplemental MOM RI at pages 1-2 through 1-8.

A. Land Use and Response History

1. Sources of Contamination

The NPL listing resulted in the initiation of studies that investigated the nature and extent of soil, surface water, sediment and groundwater contamination, potential sources of the contamination, and the pathways by which the aquifer serving the municipal wells were contaminated. These investigations resulted in identifying three likely sources of contamination in the general area of the Site: the A.W. Chesterton Company property, the Haverhill Municipal Landfill and the Valley Manufactured Products Company property.

Because three different sources of contamination were discovered, EPA made the decision to address each source individually based upon the type of contamination discovered, whether the contamination could be dealt with more effectively under a Federal environmental statute other than CERCLA, and whether the nature of contamination at a source warranted its listing as a separate CERCLA site. A description of these three source areas and how they are being addressed by EPA follows:

A. W. CHESTERTON COMPANY PROPERTY

The A. W. Chesterton Company is a manufacturer of mechanical seals and industrial maintenance products, located in the south-central section of the Site along Salem Street (Figure 2). The 70-acre Chesterton property is located along Brindle Brook, a tributary of Johnson Creek. An investigation was performed on the Chesterton property in 1984 and 1985 in accordance with an Administrative Order issued pursuant to the Resource Conservation and Recovery Act ("RCRA"), 42 U.S.C. §§ 6901 et seq. The investigation determined that the Chesterton property was contaminated, that the source of the contamination was a subsurface disposal system on the Chesterton property, and that soil and groundwater contamination was confined to the property boundary. EPA has decided that remediation of contamination on the Chesterton property best can be dealt with using corrective action and closure activities under RCRA.

Although RCRA will be used to address contamination at the Chesterton property and remediation of contamination at that property is not addressed in this Management of Migration ROD, that property remains part of the Groveland Wells Site. Before delisting the Groveland Wells Site from the NPL, EPA will ensure that contamination at the Chesterton property has been properly addressed.

HAVERHILL MUNICIPAL LANDFILL

The Haverhill Municipal Landfill was originally named a potential source of the contamination that led to the closure of Station Nos. 1 & 2. The Supplemental MOM RI revealed that low level groundwater contamination in the northwestern section of the Site immediately east of the landfill, driven by groundwater mounding beneath the landfill, was migrating toward Johnson Creek. The contamination did not form a definable plume, however, because chemical detections were sporadic and at low levels.

Some portion of the contaminants in the groundwater at the Site may have originated from the Haverhill Municipal Landfill. However, the limited nature and extent of contamination detected east of the landfill, in the direction of the contaminant plume, suggests that the landfill is a minor source of the contaminants found in the plume.

Because of the distinct nature of the contamination found there, much of which appears to be unrelated to the VOC contamination of the municipal supply wells, the Haverhill Municipal Landfill was placed on the NPL in October 1984 as a separate site from the Groveland Wells Site. As a result, cleanup of the Haverhill Municipal Landfill is being addressed as a separate CERCLA action. The Haverhill Municipal Landfill is no longer part of the Groveland Wells Site, and remediation of contamination at the Haverhill Municipal Landfill is not addressed in this Management of Migration ROD.

VALLEY MANUFACTURED PRODUCTS COMPANY PROPERTY

Valley Manufactured Products Company, Inc. ("Valley") is a screw machine products manufacturer and finisher. The company is located near the southwest corner of the Site, west of Johnson Creek and upstream of Mill Pond. Since operations began at the property in May 1963, three subsurface waste disposal systems have been installed and used on the property for dispersal of liquid effluent into the environment by filtration through sand and gravel leachfields.

According to Valley employee accounts, as much as 3000 gallons of waste oil and solvent (including TCE) were released on the Valley property during the period 1963 to 1974. Of this amount, five to seven hundred gallons of TCE escaped from an underground storage tank. The balance of the releases came from spills or leaks into the subsurface disposal systems and use of waste oil containing TCE as a defoliant. Studies at the Site have shown that TCE released at the Valley property has migrated into the aquifer below the property and has extended beyond the boundary of the property to other areas of the Site.

To remediate contamination within the boundary of the Valley property, EPA issued a first Record of Decision (the "Source Control ROD") for the Site in September, 1988. The Source Control ROD required cleanup of the organic chemical contamination source at the Valley property. That action constitutes the Source Control Operable Unit at the Groveland Wells Site. The Source Control ROD approved an innovative technology consisting of soil vapor vacuum extraction to treat VOC-contaminated soil on the Valley property. The ROD also approved the installation of a groundwater recovery, treatment and reinjection system to treat VOC-contaminated groundwater located directly under the Valley property. Pursuant to an Amended Administrative Order issued on February 1, 1991 under CERCLA § 106(a), Valley/Groveland Resources Corporation ("GRC") is presently designing a full scale soil vapor vacuum extraction treatment system and a groundwater recovery, treatment and reinjection system for use on its property.

After issuing the Source Control ROD, EPA commissioned the preparation of a Supplemental Management of Migration Remedial Investigation and Feasibility Study ("Supplemental MOM RI/FS"). This study, together with earlier studies, was aimed at determining the nature and extent of the sources of contamination off the Valley property. Based upon the findings of the Supplemental MOM RI/FS, as well as earlier studies, EPA is issuing this Management of Migration ROD. Remedial action required by the Management of Migration ROD supplements, not replaces or supplants, the remedial action required by the Source Control ROD. The Management of Migration ROD outlines actions necessary to remediate contaminated groundwater that extends from the Valley property throughout the rest of the Site.

2. Other Actions at the Site

In addition to the remedial action initiated at the Valley property pursuant to the Source Control ROD, the following additional actions have been undertaken at the Site:

MILL POND GROUNDWATER EXTRACTION AND TREATMENT SYSTEM

Beyond the work required as part of the Source Control Operable Unit at the Site, the Commonwealth of Massachusetts has required Valley/GRC to construct and operate a groundwater extraction and air stripping treatment system to intercept and treat the VOC plume at Mill Pond. The system is currently in place and operating at the north end of Mill Pond. It consists of two extraction wells, G-1 and G-2, pumping at an aggregate rate of about 80 gpm currently, and an air stripping unit used for removal of VOCs from the pumped water. Pumped water is discharged under an existing National Pollutant Discharge Elimination System ("NPDES") permit after treatment to Johnson Creek, immediately downstream of Mill Pond. Discharge monitoring reports for the period April 1988 through November 1989 shows that the average monthly flow treated and discharged by the system has varied from 31 gpm to 75 gpm. This system has been operating since April 1988.

The Mill Pond groundwater extraction wells may be included within the broader remedy selected in this Management of Migration ROD. The air stripping treatment system, however, will be discontinued once the treatment system selected in this Management of Migration ROD becomes operational.

STATION NO. 1 WELLHEAD TREATMENT

By Action Memorandum dated July 25, 1985, EPA approved an Initial Remedial Measure ("IRM") to provide an alternate water supply by rehabilitating Station No. 1 with granular activated carbon treatment to remove VOCs from the groundwater at Station No. 1. The need for the IRM was based on an EPA evaluation of water supply/demand and an aquifer-wide study. In 1987, EPA completed the installation of the treatment system. The well operates at a pumping rate of 400 gpm and is used as a supplemental supply to Station No. 3. Station No. 1 continues to ensure a safe and adequate supply of potable water for the Town of Groveland. The station currently supplies about half the Town's drinking water while the new well, Station No. 3, provides the remainder.

EPA has taken into account that the wellhead treatment system at Station No. 1 is in place. That treatment system, however, is not incorporated into or made part of the remedy selected in this Management of Migration ROD.

B. Enforcement History

Certain enforcement activities undertaken at the Site are described above. In addition, on May 21, 1991, EPA notified five (5) parties who owned or operated, or now own or operate, portions of the Site of their potential liability with respect to the cleanup of contamination at the Site. EPA may commence negotiations with the potentially responsible parties ("PRPs") after issuance of this Management of Migration ROD.

The PRPs have been active in the remedy selection process for this Site. Comments presented by PRPs during the public comment period, and EPA's response thereto, are included in the Administrative Record.

III. COMMUNITY PARTICIPATION

Throughout the Site's history, community concern and involvement has been high. EPA has kept the community and other interested parties informed of the Site activities through informational meetings, fact sheets, press releases and public meetings.

During September, 1983, EPA released a community relations plan that outlined a program to address community concerns and keep citizens informed about and involved in activities at the Site. This original plan has been updated as necessary for all subsequent response activities. On July 24, 1989, EPA held an informational meeting in the Town of Groveland to describe the plans for the supplemental remedial investigation and feasibility study. On April 3, 1991, EPA held an informational meeting in the Town of Groveland to discuss the results of the Supplemental MOM RI.

On July 1, 1991, EPA published in the Haverhill Gazette a notice and brief analysis of the Proposed Plan for remediating groundwater contamination through the remedy selected in this Management of Migration ROD, and made the plan available to the public at the Langley-Adams Library.

On July 9, 1991, EPA held an informational meeting to discuss the results of the Supplemental MOM RI, to outline the cleanup alternatives detailed in the Supplemental MOM FS, and to present the Agency's Proposed Plan. Also during this meeting, the Agency answered questions from the public.

On July 10, 1991, EPA made the Site administrative record available for public review at EPA's Record Center at 90 Canal Street in Boston, Massachusetts and at the Langley-Adams Library in Groveland, Massachusetts.

From July 10 to August 8, 1991, the Agency held a 30-day public comment period to accept public comment on the alternatives presented in the Supplemental MOM FS and the Proposed Plan and on any other documents previously released to the public. During the comment period, EPA received two (2) requests to extend the public comment period an additional thirty (30) days. Therefore, EPA extended the public comment period to September 9, 1991. On July 31, 1991, the Agency held informal public hearing to accept any oral comments on the Proposed Plan.

A transcript of the public hearing, a summary of other comments received by EPA, and the Agency's response to the oral and written comments received concerning the Proposed Plan are included in the attached responsiveness summary.

IV. SCOPE AND ROLE OF OPERABLE UNIT OR RESPONSE ACTION

This Management of Migration ROD establishes a Management of Migration Operable Unit, which, along with the Source Control Operable Unit established in the Source Control ROD, addresses all Site-related contamination, except that found at the Chesterton property, which is being addressed under RCRA.

Through the various investigations completed at the Site, EPA has sought to determine the nature and extent of surface water, sediment, soil, and groundwater contamination at the Site, and to identify alternatives for remediating the contamination that was discovered.

Most importantly, those investigations revealed that a large groundwater contaminant plume of trichloroethene TCE and 1,2- dichloroethene ("1,2-DCE") extends from the Valley property (Figure 7). The approximate detectable area of the plume extends approximately 3,900 feet from the Valley property northward, along the path of Johnson Creek through the Mill Pond area, downgradient past Station No. 2. The plume width ranges from approximately 350 feet across in the Valley/Mill Pond area to roughly 1,000 feet wide where it encompasses Station No. 2.

Sediment and surface water contamination at the Site is low level and sporadic. No remediation of VOC contamination in surface water is planned because contaminant levels are below available Ambient Water Quality Criteria ("AWQC"). Similarly, no remediation of VOC contamination in sediment is planned because EPA believes they present minimal risk to human health and the environment. Metals concentrations detected in surface water occasionally exceed AWQC, but no remediation of those metals is planned because EPA does not believe they are Site-related. Inorganic contamination detected in sediment also are not being remediated because the contaminants do not present a risk to human health or the environment.

The response action outlined in this Management of Migration ROD is the Management of Migration Operable Unit. That operable unit includes all areas within the Site, except the Valley and Chesterton properties, where chemical specific applicable or relevant and appropriate requirements ("ARARs") are exceeded or cleanup levels are not being met in the groundwater. Because no remediation of sediment and surface water contamination is planned, the purpose of the Management of Migration Operable Unit is to restore the groundwater within the Site to ensure that both ARARs and cleanup levels established in this ROD are met.

The remedial action comprising the Management of Migration Operable Unit outlined in this Management of Migration ROD supplements, not replaces or supplants, the remedial action comprising the Valley property Source Control Operable Unit outlined in the Source Control ROD. In addition, remedial action to address contamination at the Chesterton property is not part of the Management of Migration Operable Unit because that contamination is being addressed using corrective action and closure activities under RCRA authority.

This remedial action will address the principal future threat to human health posed by the groundwater, namely, the possible ingestion, inhalation and dermal absorption by humans from multiple uses of the contaminated groundwater. The response action provides for the restoration of groundwater to meet both ARARs and cleanup standards identified in this ROD.

V. SUMMARY OF SITE CHARACTERISTICS

A. Groundwater

The principal contaminants detected in groundwater at the Site are the VOCs and metals. Chlorinated hydrocarbons such as TCE and 1,2-DCE are the VOCs most frequently detected in the groundwater samples collected. Metals frequently detected in groundwater samples collected include arsenic, barium, chromium, lead and nickel.

A large VOC plume extends from the Valley property throughout the Site. This plume has been further defined with regard to its present position about Station Nos. 1 and 2 and, in terms of contamination distribution in the overburden and bedrock formations of the Site, through the sampling conducted in the Supplemental MOM RI.

The Site can be divided into four areas based on the distribution of contaminants in groundwater (Figure 9). Although no longer regarded as part of the Site, for purposes of this discussion the Haverhill Municipal Landfill is addressed because it is part of one of the four areas discussed in the Supplemental MOM RI. The four areas impacted by the contamination consist of the three source areas (the Chesterton property, the Haverhill Municipal Landfill, and the Valley property) with adjoining downgradient districts, and a fourth area encompassing the capture zone of Station No. 1, the drinking water supply well that is the major receptor at the Site. The boundaries of these areas are based on the general patterns of contamination at the Site. It should be noted that the boundaries are approximate and may even overlap occasionally. The four areas are as follows:

- **Area A, The Chesterton Area,** includes the Chesterton property and immediate downgradient area, which is located to the southeast and upgradient of the Valley property.
- Area B, The Valley/Mill Pond Area, which is located downgradient of the Valley property, north of Area A,

and south of the "unnamed brook" flowing easterly and entering Johnson Creek north of Mill Pond.

- Area C, The Area North of Mill Pond, which is located north of the "unnamed brook." Area C abuts Area B to the south and Johnson Creek to the west. For purposes of this discussion, Area C also is referred to as the Station No. 1 area.

- Area D, The Haverhill Municipal Landfill Area, which includes the area between the landfill and Johnson Creek.

Contaminant concentrations differ significantly in each of these areas. The following sections describe contaminant occurrence and distribution in each area.

Area A - A. W. Chesterton Company

Table 1 summarizes the groundwater monitoring results for Area A, the Chesterton Area. The area encompasses the plant buildings and property and the immediate area next to the downgradient property boundaries to the north and northwest. Only first-round monitoring results are presented, because no second-round groundwater samples were collected in Area A. Three shallow overburden monitoring wells (84-3, 83-3, and 83-4) and two shallow bedrock wells (84-8 and 84-10) are located in Area A. Well 84-3 is located in the upgradient area of the Chesterton property (Figure 9).

VOCs were not detected in the shallow overburden wells, including the upgradient well. However, five VOCs were detected in the shallow bedrock well, 84-8. Although TCE and 1,2-DCE were frequently detected at significantly higher concentrations (i.e., greater than 1,000 ug/L) in other Site monitoring wells, the tetrachloroethene ("PCE"), 1,1,1-trichloroethane ("1,1,1-TCA"), and 1,1-dichloroethane ("1,1-DCA") concentrations reported in well 84-8 were higher than those reported in any other first-round monitoring well. However, the PCE concentration detected in the second-round groundwater sample from well ERT-10 (Area D) was 77 ug/L. PCE has been detected at its highest concentration (C_{max}=1,600 ug/L) in wells associated with the Chesterton property. Based on monitoring at the Site, a plume of 1,1,1-TCA-, 1,1-DCA-, 1,1-DCE-, PCE-, and TCE-contaminated groundwater has been identified at the Chesterton property. The Chesterton property is upstream of the Valley property. Groundwater quality beneath each property is not influenced by activities taking place at the other property.

The concentrations of arsenic, chromium, lead, and nickel detected in groundwater samples collected from well 84-8, a downgradient well on the Chesterton property, exceed current or proposed Federal Safe Drinking Water Act ("SDWA") primary (health-based) Maximum Contaminant Levels ("MCLs"). Concentrations of chromium, lead, aluminum and iron in background monitoring well ERT-12A and upgradient well 84-3 also exceed or approach MCLs for these contaminants.

The source of the groundwater contamination at the Chesterton Area is a subsurface disposal system on the Chesterton property. That contamination, however, is limited to the Chesterton property boundary.

Area B - The Valley/Mill Pond Area

Tables 2, 3 and 4 summarize the groundwater monitoring results for Area B, the Valley/Mill Pond Area. The area includes Mill Pond and extends from approximately the Valley property south of the pond to the unnamed brook that enters Johnson Creek north of Mill Pond.

The Area B western and eastern boundaries extend roughly to include the area just west of Washington Street and the western section of the sand and gravel surface mine. Numerous monitoring wells were installed in this area to define the groundwater contamination plume extending from the Valley property. Based on the strata in which the well screens were installed, and the contaminant concentrations detected in the groundwater samples, the following subareas were identified:

B-1 - Shallow overburden downgradient of the Valley property (VOC concentrations >1,000 ug/L)

B-2 - Shallow overburden in the Mill Pond Area beyond Subarea B-1 (VOC concentrations <100 ug/L)

B-3 - Deep overburden/shallow bedrock adjacent to Johnson Creek (VOC concentrations >100 ug/L)

B-4 - Deep overburden/shallow bedrock not adjacent to Johnson Creek (VOC concentrations <10 ug/L)

B-5 - Deep bedrock (VOC concentration = 1 ug/L)

As shown on Figure 8, the contaminant plume exhibits a sinking pattern through the overburden and into shallow bedrock. Deep overburden/shallow bedrock wells in the center of the plume are grouped together as these are highly contaminated intervals, although the well elevations monitored differ significantly.

According to first-round results, VOC concentrations detected in the two shallow overburden wells located downgradient of the Valley property (Subarea B-1) exceed 5,000 ug/L. However, only two VOCs, 1,2-DCE and TCE, were reported in wells GZ-2 and DEQE-8. TCE was detected at a maximum concentration of 11,000 ug/L in well GZ-2. VOCs were not detected at concentrations in excess of 100 ug/L in other shallow, downgradient, overburden wells, including those located in the Mill Pond/Johnson Creek Area, but beyond the immediate Valley property (i.e., Subarea B-2). As discussed in the following paragraphs, the center of the VOC contaminant plume migrates steeply downward to the deep overburden/shallow bedrock strata in the Valley/Mill Pond Area.

Maximum VOC concentrations at the Groveland Site were detected in groundwater samples from monitoring wells screened/installed in the deep overburden/shallow bedrock strata of Area B near the Valley property and the Mill Pond/Johnson Creek Area (Subarea B-3). Total VOC concentrations ranged between 100 ug/L and 50,000 ug/L (monitoring well TW-25). Seven VOCs were detected in the groundwater including: 1,1-dichloroethene, 1,1-dichloroethane, trichloroethene, benzene, tetrachloroethene, toluene and xylene.

Second-round monitoring data (Table 4) correspond with the first-round data. However, total VOC concentrations reported for deep overburden/shallow bedrock monitoring wells located in Area B, but beyond the immediate Mill Pond/Johnson Creek surface water bodies (Subarea B-4), are generally less than 10 ug/L. Only the TCE concentration detected in monitoring well ERT-16 (first-round result, C=6 ug/L) exceeds a current primary MCL.

Except for the detection of 1 ug/L xylene (first-round result), VOCs were not detected in deep bedrock well 107, which is located along Johnson Creek downgradient of the Mill Pond (Subarea B-5). However, no other deep bedrock wells are located in Area B.

The Supplemental MOM RI results confirm previous monitoring results for the Groveland Wells Site. All results suggest that a VOC groundwater contaminant plume extends from the Valley property. The TCE groundwater contaminant plume is displayed on Figures 7 and 8. As depicted on these figures, the center of the contaminant plume migrates steeply downward from the shallow overburden to the deep overburden/shallow bedrock strata. The plume is narrow and most of the contamination is found in wells located near Johnson Creek and Mill Pond. Generally, contaminant concentrations decrease with increasing distance from the

Valley property (i.e., toward the Merrimack River). The pattern of contamination noted in Area B is consistent with our current knowledge of the hydrogeologic conditions at the Groveland Wells Site (discussed in Section I).

The following inorganics were detected in one or more Area B monitoring wells at concentrations exceeding current or proposed primary MCLs:

- Arsenic - C_{max} = 281 ug/L
- Beryllium - C_{max} = 7.5 ug/L
- Chromium - C_{max} = 124 ug/L
- Lead - C_{max} = 113 ug/L
- Nickel - C_{max} = 240 ug/L

As discussed previously, chromium and lead concentrations detected in background monitoring well ERT-12A also approach or exceed MCLs. In contrast to the VOC contamination noted, inorganics concentrations in excess of current primary MCLs were not detected in monitoring wells located in the deep overburden/shallow bedrock strata near the Mill Pond/Johnson Creek Area.

Area C - The Station No. 1 Area

Tables 5, 6 and 7 summarize the groundwater monitoring results for Area C. The Station No. 1 Area is north of Mill Pond and roughly encompasses the current capture area of Station No. 1. It extends to Area D in the west, to Area B in the south, and just beyond the Massachusetts Electric Company right-of-way (former railroad right-of-way) to the north and east. The area is bounded to the south by an unnamed brook flowing easterly and entering Johnson Creek north of Mill Pond and to the north by the Merrimack River. The area includes monitoring wells along Argilla Brook but not those associated with the Haverhill Municipal Landfill.

With one exception, VOC concentrations in Area C monitoring wells do not exceed 100 ug/L. The total VOC concentration reported for the second-round groundwater sample collected from monitoring well 106 was 178 ug/L. Six VOCs were detected in the monitoring wells located in the shallow/deep overburden near Johnson Creek including: 1,2-dichloroethene, trichloroethene, toluene, ethylbenzene, tetrachloroethene, and xylene. However, only TCE, PCE, and 1,2-DCE were detected at concentrations in excess of current/proposed primary MCLs.

The maximum concentrations of TCE and 1,2-DCE were found in monitoring wells 106 and 117, respectively. In contrast to first-round results, VOCs were detected in all second-round samples from the monitoring well cluster located below the confluence of the unnamed brook and Johnson Creek (103/104/105/117).

Total VOC concentrations in Area C monitoring wells beyond the immediate vicinity of Johnson Creek generally do not exceed 10 ug/L. Four VOCs were detected in first-round groundwater samples collected (1,1,1-TCA; 1,2-DCA; 1,2-DCE; and TCE). VOCs, TCE and 1,2-DCE, were also detected in two of three second-round monitoring wells sampled (wells 114, 112). However, TCE was the only VOC detected in a monitoring well at a concentration higher than the current primary MCL. TCE (first-round result C_{max}=9 ug/L) was detected in monitoring well 114, which is located approximately midway between Johnson Creek and Argilla Brook. Monitoring well 114 was installed to determine the location of a groundwater divide between the drainage areas of Argilla Brook and Johnson Creek. Except for well 112, the monitoring wells installed in the deep overburden near Station No. 1 (wells 111, 110, 112) do not show VOC contamination. The maximum TCE concentration detected in well 112 was 2 ug/L. VOC contamination was not detected in the deep overburden well 113 or shallow bedrock well 109. These wells are located beyond the vicinity of Station No. 1. TCE was detected in monitoring well 115 at 2 ug/L. These wells were installed to define hydrological conditions during the pump test, check for additional sources of VOC contamination near Station No. 1, and characterize the VOC contamination (if present) in the deep overburden and/or shallow bedrock near Station No. 1 and the area between Johnson Creek and Station No. 1.

The results of the Supplemental MOM RI suggest that the VOC plume in Area C extends to the east of well 114 and to the north of ERT-21. Hydrogeologic conditions at the Site suggest these wells are within the plume associated with the Valley /Mill Pond Area.

The following metals were detected in groundwater samples collected from one or more Area C monitoring wells at concentrations exceeding current or proposed primary MCLs:

- Arsenic - C_{max} = 79.6 ug/L (MW-111)
- Barium - C_{max} = 1,100 ug/L (MW-111)
- Beryllium - C_{max} = 12 ug/L (MW-105)
- Cadmium - C_{max} = 57.3 ug/L (ERT-21)
- Chromium - C_{max} = 1,230 ug/L (MW-111)
- Lead - C_{max} = 364 ug/L (MW-105)
- Nickel - C_{max} = 876 ug/L (MW-105)

The pattern of the inorganic contamination in Area C wells was similar to that of Area B. Inorganics concentrations in excess of current primary MCLs were not detected in monitoring wells located in the deep overburden/shallow bedrock wells.

Area D - The Haverhill Landfill

The results of the sampling and analysis of groundwater samples collected from wells associated with the Haverhill Landfill are presented in Tables 8 and 9. The Haverhill Municipal Landfill Area includes the area between the eastern fringe of the landfill to Johnson Creek on the east. The southern part of Area D abuts Area B at the unnamed brook that empties into Johnson Creek, while the northern boundary is the Massachusetts Electric Company right-of-way (former railroad right-of-way). The following wells are located in the deep overburden downgradient of the Landfill: B-1, ERT-4, ERT-20, ERT-19, and 116.

VOCs were detected above sample quantitation limits in two of the five Area D wells. B-1 was the most heavily contaminated monitoring well. In contrast to other monitoring wells sampled at the Groveland Wells Site, the aromatic hydrocarbons were the principal contaminants detected in B-1:

- Benzene - C_{max} = 17 ug/L
- Toluene - C_{max} = 5 ug/L
- Chlorobenzene - C_{max} = 20 ug/L
- Ethylbenzene - C_{max} = 18 ug/L
- Total Xylenes - C_{max} = 86 ug/L

It should be noted that the aromatic hydrocarbons were not detected in the three landfill monitoring wells sampled during the second round (ERT-4, ERT-19, 116).

Benzene, a Class A carcinogen, was the only aromatic hydrocarbon detected at a concentration in excess of a current MCL. Several inorganics were detected in one or more groundwater samples at concentrations exceeding current/proposed standards.

TCE was detected in one second-round monitoring well at a concentration exceeding the current standard. The iron concentration (C=20,700 ug/L) was also elevated in the monitoring well sample containing the maximum arsenic concentration.

Mill Pond Extraction System

Monthly sampling data of the Mill Pond extraction and treatment system (performed by Valley) from April 1988 to September 1990 reflect the contaminant movement and distribution over time as well as the impact of the extraction system. These results are summarized in the following discussion.

The Mill Pond system monitoring records for this 2-1/2 year period report TCE and 1,2-DCE concentrations in the air stripper influent (extraction wells G-1 and G-2) and the effluent, as well as five lateral monitoring wells near the extraction system (DEQE 1-3, DEQE 1-4, DEQE 5, DEQE 6, and DEQE 9).

Of the two extraction wells, yearly average TCE concentrations in G-1 have dropped significantly since the system startup in 1988 (from 1160 ug/L to 210 ug/L). Average 1,2-DCE concentrations have decreased somewhat from the 2890 ug/L observed in the first year of operation but remained consistently high at 1750 ug/L during the last 9 months of operation. However, in G-2, TCE and 1,2-DCE concentrations have remained at fairly constant levels throughout the 30 months, at approximately 1300 ug/L and 600 ug/L, respectively.

TCE levels in the treatment system effluent have remained for the most part under the 100 ug/L discharge limitation, while DCE levels have remained somewhat above 100 ug/L. There is no discharge limitation for DCE.

TCE levels have decreased substantially in deep overburden wells DEQE 1-3, DEQE 5, and DEQE 6. Both DEQE 1-3 and DEQE 6 are downgradient wells, while DEQE 5 is positioned just east of the extraction wells. Levels in well DEQE 1-4, a shallow bedrock well, remain consistently high. DEQE 9 is a shallow overburden well that yields low levels of TCE throughout the sampling period.

Over the 2-1/2 year period, levels of 1,2-DCE have decreased in DEQE 1-4, DEQE 5, and DEQE 6, while remaining consistent in wells DEQE 1-3, and DEQE 9.

It should be noted that the averages of reported TCE and 1,2-DCE concentrations in these wells for the first 9 months of 1990 range from 300 to 9800 ug/L, and from 89 to 1830 ug/L, respectively, excluding DEQE 9, which has exhibited low concentrations consistently.

Results of the Mill Pond extraction system monitoring reflect the general contamination distribution pattern revealed in Supplemental MOM RI results for the Valley/Mill Pond Area. That is, the highest contaminant levels are found in the deep overburden/shallow bedrock, with lower but significant contaminant levels observed in deeper bedrock. Generally, low levels of contamination have been found in the shallow overburden. During the 30 months of operation, a downward trend is observed in the TCE levels in the overburden wells monitored. The bedrock well TCE levels are not affected significantly by the extraction system operation. Although the extraction wells are situated in deep overburden directly in the plume area, the most concentrated part of the plume appears to be traveling in shallow bedrock under the extraction system's capture zone. It should be noted that a downward trend in TCE concentrations is reported for NUS-5, a shallow bedrock well located 150 feet east of G-1 and clearly beyond the capture zone of the Mill Pond extraction system. The downward trend in TCE concentrations in monitoring well NUS-5 may be attributable to contaminant source depletion and renovation of the aquifer (dilution, contaminant biodegradation). TCE levels have steadily decreased in this well since July 1987 from an average of 1950 ug/L to 450 ug/L in July 1990.

Summary of Groundwater Quality

Based on two rounds of groundwater monitoring, the principal contaminants in the groundwater are the volatile organic compounds. Chlorinated hydrocarbons, such as TCE and 1,2-DCE, were the VOCs most frequently identified in the groundwater. The observed contamination is not uniform across the Site. A VOC contaminant plume extends from the Valley property. The plume is oriented north-south, with the long axis parallel to Johnson Creek. The center of the VOC contaminant plume migrates steeply downward to the deep overburden/shallow bedrock strata in the Valley/Mill Pond Area. TCE and 1,2-DCE contamination as high as 50,000 ug/L and 2,000 ug/L, respectively, were detected near the Valley property. Generally, VOC concentrations in the groundwater beyond the immediate vicinity of the Valley property and Mill Pond are lower than 100 ug/L.

Low-level (<100 ug/L) VOC concentrations were detected in one monitoring well located downgradient of the Chesterton facility. TCE (6 ug/L) and PCE (21 ug/L) concentrations reported for the first-round monitoring samples exceeded current MCLs. The groundwater contamination associated with the Chesterton property appears to be separate and distinct from that observed downgradient of the Valley property.

Several aromatic hydrocarbons (e.g., benzene), 1,2-DCE, and TCE were detected in at least one monitoring well located downgradient of the Haverhill Municipal Landfill. However, benzene and TCE were the only organics detected at concentrations exceeding a current MCL. In contrast to contaminant concentrations reported for the Valley/Mill Pond Area, the VOC contamination observed in wells downgradient of the Haverhill Landfill may be described as low-level (generally <100 ug/L) and sporadic.

Several inorganics were detected in the groundwater at concentrations exceeding current primary MCLs. Concentration of chromium, lead, aluminum, and iron in background and upgradient monitoring wells also exceed or approach MCLs. In contrast to the VOC contamination noted in the deep overburden/shallow bedrock wells, inorganics concentrations in excess of current primary MCLs were not detected in monitoring wells located in those wells.

The landfill cannot be discounted as a source of inorganic and VOC contamination in Areas C and D. Several inorganics were detected in groundwater samples at concentrations exceeding current/proposed standards. However, the available data indicates that the landfill is a minor VOC contaminant source. As noted above, the landfill has been listed as a separate CERCLA site, and remediation of contamination at the landfill will be accomplished through a separate CERCLA response action.

Organic and inorganic contaminants detected at concentrations greater than MCLs are shown in Figures 10 and 11, respectively.

B. Surface Water and Sediments

This section summarizes the results of the sampling and analysis of surface water and sediments collected from 15 locations along Johnson Creek, Brindle Brook, and Argilla Brook. These streams, Mill Pond and the gravel operation (impoundment near Trimount) are the surface water bodies potentially affected by contaminants migrating from the three potential contaminant source areas at the Groveland Wells Site. Selected results of the sampling and analysis of surface waters/sediments are displayed on Figures 12, 13 and 14.

Fifteen (15) surface water (SW) and 14 sediment (SD) samples were collected during the first-round. Eight surface water and eight sediment samples were collected during the second round of sampling. The results of the surface water and sediment monitoring conducted at the Groveland Site are summarized in Tables 10 and 11.

VOCs were detected in surface water samples collected at eight sampling locations along Johnson Creek. VOCs were not detected in background surface water samples (9, 11) or at sampling locations along Brindle Brook or Argilla Brook. The highest total VOC concentrations were detected at the Mill Pond outlet (total VOCs = 54.6 ug/L) and at the treatment system discharge below Mill Pond (total VOCs=150 ug/L). Total VOC concentrations detected at other sampling locations were generally less than 10 ug/L. TCE was the most frequently detected VOC.

The following table compares maximum VOC concentrations in the surface water samples to available Ambient Water Quality Criteria ("AWQC"):

Chemical	No of Positive[1] Detect./ No. of Samples	Range[1] (ug/L)	AWQC (Freshwater) Chronic (ug/L)	AWQC (Freshwater) Acute (ug/L)
Methylene chloride	1/15	44	NA	11,000[2]
1,2-dichloroethene	3/15	0.5-96	NA	NA
Chloroform	1/15	3	1,240	28,900
1,2-dichloroethane	1/15	0.6	20,000	118,000
1,1,1-trichloroethane	2/15	0.7-1	9,400[3]	18,000
Trichloroethene	9/15	0.7-56	21,900	45,000
Benzene	1/15	0.6	NA	5,300
Toluene	1/15	10	NA	17,500

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(1) First-round monitoring data presented.
(2) Halomethanes in general.
(3) Chronic value for 1,1,1-trichloroethane.
NA Not available.

A review of available AWQC for the protection of aquatic life indicates that organics concentrations detected in the surface water samples are below available AWQC.

Metals concentrations detected in the surface waters of the lower Johnson Creek watershed occasionally exceed AWQC or AWQC lowest-observed-effect levels ("LOEL") for the protection of aquatic life in surface water. Table 22 compares the metals concentrations detected to background concentrations and available standards/criteria.

Volatile organic compounds (MC, acetone, PCE) were detected in first-round sediment samples from one location on Brindle Brook (downstream of the Chesterton Facility), three locations along Johnson Creek (downstream of Valley), and two locations along Argilla Brook. In contrast to surface water results, TCE and 1,2-DCE were not detected in first-round sediment samples. PCE, a contaminant associated with the Chesterton Facility, was detected in one first-round sample downstream of Chesterton at 5 ug/kg. Acetone was detected (C=19-140 ug/kg) at three locations on Johnson Creek downstream of the Valley property and at two locations on Argilla Brook.

1,2-DCE was detected in one second-round sediment sample (SD-05) located downstream of Mill Pond. MC, acetone, and PCE were not detected in second-round samples. Total VOC concentrations were highest in sediments collected at the Mill Pond inlet (C=140 ug/kg) and the Argilla Brook (C_{max}=94 ug/kg) sampling locations. In general, the VOC contamination in the sediments may be described as low-level (total VOCs less than 150 ug/kg) and sporadic.

Polynuclear aromatic hydrocarbons ("PAH") and phthalate esters were the principal semivolatile organics detected in sediments from the lower Johnson Creek watershed. Except for sample location SD-4, PAH and phthalate ester concentrations are higher in the background samples than actual Site location samples. Because SD-4 is just below the location where Main Street crosses Johnson Creek, run-off from the road may be affecting sample location SD-4. PAHs are produced by the combustion process and, consequently, are frequently found along roadways traversed by motor vehicles.

A review of the data presented in Table 11 indicates that the inorganic concentrations detected in Site sediment samples generally reflect background conditions for the Groveland Wells Site.

Summary of Surface Water and Sediment Quality

Sediment and surface water contamination at the Site is low level and sporadic. VOC contamination in surface water and sediment are below available AWQC and therefore represent minimal risk. Metals concentrations detected in surface water occasionally exceed AWQC, but EPA does not believe they are Site-related and represent minimal risk to the majority of the aquatic community. Inorganic concentrations detected in sediment appear to reflect background for the Site.

Other than as discussed above, and except for soil contamination on the Valley property (and possibly on the Chesterton property and at the Haverhill Municipal Landfill), no other media are affected by the contamination on the Groveland Wells Site.

A complete discussion of Site characteristics can be found in the Supplemental MOM RI at Pages 4-1 through 4-85.

VI. SUMMARY OF SITE RISKS

The Supplemental MOM RI includes a Public Health Risk Assessment and an Ecological Risk Assessment. The objective of these assessments was to define potential risks to human health and the environment arising from the contaminants at the Site. These assessments are summarized below.

A. Public Health Risk Assessment

A Public Health Risk Assessment was performed to estimate the probability and magnitude of potential adverse human health and environmental effects from exposure to contaminants associated with the Site. The public health risk assessment followed a four step process: (1) contaminant identification, which identified those hazardous substances which, given the specifics of the site, were of significant concern; (2) exposure assessment, which identified actual or potential exposure pathways, characterized the potentially exposed populations, and determined the extent of possible exposure; (3) toxicity assessment, which considered the types and magnitude of adverse health effects associated with exposure to hazardous substances; and (4) risk characterization, which integrated the three earlier steps to summarize the potential and actual risks posed by hazardous substances at the site, including carcinogenic and non-carcinogenic risks. The results and conclusions of the public health risk assessment for the Groveland Site are discussed below.

Twenty-six (26) contaminants of concern, listed in Table 12 of this Record of Decision, were selected for evaluation in the risk assessment. These contaminants constitute a representative subset of the more than thirty-eight (38) contaminants identified at the Site during the Supplemental MOM RI. The twenty-six (26) contaminants of concern were selected to represent potential Site-related hazards based on toxicity, concentration, frequency of detection, and mobility and persistence in the environment. A summary of the health effects of each contaminant of concern can be found in Section 6.2.2 of the risk assessment.

Potential human health effects associated with exposure to the contaminants of concern were estimated quantitatively through the development of several hypothetical exposure pathways. These pathways were developed to reflect the potential for exposure to hazardous substances based on the present uses, potential future uses, and location of the Site. The following is a brief summary of the exposure pathways evaluated. A more thorough description can be found in Section 6.4 of the Supplemental MOM RI.

For each exposure pathway, the frequency and duration of exposure was evaluated. Exposures to adults for each medium were evaluated quantitatively while those for a child were evaluated qualitatively. For contaminated groundwater, an adult and child (3-6 years) were assumed to consume 2 and 1 liter of groundwater per day throughout the year for 70 and 4 years, respectively. Accidental ingestion and dermal contact with surface water and dermal contact with sediments was evaluated for an adult and child (9-15 years) assuming each would swim in the pond 2 hours per day, 24 days per year for 70 years (for the adult) and seven years (for the child). Ingestion of finfish taken from the lower Johnson Creek Watershed was evaluated for an adult and child assuming that 20 percent of all fish consumed by these populations were derived from the Johnson Creek Watershed and that 6.5 g of fish were ingested per day per year for 70 years.

Excess lifetime cancer risks were determined for each exposure pathway by multiplying the exposure level with the chemical specific cancer potency factor. Cancer potency factors have been developed by EPA from epidemiological or animal studies to reflect a conservative "upper bound" of the risk posed by potentially carcinogenic compounds. That is, the true risk is very unlikely to be greater than the risk predicted. The resulting risk estimates are expressed in scientific notation as a probability (e.g., 1×10^{-6} for 1/1,000,000) and indicate (using this example) that an individual is not likely to have greater than a one in a million chance of developing cancer over 70 years as a result of site-related exposure as defined to the compound at the stated concentration. Current EPA practice considers carcinogenic risks to be additive when assessing exposure to a mixture of hazardous substances.

The hazard index was also calculated for each pathway as EPA's measure of the potential for non-carcinogenic health effects. The hazard index is calculated by dividing the exposure level by the reference dose ("RfD") or other suitable benchmark for non-carcinogenic health effects. Reference doses have been developed by EPA to protect sensitive individuals over the course of a lifetime and they reflect a daily exposure level that is likely to be without an appreciable risk of an adverse health effect. RfDs are derived from epidemiological or animal studies and incorporate uncertainty factors to help ensure that adverse health effects will not occur. The hazard index is often expressed as a single value (e.g., 0.3) indicating the ratio of the stated exposure as defined to the reference dose value (in this example, the exposure as characterized is approximately one third of an acceptable exposure level for the given compound). The hazard index is only considered additive for compounds that have the same or similar toxic endpoints (for example: the hazard index for a compound known to produce liver damage should not be added to a second whose toxic endpoint is kidney damage).

1. Groundwater

a. Area A - Chesterton Property

Table 13 depicts the cumulative carcinogenic risk and hazard indices, respectively, posed by ingestion of groundwater in areas A, B, C and D. The Reasonable Maximum Exposure ("RME") total cancer risk predicted for the shallow bedrock is 3×10^{-3}. A RME scenario was not presented for the shallow overburden because only one well was sampled for this depth. The average risk estimates for the shallow overburden and shallow bedrock areas are 1.9×10^{-3} and 1.5×10^{-3}, respectively. The compound that contributes most significantly to these carcinogenic risk estimates is arsenic in every case. The average case and RME scenarios for each subarea in Area A exceeds the Superfund target risk range of 10^{-4} to 10^{-6}.

A summation of all average case and RME hazard indices ("HI") for every subarea at the Chesterton Facility area results in a value greater than unity. When segregated by toxic endpoint, however, only the target organs for skin and liver exceed unity with HIs of 1.6 and 1.4, respectively. The greatest contributor to the HI for skin is arsenic and for the liver is chromium.

Maximum Contaminant Levels ("MCLs") or Proposed Maximum Contaminant Levels ("PMCLs") were exceeded for the following compounds identified in either the shallow overburden or shallow bedrock from Area A: trichloroethene, tetrachloroethene, arsenic, chromium and nickel.

b. Area B - The Valley/Mill Pond Area

The RME total cancer risk predicted for the shallow bedrock, downgradient of Valley (Subarea B-1), shallow overburden in the Valley/Mill Pond Area (Subarea B-2), deep overburden/shallow bedrock in the immediate vicinity of Valley and Johnson Creek (Subarea B-3), and the Deep overburden/shallow bedrock beyond Johnson Creek (subarea B-4) is 3.5×10^{-3}, 3.4×10^{-4}, 1.7×10^{-2} and 1.5×10^{-2}, respectively. The average risk estimates for subareas B-1 through B-4 are 2.8×10^{-3}, 2.0×10^{-3}, 2.6×10^{-3} and 1.5×10^{-2}, respectively. The compound which contributes most significantly to carcinogenic risk estimates in Subarea B-1 is trichloroethene, in Subarea B-2 is arsenic and beryllium, in Subarea B-3 is trichloroethene and arsenic and in Subarea B-4 is arsenic and beryllium. The average case and RME scenarios for every subarea in Area B exceed the Superfund target risk range of 10^{-4} to 10^{-6}.

A summation of all average case and RME hazard indices for every subarea in Area B results in a value greater than unity. When segregated by toxic endpoint, subarea B-1 exceeds a hazard index of unity for the target endpoint of blood in both the average case (7.0) and the RME scenario (12.6). The sole contributor to this hazard index is 1,2-dichloroethene. For subarea B-2 a hazard index of 1 is exceeded for toxic endpoints of blood (RME-4.5 and average case-3.4), and skin (RME only-1.4). The major contributor to the HI for the toxic endpoint of blood is antimony and for skin is arsenic. For subarea B-3 a hazard index of 1 is exceeded for the toxic endpoint of blood for both the RME (6.6) and average case (1.7). The major contributor to these HIs is 1,2-dichloroethene. For subarea B-4 a hazard index of 1 is exceeded for the toxic endpoints of skin for both the RME (8.0) and average case scenario (8.0). The major contributor to these HIs is arsenic.

MCLs or PMCLs were exceeded for the following compounds in all of the four subareas: 1,2-dichloroethene, trichloroethene, 1,1-dichloroethene, antimony, beryllium, tetrachloroethene, arsenic, and nickel.

c. Area C - The Area North of Mill Pond

The RME total cancer risk predicted for the shallow/deep overburden near Johnson Creek (C-1) and for the shallow/deep overburden beyond Johnson Creek (C-2) was 3 x 10^{-3} and 5.2 x 10^{-3}, respectively. The average risk estimates for subareas C-1 and C-2 were both 1.1 x 10^{-3}. Compounds which contribute most significantly to these risk estimates are arsenic and beryllium for every scenario. The average case and RME scenarios for each subarea in Area C exceed the Superfund target risk range of 10^{-4} to 10^{-6}.

A summation of all average case and RME hazard indices for every subarea in Area C produces a value greater than unity. When segregated by toxic endpoint, however, results from round one sampling indicate that a target hazard index of one is exceeded in Subarea C-1 for the RME scenario for the target endpoints of skin and kidneys due solely to arsenic and cadmium, respectively. For the same depth in Subarea C-2, a hazard index of one is exceeded for the target endpoints of blood in both the average case and RME scenario due mainly to antimony and barium. For the RME scenario a hazard index of one is exceeded for liver and skin due solely to chromium and arsenic. Second round monitoring data produces similar results.

MCLs or PMCLs were exceeded for the following chemicals: trichloroethene, antimony, arsenic, barium, beryllium, cadmium, chromium, iron, nickel, selenium and aluminum.

d. Area D - The Haverhill Municipal Landfill Area

The RME total cancer risk predicted for the deep overburden (first and second round data) was 5 x 10^{-3} and 2 x 10^{-2}, respectively. The average cancer risk estimates for sampling round one and two were 3 x 10^{-3} and 9 x 10^{-3}, respectively. The major contributor to this risk was arsenic in both scenarios. The average case and RME scenarios for both sampling rounds of data in the deep overburden in Area D exceed the Superfund target risk range of 10^{-4} to 10^{-6}.

A summation of all average case and RME hazard indices for both sampling rounds of data in area D exceeds unity. Only two target endpoints exceeded a hazard index of one when segregated by similar endpoint. The first is the liver for second round data in the RME scenario, with chromium being the major contributor. The second is the HI for skin which exceeds unity in every scenario for both first and second round data, due solely to arsenic.

MCLs or PMCLs are exceeded for the following compounds in Area D; trichloroethene, arsenic, beryllium, cadmium, chromium, nickel, iron and aluminum.

2. Surface Water

Tables 14 and 15 depict the carcinogenic and non-carcinogenic risk, respectively, posed by the current potential accidental ingestion of contaminants in surface water, for the RME scenario. Exposure parameters for both present and future scenarios are assumed to be the same, thus there is one calculation for surface water. Exposure to this medium can occur through dermal contact and ingestion. Tables 16 and 17 depict the carcinogenic and non-carcinogenic risk, respectively, posed by dermal exposure to contaminants in surface water for the RME scenario. Exposure parameters for both present and future scenarios are assumed to be the same, thus there is one calculation. Cancer and non-cancer effects associated with all surface water exposures are within Superfund's target risk range.

3. Sediment

Table 18 and 19 depict the carcinogenic and non-carcinogenic risks, respectively, posed by current and future exposures to sediment in the lower Johnson Creek watershed through the dermal route for the RME. Exposure parameters for both present and future scenarios are assumed to be the same, thus there is one calculation. Both cancer and non-cancer effects associated with exposure to sediments are within the EPA's Superfund target risk range.

4. Fish

Tables 20 and 21 depict the carcinogenic and non-carcinogenic risk, respectively, posed by the current and future potential consumption of fish taken from the lower Johnson Creek for the RME. Exposure parameters for both present and future scenarios are assumed to be the same, thus there is one calculation. Both cancer and non-cancer effects associated with fish ingestion are within EPA's target risk range.

5. Uncertainty in Risk Assessment

Carcinogenic and non-carcinogenic health risks are estimated using various assumptions; therefore, the values presented in this section contain an inherent amount of uncertainty. The extent to which health risks can be characterized is primarily dependent upon the accuracy with which a chemical's toxicity can be estimated and the accuracy of the exposure estimates. The toxicological data that form the basis for all risk assessments contain uncertainty in the following areas:

- The extrapolation of non-threshold (carcinogenic) effects from the high doses administered to laboratory animals to the low doses received under more common exposure scenarios.
- The extrapolation of the results of laboratory animal studies to human or environmental receptors.
- The interspecies variation in toxicological endpoints used in characterizing potential health effects resulting from exposure to a chemical.
- The variations in sensitivity among individuals of any species.

6. Summary of Site Risks to Public Health

Actual or threatened releases of hazardous substances from this Site, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to public health, welfare, or the environment. The media which is the focus for remedial actions for this Record of Decision is the contaminated groundwater.

The surficial aquifer in the general contaminant plume area is classified as a Class I aquifer by the Commonwealth of Massachusetts (314 CMR § 6.03), which is groundwater designated as a source of potable water supply.

Under the EPA Groundwater Classification System [EPA Groundwater protection Strategy ("GWPS"), Office of Groundwater Protection, August 1984], this aquifer is classified as a Class II. The policy under the GWPS establishes protection goals based on the "highest beneficial uses to which groundwater having significant water resources value can presently or potentially be put." The aquifer in the general contaminant plume area is considered a current drinking water source since groundwater is used for drinking within a two-mile radius of the Site (the classification review area).

The threat to public health posed by the contaminated groundwater plume represents a possible future threat since groundwater in the general plume area is not known to be consumed owing to the availability of the public water supply. However, the threat to public health posed by the contaminated groundwater plume could also represent a future threat if the water withdrawn at Station No. 1 were to increase beyond its present rate, thereby drawing the contaminated plume to itself, or if additional drinking water wells were placed into the aquifer. However, as previously mentioned, Station No. 1 is presently equipped with granular activated carbon treatment to remove VOCs from the groundwater, so the resultant risk would be minimal. This remedial action will address the principal future threat to human health posed by the contaminant plume, namely the possible ingestion, inhalation and dermal adsorption from multiple household uses of potable groundwater.

B. Ecological Risk Assessment

The ecological risk assessment is based on data collected during the Supplemental MOM RI and information in the existing literature. No population studies, bioassays, or biomonitoring were performed in conjunction with this project.

1. Source Characterization

Contaminants in the surface water and sediment are important for the characterization of Site ecological risks. Groundwater contaminants are less important and have not been considered. Discharge of contaminated groundwater to surface water bodies could result in ecological effects. However, direct surface water and sediment sample analysis have provided sufficient data to characterize such potential impacts.

VOC contamination in surface waters and sediments may be described as low-level and sporadic. TCE and 1,2-DCE were detected in surface water samples at maximum concentrations of 54 ug/L and 96 ug/L, respectively. TCE and 1,2-DCE were detected in surface water sample collected below the discharge of the Mill Pond groundwater extraction system. These and other VOCs have been detected in surface water and sediments throughout the watershed. Chemicals detected in surface water and sediments from the lower Johnson Creek watershed during the remedial investigation are listed in Table 7-1 of the Supplemental MOM RI.

A review of available Ambient Water Quality Criteria ("AWQC") for the protection of aquatic life indicates that organics concentrations detected in the surface water samples are below available AWQC. Concentrations of aluminum, silver, iron and lead detected in the surface waters of the lower Johnson Creek watershed exceed AWQC for the protection of aquatic life in surface water. The in-text table found in Section V of the ROD and Table 22 compares the detected organic and inorganic concentrations, respectively, to available standards/criteria.

2. Habitat And Potential Receptors

This section briefly describes the habitat types present within the Site and identifies potential animal and plant receptors. This information has been compiled from field observations and data collected during sampling conducted during the Supplemental MOM RI and other recent activities at the Site.

Two types of wetland habitat, ponds and streams, are known to exist within the Site. Streams include Argilla and Brindle Brook, Johnson Creek, and the Merrimack River. Ponds include Mill Pond and the Trimount impoundment.

The 1985 Groveland Wells Site Remedial Investigation Report (ERT, 1985) identified three wetland types present in the study area: Ponds, Bordering Vegetative Wetlands ("BVW"), and Kettle Depressions. The 1987 Massachusetts Wetland Protection Regulations (310 CMR 10.0) further define wetland types. The wetland resource areas present at the Site, as defined by these regulations, include BVW (including marshes and swamps), Land Under Waterbodies and Waterways (creeks, streams and ponds), Banks, and Land Subject to Flooding.

Each aquatic habitat (ponds and streams) selected to represent the Site for this assessment includes all of the local wetland resource areas as defined by 310 CMR 10.0. There is a significant marsh area (BVW) associated with Mill Pond; this habitat is evaluated in concert with the pond.

a. Ponds and Marshes

There are two manmade surface water impoundments within the watershed: Mill Pond and the Trimount impoundment, which is located immediately north of Main Street adjacent to Trimount Bituminous Products. Mill Pond is surrounded on three sides by a marshy area dominated by purple loosestrife, cattails and numerous sedges. Although this marsh is relatively dry in the summer months, spring flooding is extensive. Johnson Creek meanders through the center of this marsh, serving as the primary influent to Mill Pond.

The Trimount impoundment has no associated marsh, but is surrounded by a woodland to the east and a field and "edge" to the west. Farther to the west is the active gravel and asphalt operation known as Trimount Bituminous Products. This operation is active during the summer and early fall. Therefore, the pond is not anticipated to provide extensive breeding habitat for birds or other species requiring privacy from human activities and noise. This pond is, however, an optimal area for amphibians, reptiles and invertebrates.

Both impoundments are relatively stagnant; they are prone to aquatic vegetation growth although significant vegetative growth was not observed in the Trimount impoundment during field activities. This pond may have been under considerable stress in the past as a result of pumping and graveling operations. Therefore, the pond bottoms may not sustain vegetative growth.

b. Streams

Four small streams exist within the study area: Brindle Brook, Johnson Creek, an unnamed brook which is a tributary to Johnson Creek south of the Haverhill Landfill, and Argilla Brook. These streams range in width from 6 to 12 feet and in depth from 4 feet during spring runoff to less than 6 inches during mid-summer drought conditions.

It is expected that small fish travel in these streams between the impoundments and the Merrimack River. Recreational fishing for trout and other warm water species is reported in both Johnson Creek and the Merrimack River. The catadromous american eel has been found to use Johnson Creek and Argilla Brook for adult habitat (NOAA, 1988).

c. Merrimack River

The Merrimack River has been noted to be an important breeding and migratory habitat for numerous commercial species of fish, including striped bass, alewife, blueback herring, and atlantic salmon (NOAA, 1988). The River basin also has been reported to serve as wintering grounds for bald eagles and is important as a summer breeding and feeding habitat for other soaring predatory birds.

d. Trustee Resources and Rare and Endangered Species

The Massachusetts Natural Heritage Program was contacted in July 1990 with respect to rare and endangered species visiting or residing in the Site area. In August 1990, representatives of the Natural Heritage Program responded that two state-listed species were known to be present near the Groveland Wells Site.

The wood turtle (Clemmys insculpta) is classified as a species of special concern and the Blandings turtle (Emydoidea blandingii) is classified as a threatened species. Both species are known to exist to the southeast of the Site. The Massachusetts Natural Heritage Program also stated that the "Argilla Brook and surrounding forested area provide the habitat necessary for these turtles' survival."

The Massachusetts Division of Fisheries and Wildlife regulations (321 CMR 8.01) identify a threatened species as any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range. These regulations identify species of special concern as any native species which has been documented to be suffering a decline such that the species in the Commonwealth could be threatened, or which occurs in such small numbers or within such a restricted distribution that it could become threatened in the Commonwealth.

3. Conclusions

Sediment and surface water contamination at the Site is low level and sporadic and do not appear to present a risk to the environment. VOC contamination in surface water and sediment are below available AWQC and therefore represent minimal risk. Metals concentrations for aluminum, sliver, iron and lead detected in surface water occasionally exceed AWQC, but EPA does not believe they present a risk to the majority of the aquatic community. Inorganic concentrations detected in sediment appear to reflect background for the Site.

VII. DEVELOPMENT AND SCREENING OF ALTERNATIVES

A. Statutory Requirements/Response Objectives

Under its legal authorities, EPA's primary responsibility at Superfund sites is to undertake remedial actions that are protective of human health and the environment. In addition, Section 121 of CERCLA establishes several other statutory requirements and preferences, including: a requirement that EPA's remedial action, when complete, must comply with all federal and more stringent state environmental standards, requirements, criteria or limitations, unless a waiver is invoked; a requirement that EPA select a remedial action that is cost effective and that uses permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable; and a preference for remedies in which treatment permanently and significantly reduces the volume, toxicity or mobility of the hazardous substances is a principal element over remedies not involving such treatment. Response alternatives were developed to be consistent with these Congressional mandates.

Based on preliminary information relating to types of contaminants, environmental media of concern, and potential exposure pathways, remedial action objectives were developed to aid in the development and screening of alternatives. These remedial action objectives were developed to mitigate future potential threats to public health and the environment.

These response objectives were:

- To prevent ingestion of groundwater contamination in excess of relevant and appropriate drinking water standards [MCLs/MCLGs/Massachusetts Drinking Water Standards(MMCLs)] or, in their absence, an excess cancer risk level of 10^{-6}, for each carcinogenic compound. Also, to prevent ingestion of groundwater contaminated in excess of a total excess cancer risk level for all carcinogenic compounds of 10^{-4} to $10^{-}6$.

- To prevent ingestion of groundwater contaminated in excess of relevant and appropriate drinking water standards for each non-carcinogenic compound and a total Hazard Index greater than unity (1) for non-carcinogenic compounds having the same target endpoint of toxicity.

- To restore the groundwater aquifer to relevant and appropriate drinking water standards (MCLs/MCLGs/MMCLs) or, in their absence, the more stringent of an excess cancer risk of 10^{-6}, for each carcinogenic compound or a hazard quotient of unity for each non-carcinogenic compound. Also, restore the aquifer to the more stringent of (1) a total excess cancer risk of 10^{-4} to 10^{-6} or (2) a hazard index not to exceed an acceptable range for non-carcinogenic compounds having the same target endpoint of toxicity.

B. Technology and Alternative Development and Screening

CERCLA and the NCP set forth the process by which remedial actions are evaluated and selected. In accordance with these requirements, a range of alternatives were developed for the Site.

With respect to groundwater response action, the Supplemental MOM RI/FS developed a limited number of remedial alternatives that attain Site specific remediation levels within different timeframes using different technologies, a no action alternative, and an institutional controls alternative.

The Supplemental MOM FS identified, assessed and screened technologies based on implementability, effectiveness, and cost. Chapter 5 of the Supplemental MOM FS presented the remedial alternatives developed by combining the technologies identified in the previous screening process. The purpose of the initial screening was to narrow the number of potential remedial actions for further detailed analysis while preserving a range of options. Each alternative was then evaluated and screened in Chapter 5 of the Supplemental MOM FS .

In summary, of the thirty-seven (37) management of migration remedial alternative technology/process options screened in Chapter 4, seventeen (17) were retained and combined into six (6) general alternatives for detailed analysis. Table 4-1 of the Supplemental MOM FS identifies the seventeen (17) technology/process options that were retained in the preliminary screening as well as those that were eliminated from further consideration. Table 4-6 of the Supplemental MOM FS identifies the six (6) general alternatives that were finally retained through the screening process.

VIII. DESCRIPTION OF ALTERNATIVES

This Section provides a narrative summary of each alternative evaluated. A detailed tabular assessment of each alternative can be found in Table 5-14 of the Supplemental MOM FS.

Management of Migration ("MOM") Alternatives Analyzed

The Supplemental MOM FS outlined management of migration alternatives at the Groveland Site to address contaminants in the plume extending from the Valley property and throughout the Site. The management of migration alternatives evaluated for the Site include: (1) a no-action alternative; (2) institutional controls; (3) partial inorganics removal and treatment, and discharge to the Haverhill Sewage Treatment System; and inorganics removal and treatment and subsequent organics treatment using (4) air stripping, (5) carbon adsorption, and (6) ultraviolet ("UV")/oxidation.

Alternative No. 1 - No Action

This alternative was evaluated to serve as a baseline for comparison with the other remedial alternatives under consideration. Under no action, no removal of contaminants from the aquifer would occur, other than those currently being removed and treated by the air stripper at the Mill Pond Groundwater Extraction and Treatment System as well as the granular carbon adsorption ("GAC") system at Station No. 1. The only cost requirement is the provision for monitoring every 5 years.

Estimated Time for Design and Construction: Not applicable
Estimated Time of Operation: Not applicable
Estimated Capital Cost: Not applicable
Estimated Annual Operation and Maintenance Costs: $5,000
Estimated Total Cost (net present worth): $70,000

Alternative No. 2 - Institutional Controls

Alternative No. 2 involves the imposition of institutional controls. These institutional controls would be designed to prohibit the use of groundwater in the contaminated area until cleanup levels have been achieved. Such controls could include, for example, deed restrictions prohibiting installation of private wells in the contaminated plume. The institutional controls would be implemented to minimize future risks associated with the potential direct use of contaminated groundwater and to provide notice of the migration of contaminants to Station No. 1. The cost requirements include quarterly sampling of monitoring wells.

Estimated Time for Design and Construction: Not applicable
Estimated Time of Operation: Not applicable
Estimated Capital Cost: Not applicable
Estimated Annual Operation and Maintenance Costs: $39,000
Estimated Total Cost (net present worth): $600,000

Alternative No. 3 - Extraction Wells, Partial Inorganics Removal, and Discharge to the Haverhill POTW

This alternative includes the institutional controls and sampling in Alternative 2. Also included is the construction of a network of approximately six groundwater extraction wells to intercept the entire width and depth of the contaminated groundwater plume originating from the Valley property (See Figures 7 and 8). The total estimated flow rate needed to intercept the plume is about 400 gallons per minute ("gpm"). During remedial design, the existing Mill Pond extraction system will be considered for use to supplement or replace one of the six new extraction wells proposed for this area. Additionally, sampling of the surface water and sediments in Johnson Creek and other nearby streams would be conducted on a semi-annual basis to identify any potential discharge of contaminated groundwater to surface water bodies.

This alternative includes a system for the removal of metals (primarily iron) in the extracted groundwater to an acceptable level for discharge to the Haverhill POTW. Contaminated groundwater is pumped to a mixed equalization tank to lessen effects of flow and concentration variations. Air is diffused into the tank to convert soluble ferrous iron into insoluble ferric iron. The overflow from the equalization/aeration system would be transferred to a sedimentation unit (also referred to as clarifier). In the sedimentation unit, most of the suspended solids would settle to the bottom of the unit because of the quiescent condition. Flocculation and coagulation would be performed prior to sedimentation to promote rapid and effective removal of the suspended solids. The settled solids would be transferred to the residual treatment system.

To minimize sludge disposal requirements, a filter press was selected as the representative process option for separating free water from the suspended solids in the residual treatment process. For disposal, the dewatered filter cake (dewatered sludge) would be transferred offsite for disposal. Classification of this waste would have to be determined during remedial design/action. If this filter cake is found to be a hazardous waste it will be disposed of in accordance with applicable requirements.

The partially treated groundwater would be discharged to existing sanitary sewers located throughout the plume area. The sewers discharge to the Groveland lift station (located north of Argilla Brook near Washington Street). The current flow rate into this lift station is about 60 to 140 gpm. Since the estimated extraction rate is significantly higher than the current rate, it is assumed that upgrading at the lift station would be required. A parallel lift station intercepting the sewers and connected to the existing (and sufficiently sized) discharge header would be considered.

At the Haverhill POTW, the contaminated groundwater would be blended with about 11.5 MGD or 8,000 gpm of sanitary wastewater. An estimated 95 percent of the insoluble metals would be removed from the water at the POTW because of the primary and secondary sedimentation treatment units. Approximately 83 percent of the volatile organics would be volatilized in the aeration basin; an indeterminate quantity would be adsorbed onto the sludge for subsequent removal in the secondary sedimentation unit. The Haverhill POTW effluent is discharged to the Merrimack River.

Estimated Time for Design and Construction: 4 months and 6 months, respectively
Estimated Time of Operation: 30 years
Estimated Capital Cost: $1,800,000
Estimated Annual Operation and Maintenance Costs: $643,000
Estimated Total Cost (net present worth): $11,700,000

Alternative No. 4 - Extraction Wells, Inorganics Removal, Air Stripping, and Discharge to Johnson Creek

This alternative includes the institutional controls and sampling in Alternative 2. It also includes other portions of Alternative 3 (installation of a groundwater extraction network and equalization/aeration and sedimentation to remove inorganics, as well as sampling of surface water and sediments). A new component of the metal removal scheme would be filtration, which provides additional removal of suspended solids which would be necessary to achieve the metal discharge standards and to allow for the efficient operation of the treatment equipment.

TCE and other volatile organics would be removed from the filtered groundwater by a 25 foot air stripping tower. Emissions from the tower would be captured by a granular activated carbon unit. Spent carbon would be transported off-site for regeneration and destruction of the organics. The treated groundwater would be discharged into Johnson Creek. The estimated discharge flow rate of about 400 gpm is within the normal flow rate that the existing stream channel can accommodate. The discharge structure would include measures to minimize potential erosion of the river bed and would be designed to ensure that it will not cause physical disruption of wetlands (if any) near the discharge point.

Estimated Time for Design and Construction: 6 months and
9 months, respectively.
Estimated Time of Operation: 30 years
Estimated Capital Cost: $3,400,000
Estimated Annual Operation and Maintenance Costs: $341,000
Estimated Total Cost (net present worth): $8,700,000

Alternative 5: Extraction Wells, Inorganics Removal, Carbon Adsorption, and Discharge to Johnson Creek

This alternative includes the institutional controls and sampling in Alternative 2. It also includes other portions of Alternative 4 (installation of a groundwater extraction network and equalization/aeration, sedimentation and filtration to remove inorganics, as well as sampling of surface water and sediments). Under Alternative 5, the filtered groundwater would then be transferred to granular carbon adsorption units to remove TCE and other organic volatiles. Spent carbon would be transported off-site for regeneration and destruction of the organics. The treated groundwater would be discharged to Johnson Creek. The estimated discharge flow rate of about 400 gpm is within the normal flow rate that the existing stream channel can accommodate. The discharge structure would include measures to minimize potential erosion of the river bed and would be designed to ensure that it will not cause physical disruption of wetlands (if any) near the discharge point.

Estimated Time for Design and Construction: 6 months and 9
months, respectively.
Estimated Time of Operation: 30 years
Estimated Capital Cost: $3,500,000
Estimated Annual Operation and Maintenance Costs: $610,000
Estimated Total Cost (net present worth): $12,900,000

Alternative 6: Extraction Wells, Metals Removal, UV/Oxidation and Discharge to Johnson Creek

This alternative includes the institutional controls and sampling in Alternative 2. It also includes other portions of Alternative 4 (installation of a groundwater extraction network and equalization/aeration, sedimentation and filtration to remove inorganics, as well as sampling of surface water and sediments). Under Alternative 6, the filtered water would then be subjected to a process involving ultraviolet ("UV") light and oxidation to destroy TCE and other volatile organics. (A more complete description of this alternative is provided below). The treated groundwater would be discharged to Johnson Creek. The estimated discharge flow rate of about 400 gpm is within the normal flow rate that the existing stream channel can accommodate. The discharge structure will include measures to minimize potential erosion of the river bed and will be designed to ensure that it will not cause physical disruption of wetlands (if any) near the discharge point.

Estimated Time for Design and Construction: 9 months for each
Estimated Time of Operation: 30 years
Estimated Capital Cost: $3,800,000
Estimated Annual Operation and Maintenance Costs: $333,000
Estimated Total Cost (net present worth): $8,900,000

IX. SUMMARY OF THE COMPARATIVE ANALYSIS OF ALTERNATIVES

Section 121(b)(1) of CERCLA presents several factors that at a minimum EPA is required to consider in its assessment of alternatives. Building upon these specific statutory mandates, the National Contingency Plan articulates nine evaluation criteria to be used in assessing the individual remedial alternatives.

A detailed analysis was performed on the alternatives using the nine evaluation criteria in order to select a Site remedy. The following is a summary of the comparison of each alternative's strengths and weaknesses with respect to the nine evaluation criteria. These criteria and their definitions are as follows:

Threshold Criteria

The two threshold criteria described below must be met in order for the alternatives to be eligible for selection in accordance with the NCP.

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

2. **Compliance with applicable or relevant and appropriate requirements ("ARARS")** addresses whether a remedy will meet all of the ARARs of other Federal and State environmental laws and/or provide grounds for invoking a waiver.

Primary Balancing Criteria

The following five criteria are used to compare and evaluate the elements of different alternatives that meet the threshold criteria.

3. **Long-term effectiveness and permanence** addresses the criteria that are used to assess alternatives for the long-term effectiveness and permanence they afford, along with the degree of certainty that they will prove successful.

4. **Reduction of toxicity, mobility, or volume through treatment** addresses the degree to which alternatives employ recycling or treatment that reduces toxicity, mobility, or volume, including how treatment is used to address the principal threats posed by the Site.

5. **Short-term effectiveness** addresses the period of time needed to achieve protection and any adverse impacts on human health and the environment that may be posed during the construction and implementation period, until cleanup levels are achieved.

6. **Implementability** addresses the technical and administrative feasibility of a remedy, including the availability of materials and services needed to implement a particular option.

7. **Cost** includes estimated capital and operation and maintenance ("O&M") costs, as well as present-worth costs.

Modifying Criteria

The modifying criteria generally are used during the final evaluation of remedial alternatives after EPA has received public comment on the Remedial Investigation, Feasibility Study, and Proposed Plan.

8. **State acceptance** addresses the Commonwealth of Massachusetts's position and key concerns related to the preferred alternative and other alternatives, and the Commonwealth of Massachusetts's comments on ARARs or the proposed use of waivers.

9. **Community acceptance** addresses the publics' general response to the alternatives described in the Feasibility Study and Proposed Plan .

A detailed assessment of each alternative according to the above criteria, except the State and community acceptance criteria, can be found in Section 5.2 of the Supplemental MOM FS.

Following the detailed analysis of each individual alternative, a comparative analysis, focusing on the relative performance of each alternative against the above criteria, except the State and community acceptance criteria, was conducted. This comparative analysis can be found in Table 5-14 of the Supplemental MOM.

The section below discusses each of the nine criteria, including the State and community acceptance criteria, in connection with each alternative, and outlines their strengths and weaknesses.

1. OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

Alternatives 3, 4, and 5 would provide equal overall protection to human health and the environment by identifying contaminant migration, treating groundwater contaminants, controlling new contact with groundwater contamination and controlling its migration. Alternative 1 (the no-action alternative) would not provide overall protection of human health and the environment. Humans could be exposed to excessive levels of certain organic contaminants if new private wells were to be located in the contaminated plume. Alternative 2 (institutional controls) is of moderate effectiveness in terms of protecting human health and the environment over long periods of time.

Only Alternative 6, however, provides for on-site destruction of organic contaminants in groundwater and utilizes a treatment process for organic contaminants that produces virtually no waste residuals. Of all the alternatives, the organic treatment process used in Alternative 6 provides the greatest overall protection of human health and the environment because it destroys virtually all organic contaminants in the extracted groundwater.

2. COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS ("ARARs")

Except for the no-action (Alternative 1) and institutional control (Alternative 2) alternatives, all of the other alternatives that received detailed analysis in the FS would meet all ARARs.

3. LONG-TERM EFFECTIVENESS AND PERMANENCE

Alternatives 3, 4, 5 and 6 provide similar degrees of long-term effectiveness and permanence in reducing risks presented by the contaminated groundwater at the Site. In each of those alternatives , no significant residual risks should remain in the groundwater. Under Alternative 1 (no-action), long-term risks remain and may increase with time. Under Alternative 2, the use of institutional controls is of unknown effectiveness in terms of protecting human health over long periods of time.

Only Alternative 6 provides for on-site destruction of organic contaminants in groundwater and utilizes a treatment process for organic contaminants that produces virtually no waste residuals. Of all the alternatives, the organic treatment process used in Alternative 6 provides the greatest long-term effectiveness and permanence because it destroys virtually all organic contaminants in the extracted groundwater.

4. REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT

Neither Alternatives 1 or 2 would provide additional treatment resulting in a reduction of toxicity, mobility or volume. Alternatives 3, 4, 5 and 6 would remove or destroy approximately 99 percent of the Site organics by treating approximately 6.3 billion gallons of contaminated groundwater and removing or destroying approximately 6,600 pounds of organics. Each of these latter four treatment schemes is irreversible.

Only Alternative 6 provides for on-site destruction of organic contaminants in groundwater and utilizes a treatment process for organic contaminants that produces virtually no waste residuals. Use of this technology permanently destroys (not merely reduces) virtually all organic contaminants in the extracted groundwater.

5. SHORT-TERM EFFECTIVENESS

Of the alternatives, Alternatives 1 and 2 would have the least effects on the community and workers since minimal or no actions would occur. However, Alternatives 1 and 2 would provide the least protection of the environment, since the contaminants would continue to migrate.

Alternatives 3, 4, 5 and 6 are all similar in terms of their short-term effectiveness. There would be a minimal increase in risk because of the construction and operation of an extraction, treatment, and/or discharge system. Worker health and safety practices would have to be employed during the construction of extraction wells, particularly in the more contaminated areas. Alternatives, 3, 4, 5 and 6 would require an estimated 30 years before achieving compliance with remedial action objectives.

Only Alternative 6 provides for on-site destruction of organic contaminants in groundwater and utilizes a treatment process for organic contaminants that produces virtually no waste residuals. Use of this technology most effectively eliminates possible adverse impacts of organic contaminant transport or transfer off-site, as occurs with Alternatives 3, 4 and 5.

6. IMPLEMENTABILITY

The technologies required to implement Alternatives 2 through 6 are readily available, reliable and easy to undertake. In each case, migration and exposure pathways should be effectively remediated. Alternative 6 utilizes an innovative technology, the UV/Oxidation organics treatment process, and treatability testing would be required to confirm the feasibility of the use of that technology in remediating organic groundwater contamination at the Site, but EPA believes that the reliability of that technology has been established. Alternative 1 is simple to undertake since it requires no treatment or additional monitoring.

7. COST

The capital, operation and maintenance, and total cost for each alternative is provided as part of the description of alternatives in Section VIII of the ROD. Alternatives 1 and 2 are the least costly alternatives, with total costs of $70,000 and $600,000, respectively. Alternatives 3, 4, 5, and 6 have total costs of $11,700,000, $8,700,000, $12,900,000, and $8,900,000, respectively. Thus, of the four latter alternatives, Alternatives 4 and 6 would involve the least total cost.

8. STATE ACCEPTANCE

Based on its review of the remedial investigations and feasibility studies for the Site, and the Proposed Plan, the Commonwealth of Massachusetts concurs in the selection of EPA's alternative.

9. COMMUNITY ACCEPTANCE

Community reaction to Alternative 6, the preferred alternative, has been mixed. Two commenters specifically supported EPA's preference for Alternative 6. Other commenters stated that Alternative 2 (institutional controls) or Alternative 4 (air stripping) should be selected. A number of commenters stated that remedial action should be focused only in the most contaminated portion of the plume.

X. THE SELECTED REMEDY

Based on the comparative analysis as summarized above, EPA has selected Alternative 6 as the remedy for this Site.

A. Interim Groundwater Cleanup Levels

Interim groundwater cleanup levels have been established for all contaminants of concern identified in the baseline risk assessment found to pose an unacceptable risk to either public health or the environment. Interim cleanup levels have been set based on ARARs [e.g., Drinking Water Maximum Contaminant Level Goals ("MCLGs" and MCLs)], if available, or other suitable criteria described below. Periodic assessments of the protection afforded by the selected remedial action will be made as the remedy is being implemented and at the completion of the remedial action. At the time all groundwater ARARs identified in the ROD, and newly promulgated ARARs and modified ARARs which call into question the protectiveness of the remedy, have been achieved, a risk assessment shall be performed on all residual groundwater contamination. This risk assessment of the residual groundwater contamination shall follow EPA procedures and will assess the cumulative risks for carcinogens and non-carcinogens posed by the consumption of Site groundwater. If the risks are not within EPA's risk management goal for carcinogens and non-carcinogens, then the remedial action will continue until protective levels are attained, or the remedy is otherwise deemed protective. These final protective cleanup levels shall be performance standards for this ROD.

The goal of this remedial action is to restore groundwater to its beneficial use, which is, at this Site, to restore a potential drinking water source to acceptable levels. Based on information obtained during the remedial investigation and on a careful analysis of all remedial alternatives, EPA believes that the selected remedy will achieve this goal. It may become apparent, during implementation and operation of the groundwater extraction system and its modifications, that contaminant levels have ceased to decline and are remaining constant at levels higher than the remediation goal over some portion of the contaminated plume. In such a case, the system performance standards and/or the remedy may be re-evaluated.

The selected remedy will include groundwater extraction for an estimated period of 30 years, during which the system's performance will be carefully monitored on a regular basis and adjusted as warranted by the performance data collected during operation. Modifications may include the following:

(1) pumping may be discontinued at individual wells where cleanup levels have been attained;

(2) pumping may be attenuated at wells to eliminate stagnation points;

(3) pumping may be pulsed to allow aquifer equilibration and to allow adsorbed contaminants to partition into groundwater;

(4) additional extraction wells may be installed to facilitate or accelerate cleanup of the contaminant plume; and

(5) additional monitoring wells may be installed to evaluate remedial progress

To ensure that cleanup levels continue to be maintained, the aquifer will be monitored at those wells where pumping has ceased, and at the same frequency as that of other monitoring wells. The frequency of monitoring for all wells will be determined during remedial design.

Groundwater monitoring wells adjacent to the Chesterton property and Haverhill Municipal Landfill will be sampled on a regular basis to ensure that the remedial extraction system does not adversely spread the contamination originating from these properties. If it is determined that the remedial extraction wells are causing the contamination from these properties to adversely spread, the extraction system will be modified, e.g., by reducing the pumping rate or relocating extraction wells.

The proposed extraction well locations (See Figure 15) are sufficiently distant from the Valley property so as not to cause any interference with the remedial activities occurring there. The anticipated zone of influence of the most southerly well will not extend to the Valley property.

The area of attainment for the management of migration operable unit is the contaminated plume that extends from the Valley property as well as any other areas within the Site where cleanup levels or ARARs are exceeded in groundwater. The Chesterton property, the Haverhill Municipal Landfill, and the Valley property are not part of the area of attainment for the Management of Migration

Operable Unit. As discussed previously, remediation for those areas are being handled separately as follows: (1) remediation of contamination at the Chesterton property will be conducted under RCRA ; (2) remediation of contamination at the Haverhill Municipal Landfill, which has been listed on the NPL, will be conducted separately under CERCLA; and (3) remediation of contamination at the Valley property is being implemented under an Amended Administrative Order dated February 1, 1991, in accordance with the Source Control ROD.

The approximate area of attainment for the plume, as presented in Figure 7, is believed to encompass approximately 75 acres (as delineated using the maximum concentration of TCE detected during the Supplemental MOM RI). A calculated 360 million gallons of groundwater is believed to be currently affected by virtue of being contaminated with approximately 6,700 pounds of TCE and 1,2-DCE, plus lesser quantities of other contaminants. No free product or dense non-aqueous phase liquids ("DNAPLs") have been detected in the aquifer downgradient of the Valley property. However, the possibility that free-product may exist cannot be ruled out. If free-product is discovered during remediation, the remedy may be reevaluated in a supplemental decision document.

Organic groundwater contaminants in the area of attainment will be treated to the interim cleanup levels presented below. TCE and DCE were selected as the two major organic contaminants of concern in this area of attainment, based on mobility, toxicity, observed concentrations, and remedial levels. Remediation of groundwater to the interim cleanup levels for these two organic contaminants should result in achieving the respective levels for each of the other organic contaminants.

Inorganic groundwater contaminants which exceed MCLs (aluminum, antimony, arsenic, barium, beryllium, cadmium, chromium, nickel and selenium) within the area of attainment will be treated to interim cleanup levels presented below. During the design stage of the remedy, a comprehensive background groundwater sampling program will be conducted. If study results indicate that certain Site inorganic chemicals are present at background concentrations, then those inorganics will no longer be identified as Site-related contaminants and standards (ARARs/cleanup levels) for those inorganics would not need to be met. If necessary, however, these contaminants may be cleaned up to background. If study results indicate that certain inorganic concentrations are not representative of background, then the remedy will be designed to attain inorganic interim cleanup levels for those chemicals.

Because the aquifer, including the area of attainment, is a Class II aquifer, which is a potential source of drinking water, MCLs and non-zero MCLGs established under the Safe Drinking Water Act are ARARs.

Interim cleanup levels for known and probable carcinogenic compounds (Class A & B) have been set at the appropriate MCL as the MCLGs for these groups of compounds are zero. Interim cleanup levels for the Class C (possible carcinogens) have been set at the non-zero MCLG. In the absence of a non-zero MCLG, an MCL, or a proposed drinking water standard or other suitable criteria to be considered (i.e. health advisory, State standard), a cleanup level was derived for carcinogenic effects based on a 10^{-6} excess cancer risk level considering the ingestion of groundwater.

Interim cleanup levels for compounds in groundwater exhibiting non-carcinogenic effects have been set at the non-zero MCLG. In the absence of a non-zero MCLG, interim cleanup levels for non-carcinogenic effects have been set at a level thought to be without appreciable risk of an adverse effect when exposure occurs over a lifetime (hazard quotient = 1).

Table 23 below summarizes the interim cleanup levels for carcinogenic and non-carcinogenic contaminants of concern identified in groundwater at the Site.

All groundwater ARARs identified in the ROD, and newly promulgated ARARs and modified ARARs which call into question the protectiveness of the remedy and the interim cleanup levels prescribed by the above described risk assessment, must be achieved at the completion of the remedial action within the area of attainment. EPA has estimated that these levels will be obtained within thirty (30) years.

While these interim cleanup levels are consistent with ARARs (and suitable criteria to be considered) for groundwater, a cumulative risk that could be posed by these compounds may exceed EPA's goals for remedial action. Consequently, these levels are considered interim cleanup levels for groundwater. When all groundwater ARARs identified in the ROD, and newly promulgated ARARs and modified ARARs which call into question the protectiveness of the remedy, have been attained, a risk assessment will be performed on residual groundwater contamination to determine whether the remedial action is protective. Remedial actions shall continue until protectiveness concentrations of residual contamination have been achieved or until the remedy is otherwise deemed protective. These protective residual levels shall constitute the final cleanup levels for this

TABLE 23
INTERIM GROUNDWATER CLEANUP LEVELS

Noncarcinogenic Cont. of Concern	Reference Dose(oral) (mg/kg-day)	Clean-up Level (mg/L)	Basis	Target Endpoint of Toxicity	Hazard Index
Acetone	1.1E-01	0.7	MMCL	liver, kidney	1.9E-01
Antimony	4.0E-04	0.003	MCL	blood	2.3E-01
Arsenic	1.0E-03	0.05	MCL	skin	1.5E+00
Barium	5.0E-02	1	MCL	blood, fetotox.	6.0E-01
Beryllium	5.0E-03	0.001	MCL	none	6.0E-03
Cadmium	5.0E-04	0.005	MCL	kidney	3.0E-01
Chlorobenzene	2.0E-02	0.1	MCL	liver, kidney	1.5E-01
Chromium(VI)	5.0E-03	0.05	MCL	kidney	3.0E-01
1,1-Dichloroethane	1.0E-01	0.005	MMCL	kidney	1.5E-03
1,1-Dichloroethene	9.0E-03	0.007	MCL	liver	2.3E-02
1,2-Dichloroethene(c)	1.0E-02	0.07	MCL	blood	2.1E-01
Mercury	3.0E-04	0.002	MCL	neurotox., kidney	2.0E-01
Methylene chloride	6.0E-02	0.005	MCL	liver	2.5E-03
Nickel	2.0E-02	0.1	MCL	body weight	1.5E-01
Selenium	-	0.01	MCL	CNA	-
Silver	3.0E-03	0.05	MMCL	skin	5.0E-01
Tetrachloroethene	1.0E-02	0.005	MCL	liver	1.5E-02
Toluene	2.0E-01	1	MCL	CNS, kidney, liver	1.5E-01
1,1,1-Trichloroethane	9.0E-02	0.2	MCL	liver	6.7E-02
Vanadium	7.0E-03	0.24	HB	none	1.0E+00
					SUM
				Liver Endpoint	6.0E-01
				Kidney Endpoint	1.3E+00
				CNS	3.5E-01
				Blood	1.1E+00
				Skin	2.0E+00

TABLE 23
INTERIM GROUNDWATER CLEANUP LEVELS(CONT'D)

Carcinogenic Contaminants of Concern	Carc. Potency Factor (oral) (mg/kg-day)	Clean-up Level (mg/L)	Basis	Cancer Risk Level
Arsenic	1.8E+00	0.05	MCL	8.8E-04
Benzene	2.9E-02	0.005	MCL	1.5E-06
Beryllium	4.3E+00	0.001	MCL	4.3E-05
1,1-Dichloroethene	6.0E-01	0.007	MCL	4.2E-05
Lead	-	0.015	Policy(1)	-
Methylene chloride	7.5E-03	0.005	MCL	3.8E-07
Tetrachloroethene	2.9E-02	0.005	MCL	1.5E-06
Trichloroethene	1.1E-02	0.005	MCL	5.5E-07
Vinyl chloride	1.9E+00	0.002	MCL	3.8E-05
			SUM	1.0E-03

NOTES:

(1) - Superfund Policy- Memo from Henry Longest, Director, Office of Emergency and Remedial Response to Patrick Tobin, Director, Waste Management Division, Region IV, Cleanup Level for Lead in Groundwater, June, 1990."

MCL - Maximum Contaminant Level
SMCL - Secondary Maximum Contaminant Level
HB - Hazard Based (noncarcinogens)
CNA - Criteria Not Available
MMCL - Massachusetts Maximum Contaminant Level
CNS - Central Nervous System

Management of Migration ROD and shall be considered performance standards for remedial action. If final cleanup levels differ significantly from interim cleanup levels, EPA will reevaluate the selected remedy and take appropriate action to ensure that the cleanup levels are attained.

B. Description of Remedial Components

EPA's preferred alternative includes:

- Installing a groundwater extraction system;
- Constructing inorganics and ultraviolet ("UV")/Oxidation organics treatment units;
- Extracting and treating contaminated groundwater; and
- Discharging treated groundwater to Johnson Creek.

Each of these components are described separately below.

This alternative includes institutional controls that would prohibit the use of groundwater in the contaminated area until cleanup levels have been achieved. Such controls could include, for example, deed restrictions prohibiting the installation of private wells in the contaminated plume. This alternative also includes quarterly sampling of monitoring wells around Station No. 1. These actions would be implemented to minimize current and future risks associated with the potential direct use of contaminated groundwater, and would monitor any potential migration of contaminants to Station No. 1.

Also included is the construction of an estimated six groundwater extraction wells to intercept the entire width and depth of the contaminated groundwater plume originating from the Valley property (See Figures 7 and 8). The locations of the extraction wells and treatment system are shown in Figure 15, but the final decision concerning the location and number of those wells and the extraction system will be made during remedial design. The total estimated flow rate needed to intercept the plume is about 400 gallons per minute (gpm). During remedial design, the existing Mill Pond extraction system will be evaluated for use to supplement or replace one of the six new extraction wells proposed for this area.

As previously stated, groundwater monitoring wells adjacent to the Chesterton property and Haverhill Municipal Landfill will be sampled on a regular basis to ensure that the remedial extraction system does not adversely spread the contamination originating from these properties. Also, a background groundwater sampling program for inorganics is planned during the remediation phases of the remedy. Site inorganic concentrations will then be re-evaluated in comparison to these results. If it is determined through background groundwater sampling that certain inorganic levels represent background, then those inorganics will no longer be identified as Site-related contaminants, and standards for those inorganics would not need to be met. Additionally, sampling of the surface water and sediments in Johnson Creek and other nearby streams would be conducted on a semi-annual basis to identify any potential discharge of contaminated groundwater to surface water bodies. Exact sample locations would be determined during the remedial design.

This alternative includes a system for the removal of metals in the extracted groundwater to an acceptable level for efficient operation of the treatment process and to meet the effluent limitations for discharge into Johnson Creek. Under the representative process option, contaminated groundwater would be pumped to a mixed equalization tank to lessen effects of flow and concentration variations (Figure 16). Air would be diffused into the tank to convert soluble ferrous iron into insoluble ferric iron. The overflow from the equalization/aeration system would be transferred to a sedimentation unit (also referred to as clarifier). In the sedimentation unit, most of the suspended solids would settle to the bottom of the unit because of the quiescent condition. Flocculation and coagulation would be performed prior to sedimentation to promote rapid and effective removal of the suspended solids. The settled solids would be transferred to the residual treatment system. Finally, filtration would provide additional removal of suspended solids to achieve the metal discharge standards and to allow for the efficient operation of the treatment equipment.

To minimize sludge disposal requirements, a filter press was selected as the representative process option for separating free water from the suspended solids in the residual treatment process. For disposal, the dewatered filter cake (dewatered sludge) would be transferred offsite. Classification of this material would have to be determined during remedial design/action. If this filter cake is found to be a either a listed or characteristic hazardous waste, then it must be treated and disposed of in accordance with applicable requirements.

The filtered water would then be subjected to a process involving ultraviolet (UV) light and oxidation to destroy TCE and other volatile organics (see Figure 17). Pretreatment is especially important in the UV/Oxidation process because turbid waters do not transmit UV light effectively. Additionally, metals present in the groundwater in reduced form (e.g., ferrous ion and cuprous ion) could exert a demand upon the free hydroxyl radicals (discussed below). Metals can also cause problems if there is a pH shift during treatment which causes them to precipitate in the UV/Oxidation reactor. Precipitate formation would increase the turbidity of the water and may also coat the UV lamp jackets and be difficult to remove.

The oxidants are typically ozone and/or hydrogen peroxide. The UV/Oxidation treatment process is actually a two-step process. First, UV radiation photolyzes (breaks down) ozone or hydrogen peroxide. This results in the formation of highly reactive hydroxyl ("OH") free radicals. These radicals are important because they are stronger oxidizing agents than either ozone or hydrogen peroxide alone. These hydroxyl radicals then oxidize (take away hydrogen by combining with oxygen) the organic contaminants in the extracted groundwater. Once the organics are completely oxidized, the reaction products would consist of carbon dioxide and water.

The treated groundwater would be discharged to Johnson Creek. The estimated discharge flow rate of about 400 gpm is within the normal flow rate that the existing stream channel can accommodate. The discharge structure will include measures to minimize potential erosion of the river bed and will be designed to ensure that it will not cause physical disruption of wetlands (if any) near the discharge point.

The extraction and metals removal treatment component for this alternative are very well established and of proven performance. The UV/Oxidation process has been known for at least 10 years and has been evaluated under the EPA Superfund Innovative Technology Evaluation ("SITE") program. The process is still considered an innovative technology, mostly because of the small size and number of the existing full-scale treatment units.

The SITE project evaluation of the UV/Oxidation (ozone) process revealed that at "preferred" operating conditions, the process achieved removal efficiencies as high as 90 percent for the total VOCs present in the groundwater. The major Site contaminant, TCE, had removal efficiencies greater than 99 percent. Treatability testing would be required to confirm feasibility of the UV/Oxidation process and derive design parameters. Subject to this verification, the process reliability of this technology is expected to be good, based on experience with normal ozonation.

After the cleanup levels have been met and the remedy is determined to be protective, the ground water treatment system will be shut down. The ground water monitoring system will be used to collect information quarterly for three years to ensure that the cleanup levels have been met and the remedy is protective.

EPA will review the Site at least once every five years after the initiation of remedial action at the Site if any hazardous substances, pollutants or contaminants remain at the Site to assure that the remedial action continues to protect human health and the environment. EPA will also evaluate risk posed by the Site at the completion of the remedial action (i.e., before the Site is proposed for deletion from the NPL).

FLOODPLAIN/WETLANDS ISSUES

When a site is located within a floodplain/wetland, or when a proposed remedial action would affect a floodplain/wetland, EPA as lead agency must conduct an assessment, which is integrated into the remediation process. A remedial alternative that affects a floodplain or wetland may not be chosen unless a determination is made that no practical alternative exists outside the floodplain or wetland. If no practical alternative exists, then EPA, as lead agency, shall act to minimize potential harm or avoid adverse effects to the floodplain or wetland.

Appendix F of the Supplemental MOM FS indicates that there are certain limited wetland areas at the Site and that a portion of the Site lies in a floodplain. It is currently anticipated that potential impacts to the floodplain or wetlands which might occur are from: (1) the placement of extraction wells for pumping and treating groundwater; (2) construction of the treatment plant; and (3) the discharge of treated groundwater to Johnson Creek .

A significant portion of the contaminant plume is located within the 100-year floodplain. EPA has determined that no practical alternative exists other than to locate extraction wells within this area. However, the extraction wells will be designed and constructed to withstand the 100-year flood and will be designed to ensure that the wells will not cause physical disruption of wetlands (if any).

EPA has also determined that no practical alternative exists other than to discharge the treated groundwater directly to Johnson Creek. The only other alternative would have been the installation of wells to reinject groundwater in the vicinity of the contaminant plume. However, reinjection of treated water poses a risk that may exacerbate the current situation by causing an unwanted redistribution of contamination. It may also conflict with, or increase costs of the proposed extraction system. Reinjection would involve additional construction of wells in the floodplain/wetlands area. Lastly, this alternative was rejected because of the added cost to install and maintain the reinjection wells.

EPA has made a preliminary determination that the treatment plant can be located outside the 100-year floodplain. If during remedial design it becomes necessary to locate the treatment plant within the 100-year floodplain, then EPA will publish its determination for public review and comment.

ENDANGERED SPECIES

The Massachusetts Natural Heritage Program was contacted in September 1991 with respect to proposed remedy (as discussed in the Supplemental MOM FS and the Proposed Plan) and its possible implications for the rare and endangered species visiting or residing in the Site area. Representatives of the Natural Heritage Program responded that the proposed remedy should not interfere with the two state-listed species that are known to be present near the Groveland Wells Site.

XI. STATUTORY DETERMINATIONS

The remedial action selected for implementation at the Groveland Site is consistent with CERCLA and, to the extent practicable, the NCP. The selected remedy is protective of human health and the environment, attains ARARs and is cost effective. The selected remedy also satisfies the statutory preference for treatment which permanently and significantly reduces the mobility, toxicity or volume of hazardous substances as a principal element. Additionally, the selected remedy uses alternate treatment technologies or resource recovery technologies to the maximum extent practicable.

A. The Selected Remedy is Protective of Human Health and the Environment

The remedy at this Site will permanently reduce the risks posed to human health and the environment by eliminating, reducing or controlling exposures to human and environmental receptors through treatment, engineering controls, and institutional controls. More specifically, over the short-term, the institutional control components of this alternative would limit potential new contact with the contaminated groundwater. This would be accomplished through institutional controls that prohibit the use of groundwater in the contaminated area until cleanup levels have been achieved. Such controls could include, for example, prohibiting the installation of private wells. The continued use of activated carbon at Station No. 1 provides additional protection for public water users. In addition, the extraction system would provide a hydraulic barrier to minimize the potential for contaminated groundwater to migrate toward Station No. 1.

Over the long-term, the organic and inorganic contaminants should be removed from the aquifer that extends from the Valley property. Groundwater contamination directly under the Valley property and the Chesterton property, and associated with the Haverhill Landfill, are being addressed under separate actions and should not be affected by the extraction system selected in this Management of Migration ROD. The result should be restoration of the aquifer and unrestricted future use thereof. Most of the organics should be destroyed at the onsite treatment system or adsorbed into the sludge and disposed in an appropriate manner.

Moreover, the selected remedy will result in human exposure levels that are within the 10^{-4} to 10^{-6} incremental cancer risk range and that are at or below the hazard index of one for non-carcinogens. More specifically, the remediation goals for groundwater for both the organic and inorganic contaminants of concern will be met. Finally, implementation of the selected remedy will not pose unacceptable short-term risks or cross-media impacts. The remedy provides for on-site destruction of organic contaminants in groundwater and is a treatment process for organic contaminants that produces virtually no waste residuals. Use of this technology eliminates possible adverse impacts of organic contaminant transport off-site or cross-media contamination.

B. The Selected Remedy Attains ARARs

This remedy will attain all applicable or relevant and appropriate federal and state requirements that apply to the Site. Environmental laws from which ARARs for the selected remedial action are derived, and the specific ARARs include:

- Clean Water Act (CWA)
- Safe Drinking Water Act (SDWA)
- Clean Air Act (CAA)
- Massachusetts Hazardous Waste Regulations
- Massachusetts Drinking Water Standards
- Massachusetts Groundwater Quality Standards
- Massachusetts Wetlands Protection Regulations

- Massachusetts Ambient Air Quality Standards
- Massachusetts Air Pollution Control Regulations
- Massachusetts Surface Water Discharge Permit Program
- Massachusetts Operation and Maintenance and Pretreatment Standards for Wastewater, Treatment Works and Indirect Discharge
- Massachusetts Surface Water Quality Standards
- Massachusetts Supplemental Requirements for Hazardous Waste Management Facilities
- Wetlands Executive Order
- Floodplains Executive Order
- Town Of Groveland Wetlands By-laws
- Ambient Air Levels

A discussion of the ARARs and TBCs, and the actions that will be taken to meet these requirements may be found in Table 24 of the ROD. A discussion of the major ARARs for the Site follows:

1. <u>Chemical - Specific Requirements</u>

The groundwater aquifer is classified as Class II, a potential drinking water source. The Massachusetts Department of Environmental Protection has classified this aquifer under the Massachusetts classification system as Class I groundwater, a source of potable water supply. SDWA MCLs, MCLGs, and the Massachusetts Drinking Water Standards (MMCLs) are standards that apply to public water systems. Because these State and Federal requirements apply at the tap, not directly to groundwater, MCLs, MCLGs, and MMCLs are relevant and appropriate rather than applicable. In addition, this ROD requires testing to identify background levels for inorganics. If background exceeds these standards, these standards will no longer be considered appropriate requirements and would no longer be considered ARARs.

2. <u>Location - Specific Requirements</u>

40 CFR Part 6, Appendix A, requires EPA to implement Executive Order 11988 (Floodplain Management) and Executive Order 11990 (protection of Wetlands). To comply with Executive Order 11988, a remedial action must reduce the risk of flood loss and restore and preserve the natural and beneficial values served by floodplains. Executive Order 11990 requires EPA to minimize the destruction, loss or degradation of wetlands. Section X.B. of this ROD discusses how these requirements were taken into account.

3. Action - Specific Requirements

The remedy selected for this Site requires construction and operation of a groundwater treatment system. After treatment, this water will be discharged to surface waters in accordance with the substantive requirements of Section 402 of the Clean Water Act. Because this is a direct discharge of pollutants to surface waters, Section 402 of the Clean Water Act, as well as the Massachusetts Water Discharge Requirements, are applicable. Treatment will be required to ensure the State water quality standards are met.

In addition, the groundwater treatment process will generate sludge. This sludge (filter cake) will be evaluated during remedial design/remedial action to determine appropriate off-site disposal. The sludge (filter cake) will be classified (listed/characteristic) to determine whether it is a hazardous waste. If it is found to be hazardous, it will be disposed of in accordance with all applicable regulations.

C. The Selected Remedial Action is Cost-Effective

In the Agency's judgment, the selected remedy is cost effective, i.e., the remedy affords overall effectiveness proportional to its costs. In selecting this remedy, EPA first identified alternatives that would be protective of human health and the environment and that attain, or, as appropriate, waive ARARs. EPA then evaluated the overall effectiveness of each alternative by assessing, in combination, the relevant three criteria: (1) long term effectiveness and permanence; (2) reduction in toxicity, mobility, and volume through treatment; and (3) short term effectiveness, in combination. The relationship of the overall effectiveness of the selected remedial alternative has been determined to be proportional to its costs. The projected costs of the remedial alternatives are:

Alternative	Capital Cost ($)	Annual O&M Cost ($/yr)	Net Present-Worth ($)
1	0	5,000	70,000
2	0	39,000	600,000
3	1,800,000	643,000	11,700,000
4	3,400,000	341,000	8,700,000
5	3,500,000	610,000	12,900,000
6	3,800,000	333,000	8,900,000

Alternatives 1 & 2 do not comply with criteria of the NCP and were not given any further consideration in terms of cost effectiveness. Alternatives 3 through 6 would comply with the criteria of the NCP. Alternatives 3 and 5 are more expensive than the remaining alternatives and were therefore eliminated from consideration.

Alternatives 4 and 6 are similar in terms of costs, and offer many of the same benefits. Alternative 6, however, is the only alternative that provides for on-site destruction of organic contaminants in groundwater and utilizes a treatment process for organic contaminants that produces virtually no waste residuals. That treatment process provides the longest term effectiveness and permanence by destroying most organic contaminants, achieves the greatest reduction in toxicity, mobility, and volume of those contaminants, and most effectively eliminates possible adverse impacts of organic contaminant transport or transfer off-site while being equal in cost to Alternative 4.

For the foregoing reasons, EPA believes that Alternative 6 is the most cost-effective alternative.

D. The Selected Remedy Uses Permanent Solutions and Alternative Treatment or Resource Recovery Technologies to the Maximum Extent Practicable

Once the Agency identified those alternatives that attain or, as appropriate, waive ARARs, and that are protective of human health and the environment, EPA identified which alternative uses permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. This determination was made by deciding which one of the identified alternatives provides the best balance of trade-offs among alternatives in terms of: (1) long-term effectiveness and permanence; (2) reduction of toxicity, mobility or volume through treatment; (3) short-term effectiveness; (4) implementability; and (5) cost. In evaluating these trade-offs, EPA emphasized long-term effectiveness and permanence, and the reduction of toxicity, mobility and volume through treatment. It also considered the preference for treatment as a principal element and the bias against off-site land disposal of untreated waste. Finally, community and state acceptance also were considered.

<u>Long-term effectiveness and permanence.</u> All of the alternatives (except Alternatives 1 & 2) provide similar degrees of long-term effectiveness and permanence in reducing risks presented by the contaminated groundwater at the Site. In each of those alternatives, no significant residual risks should remain in the groundwater. Alternatives 3 through 6 each would remove or destroy approximately 99 percent of the Site organics by treating

approximately 6.3 billion gallons of contaminated groundwater and destroying or removing 6,600 pounds of organics. Each of these latter four treatment schemes is irreversible. Only Alternative 6, however, provides for on-site destruction of organic contaminants in groundwater and utilizes a treatment process for organic contaminants that produces virtually no waste residuals. Of all the alternatives, the organic treatment process used in Alternative 6 provides the long-term effectiveness and permanence because it destroys virtually all organic groundwater contaminants. Consequently, Alternative 6 provides the greatest long-term effectiveness and permanence.

Reduction of toxicity, mobility or volume through treatment. Neither Alternatives 1 or 2 would provide additional treatment resulting in a reduction of toxicity, mobility or volume. Alternatives 3 through 6 would remove or destroy approximately 99 percent of the Site organics by treating approximately 6.3 billion gallons of contaminated groundwater and removing or destroying approximately 6,600 pounds of organics. Each of these latter four treatment schemes is irreversible. Only Alternative 6, however, uses a technology that permanently destroys (not merely reduces) virtually all organic groundwater contaminants. For that reason, Alternative 6 results in the greatest reduction of toxicity, mobility or volume of the contaminants of greatest concern.

Short-term effectiveness. Alternatives 1 and 2 are preferable for their short-term effectiveness, but under those alternatives cleanup objectives may never be attained. Alternatives 3 through 6 would all be similar in some respects for their short-term effectiveness. Alternatives 3 through 6 all would involve a minimal increase in risk because of the construction and operation of an extraction, treatment, and/or discharge system and would require an estimated 30 years before achieving compliance with remedial action objectives. Alternative 6, however, utilizes an organic treatment system that most effectively eliminates possible adverse impacts of organic contaminant transport or transfer off-site, which occurs with Alternatives 3, 4 and 5. As a result, in relation to Alternatives 3 through 5, Alternative 6 is most effective in the short term.

Implementability. Alternative 1 is simple to implement and undertake since it requires no treatment or additional monitoring. The technologies required to implement Alternatives 2 through 6 are readily available, reliable and easy to undertake. In each case, migration and exposure pathways should be effectively remediated. Alternative 6 utilizes an innovative treatment process for organics, and treatability testing would be required to confirm the feasibility of the use of that technology in remediating organic groundwater contamination at the Site. Alternatives 3 through 5 utilize more established and predictably reliable technologies for the treatment of organic contaminants, but EPA believes that the reliability of the treatment technology for remediating those contaminants in Alternative 6 has been adequately established.

Alternatives 1 and 2 are the least costly alternatives, with total costs of $70,000 and $600,000, respectively. Alternatives 3, 4, 5, and 6 have total costs of $11,700,000, $8,700,000, $12,900,000, and $8,900,000, respectively. Thus, of the four latter alternatives, Alternatives 4 and 6, the selected remedy, would involve the least total cost.

Other Factors. Alternatives 3 through 6 all provide for treatment as a principal element. Alternatives 1 and 2 do not conform to this preference.

Community and State Acceptance. Based on its the review of the remedial investigations and feasibility studies for the Site, and the Proposed Plan, the Commonwealth of Massachusetts concurs in the selection of EPA's preferred alternative. Community reaction to Alternative 6, the preferred alternative, has been mixed. Two commenters specifically supported EPA's preference for Alternative 6. Other commenters stated that Alternative 2 (institutional controls) or Alternative 4 (air stripping) should be selected. A number of commenters stated that remedial action should be focused only in the most contaminated portion of the plume.

Balancing of Trade-offs. Based upon the foregoing factors, EPA believes that the selected remedy provides the best balance of trade-offs among the alternatives. Alternative 6 was selected because it provides for on-site destruction of organic contaminants in groundwater and utilizes a treatment process for organic contaminants that produces virtually no waste residuals. That treatment process provides the longest term effectiveness and permanence by destroying most organic contaminants, achieves the greatest reduction in toxicity, mobility, and volume of those contaminants, and most effectively eliminates possible adverse impacts of organic contaminant transport or transfer off-site.

E. The Selected Remedy Satisfies the Preference for Treatment Which Permanently and Significantly Reduces the Toxicity, Mobility or Volume of the Hazardous Substances as a Principal Element

The principal element of the selected remedy is the management of contaminant migration. This element addresses the primary threat at the Site, contamination of groundwater by volatile organic compounds. The selected remedy satisfies the statutory preference for treatment as a principal element by extracting and treating inorganic and organic contaminants. The selected remedy provides for on-site organic contaminant destruction.

XII. DOCUMENTATION OF NO SIGNIFICANT CHANGES

EPA presented a proposed plan (preferred alternative) for remediation of the Site at a public meeting on July 9, 1991. The preferred alternative included:

1. Installing a groundwater extraction system;
2. Constructing inorganic treatment and ultraviolet ("UV")/Oxidation organics treatment units;
3. Extracting and treating contaminated groundwater; and
4. Discharging treated groundwater to Johnson Creek.

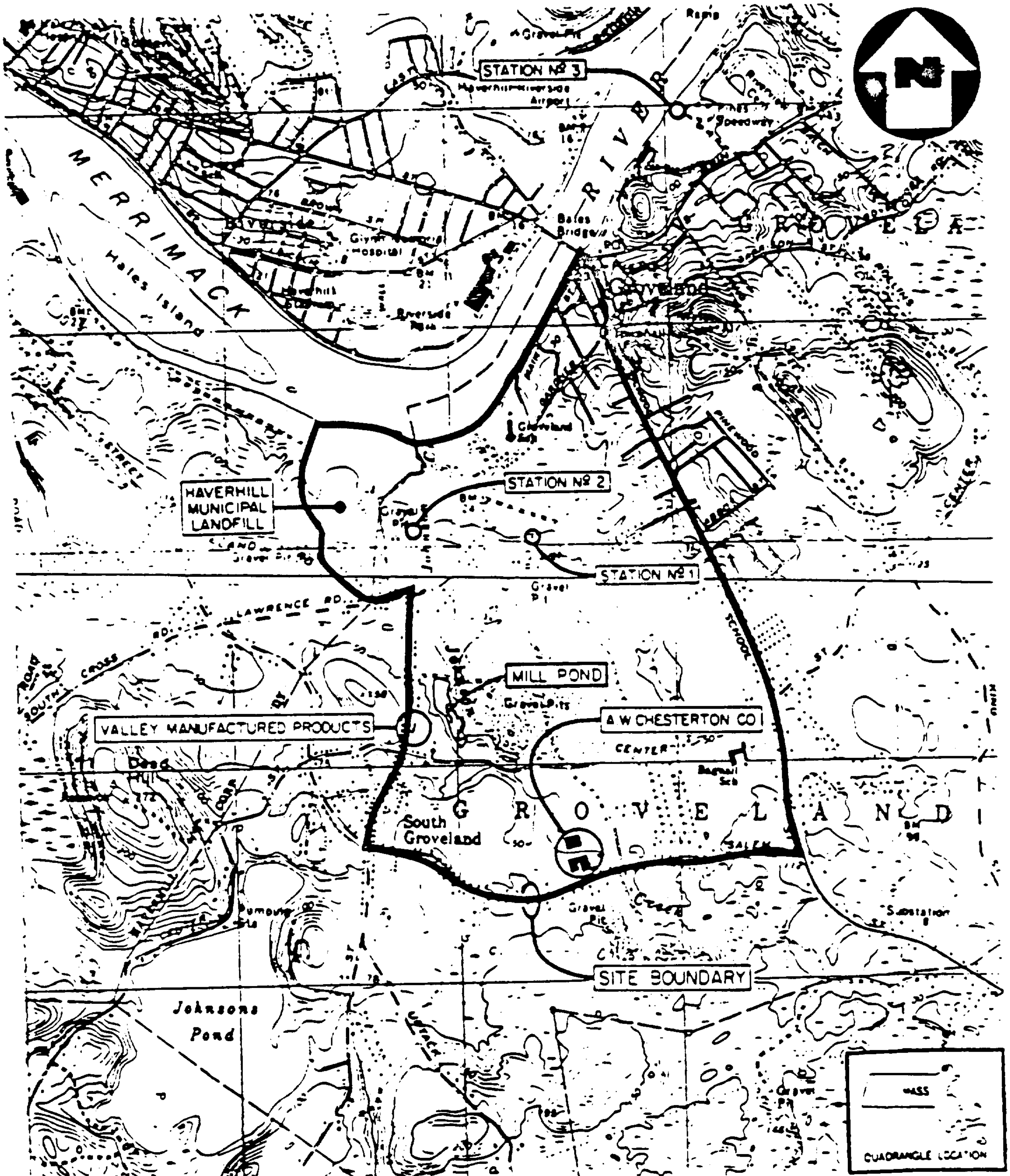
No significant changes have been made to the preferred alternative as a result of State and community comments

XIII. STATE ROLE

The Commonwealth has reviewed the Supplemental MOM RI/FS, the Proposed Plan, and the Risk Assessment to ensure that the selected remedy is in compliance with applicable or relevant and appropriate environmental laws and regulations of the Commonwealth. The Commonwealth concurs with the selected remedy for the Groveland Site. A copy of the declaration of concurrence is attached as Appendix B.

APPENDIX A

FIGURES AND TABLES



BASE MAP IS A PORTION OF THE U.S.G.S. HAVERHILL, MA - NH AND SOUTH GROVELAND, MA QUADRANGLES (7.5 MINUTE SERIES) DATED 1972 AND 1966 (PHOTOREVISED 1979) RESPECTIVELY. CONTOUR INTERVAL TEN FEET.

Figure 1

SITE BOUNDARY MAP
GROVELAND WELLS NOS. 1 AND 2 SITE
GROVELAND, MA

NUS CORPORATION

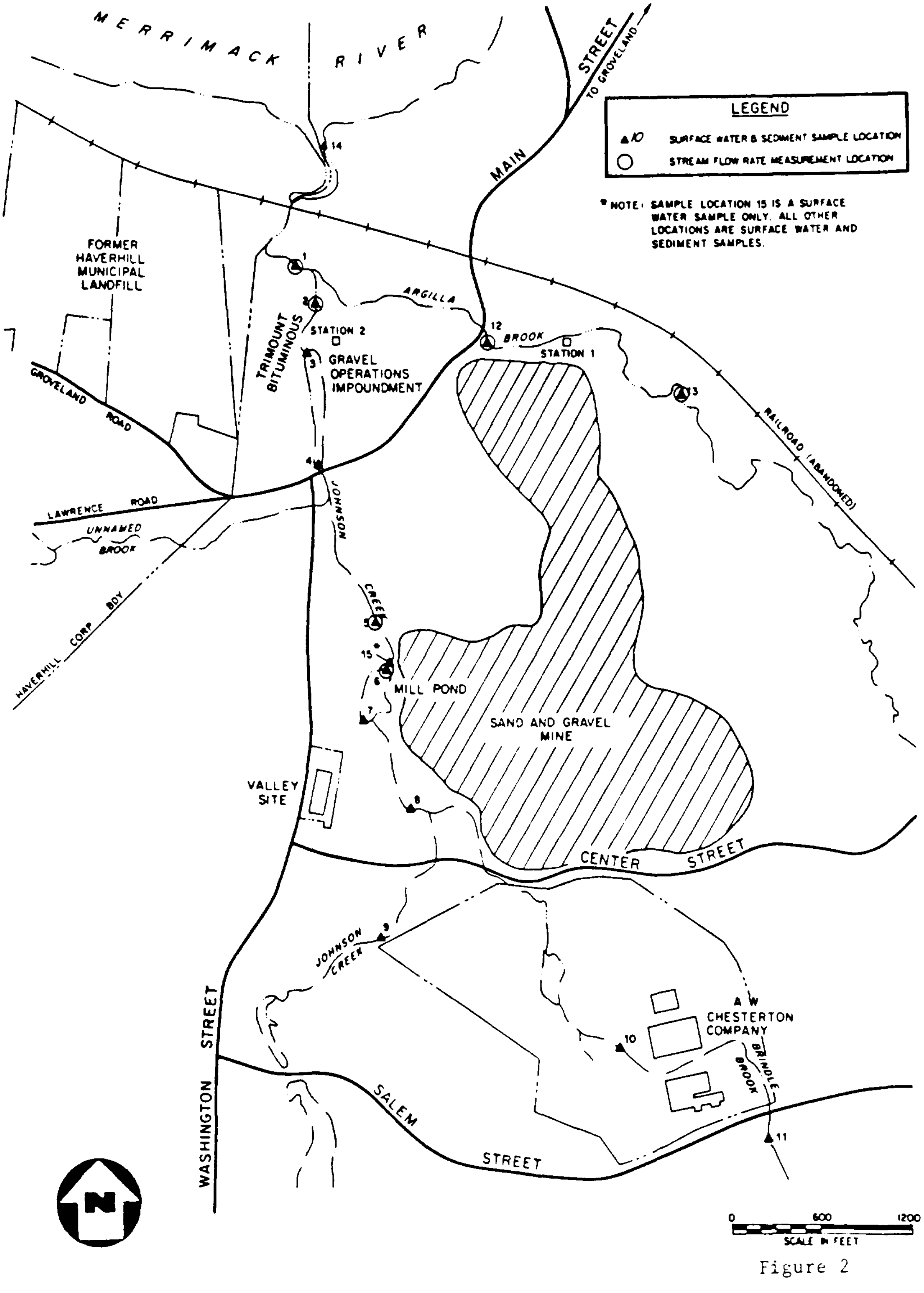


Figure 2

SURFACE WATER & SEDIMENT SAMPLE LOCATIONS
SUPPLEMENTAL MOM RI/FS
GROVELAND WELLS SITE, GROVELAND, MA

NUS CORPORATION

ACAD 0216\B—400.DWG 9/3/91

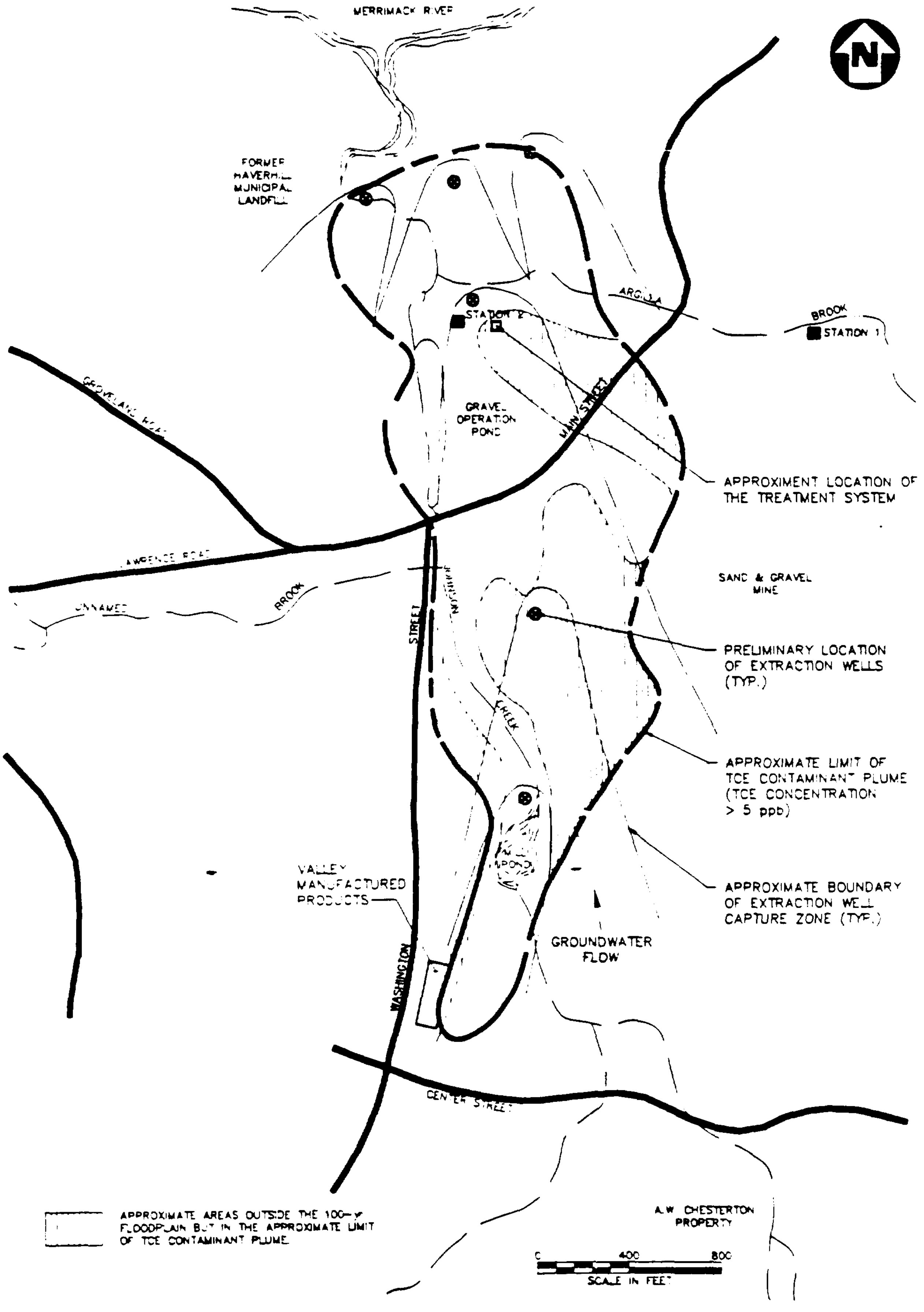


Figure 3

PRELIMINARY EXTRACTION WELLS AND
TREATMENT SYSTEM LOCATION
GROVELAND WELLS NOs. 1 AND 2 SITE
GROVELAND, MASSACHUSETTS

NUS CORPORATION

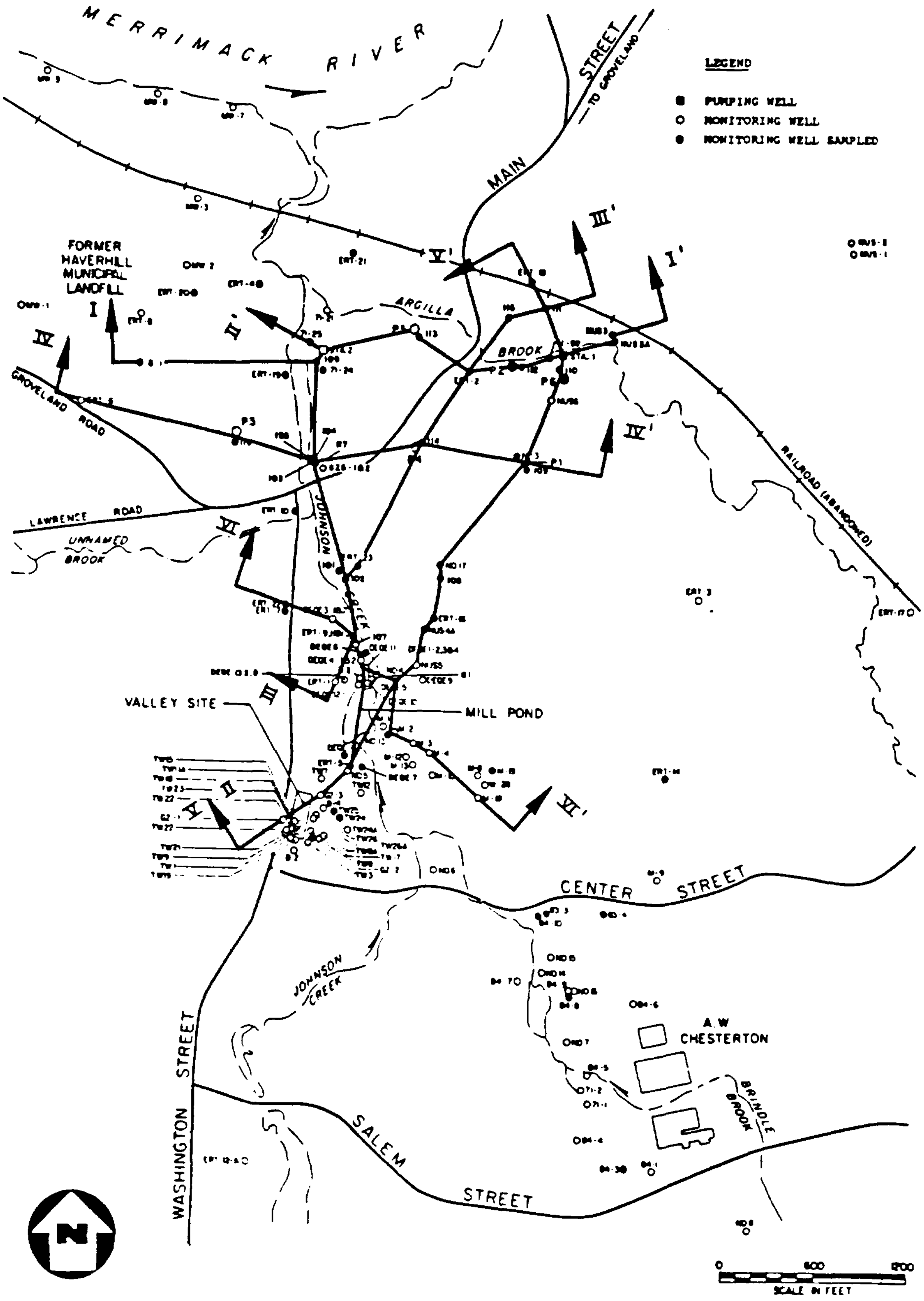
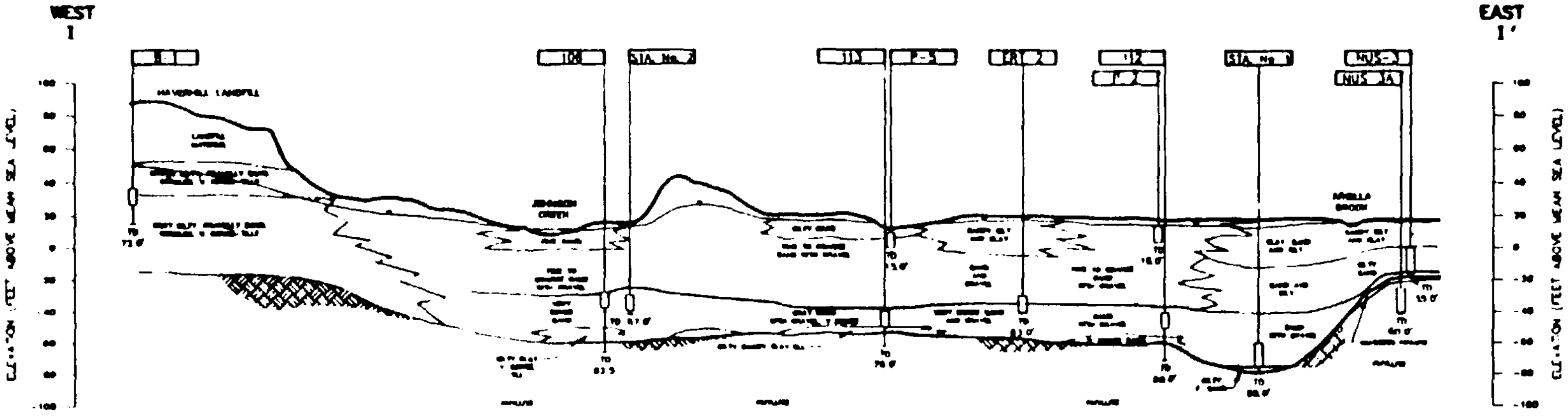


Figure 4

CROSS SECTION LOCATIONS
SUPPLEMENTAL MOM RI/FS
GROVELAND WELLS SITE, GROVELAND, MA

NUS CORPORATION



DATA USED:

BORING LOGS OF B-1, 108, STA. No. 2, 113, ERT-2, 112, STA. No. 1, NUS 3A

TOPOGRAPHIC MAP BY ACT, FEB. 1984 AERIAL PHOTOGRAMMETRIC SURVEY

ELEVATIONS OF MONITORING WELLS AFTER NUS WORK PLAN AUG. 1989, APPENDIX A, AND SURVEY DATA FROM MAY 1990.

WATER LEVELS FROM MARCH 6, 1990.

SEE BORING LOGS FOR DETAILED DESCRIPTIONS OF LITHOLOGY.

LEGEND

112	WELL NUMBER
▯	SCREENED INTERVAL
TD	TOTAL DEPTH OF BORING
———	LITHOLOGIC CONTACT - DASHED WHERE INFERRED

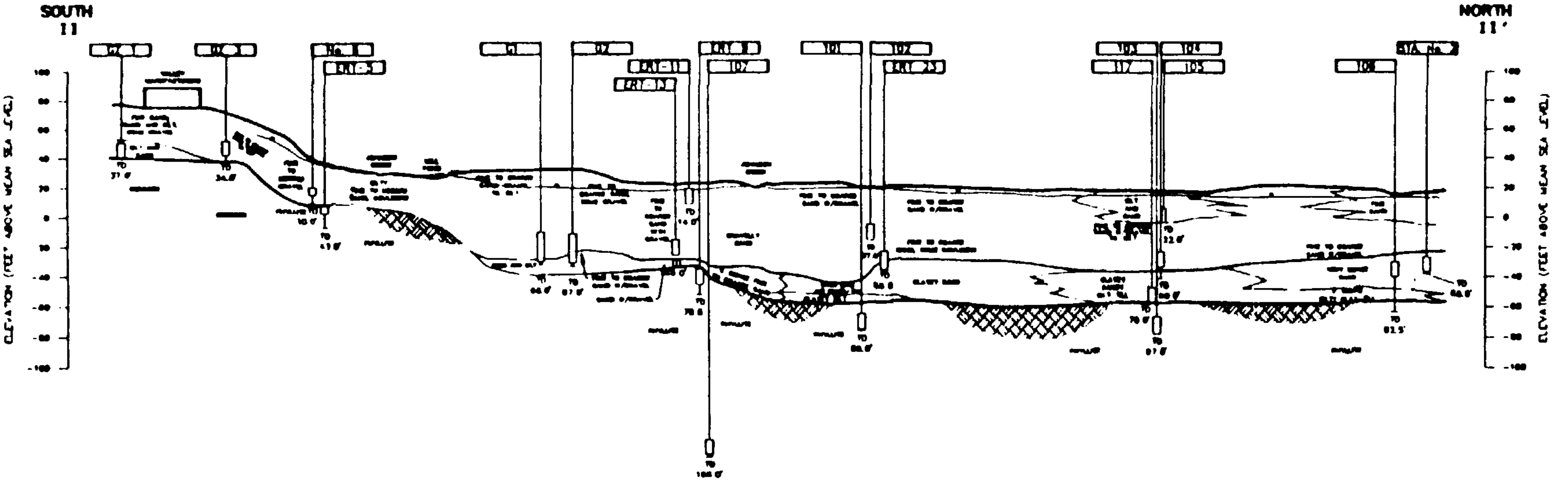
0 300 600
HORIZONTAL SCALE IN FEET

0 75 150
VERTICAL SCALE IN FEET
VERTICAL EXAGGERATION 4X

CROSS SECTIONS I-I'
SUPPLEMENTAL MOM RI/FS
GROVELAND WELLS, GROVELAND, MA

Figure 5

NUS CORPORATION



DATA USED:

BORING LOGS OF GZ-1, GZ-3, No 5, ERT-5, #1G, #2G, ERT-9, 107, 101, ERT-23, 103, 108, STA No 2

SECTIONS A-A', B-B', C-C' BY LALLY ASSOCIATES 1984 (FIG VI-1, VI-2, VI-3)

SECTION A-A' RI VOL 1 BY ERT 1985, FIG. 5-4

TOPOGRAPHIC MAP BY ACT, FEB 1984 AERIAL PHOTOGRAMMETRIC SURVEY

ELEVATIONS OF MONITORING WELLS AFTER NUS WORK PLAN AUG 1989, APPENDIX A, AND SURVEY DATA FROM MAY 1990.

WATER LEVELS FROM MARCH 6, 1990.

SEE BORING LOGS FOR DETAILED DESCRIPTIONS OF LITHOLOGY.

LEGEND

112	WELL NUMBER
▯	SCREENED INTERVAL
TD	TOTAL DEPTH OF BORING
—	LITHOLOGIC CONTACT - DASHED WHERE INFERRED

0 300 600
HORIZONTAL SCALE IN FEET

0 75 150
VERTICAL SCALE IN FEET
VERTICAL EXAGGERATION 4X

CROSS SECTION II-II'
SUPPLEMENTAL MOM RI/FS
GROVELAND WELLS, GROVELAND, MA

Figure 6

NUS CORPORATION

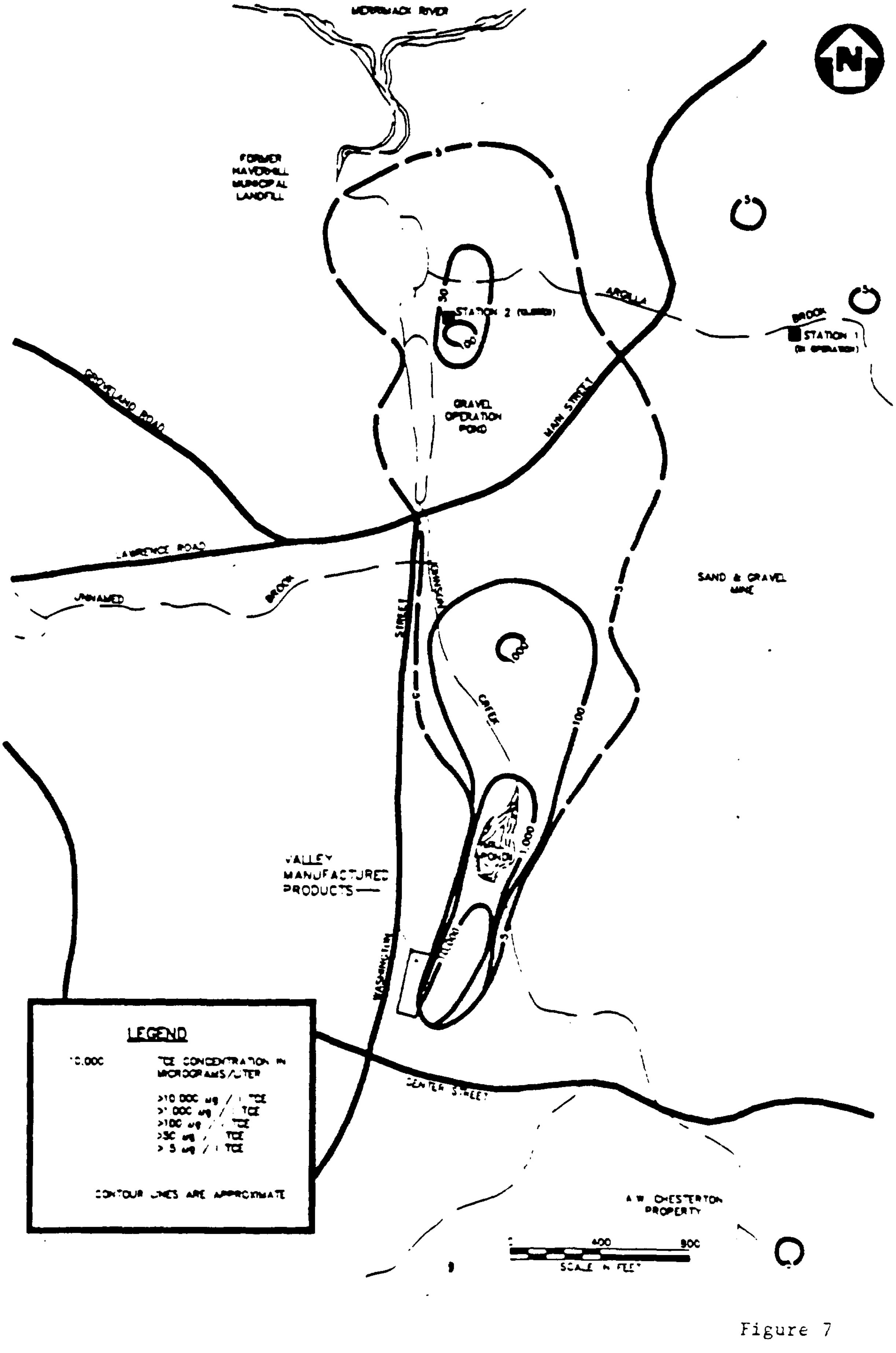
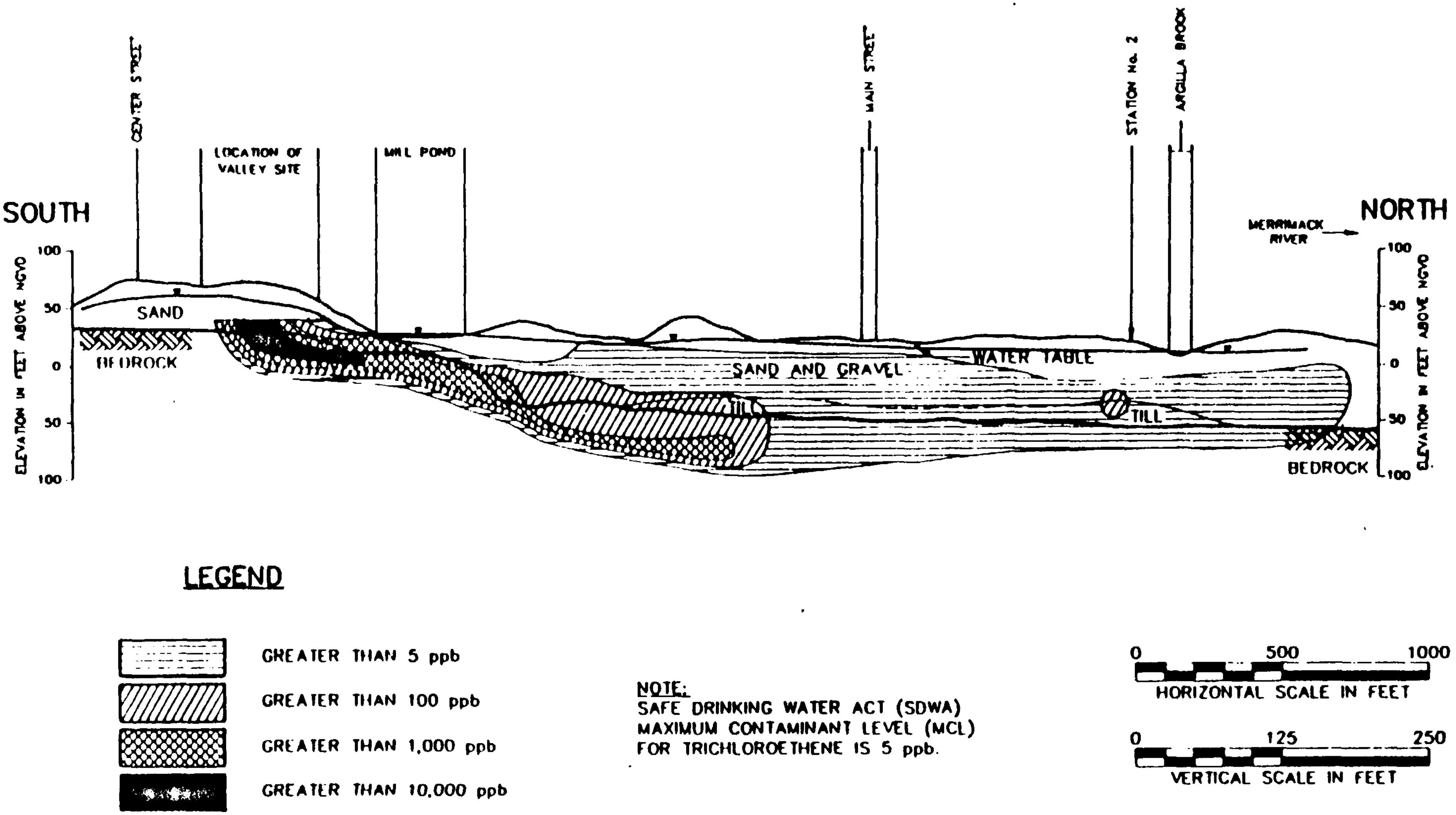


Figure 7

TRICHLOROETHENE CONTAMINANT PLUME–MAXIMUM CONCENTRATION DETECTED
GROVELAND WELLS NOs. 1 AND 2 SITE
GROVELAND, MASSACHUSETTS

NUS CORPORATION



NOTE:
SAFE DRINKING WATER ACT (SDWA)
MAXIMUM CONTAMINANT LEVEL (MCL)
FOR TRICHLOROETHENE IS 5 ppb.

PLUME CROSS-SECTION
MAXIMUM TRICHLOROETHENE CONCENTRATIONS IN PARTS PER BILLION (ppb)
SUPPLEMENTAL MOM RI/FS
GROVELAND WELLS SITE, GROVELAND, MA

Figure 8

NUS CORPORATION

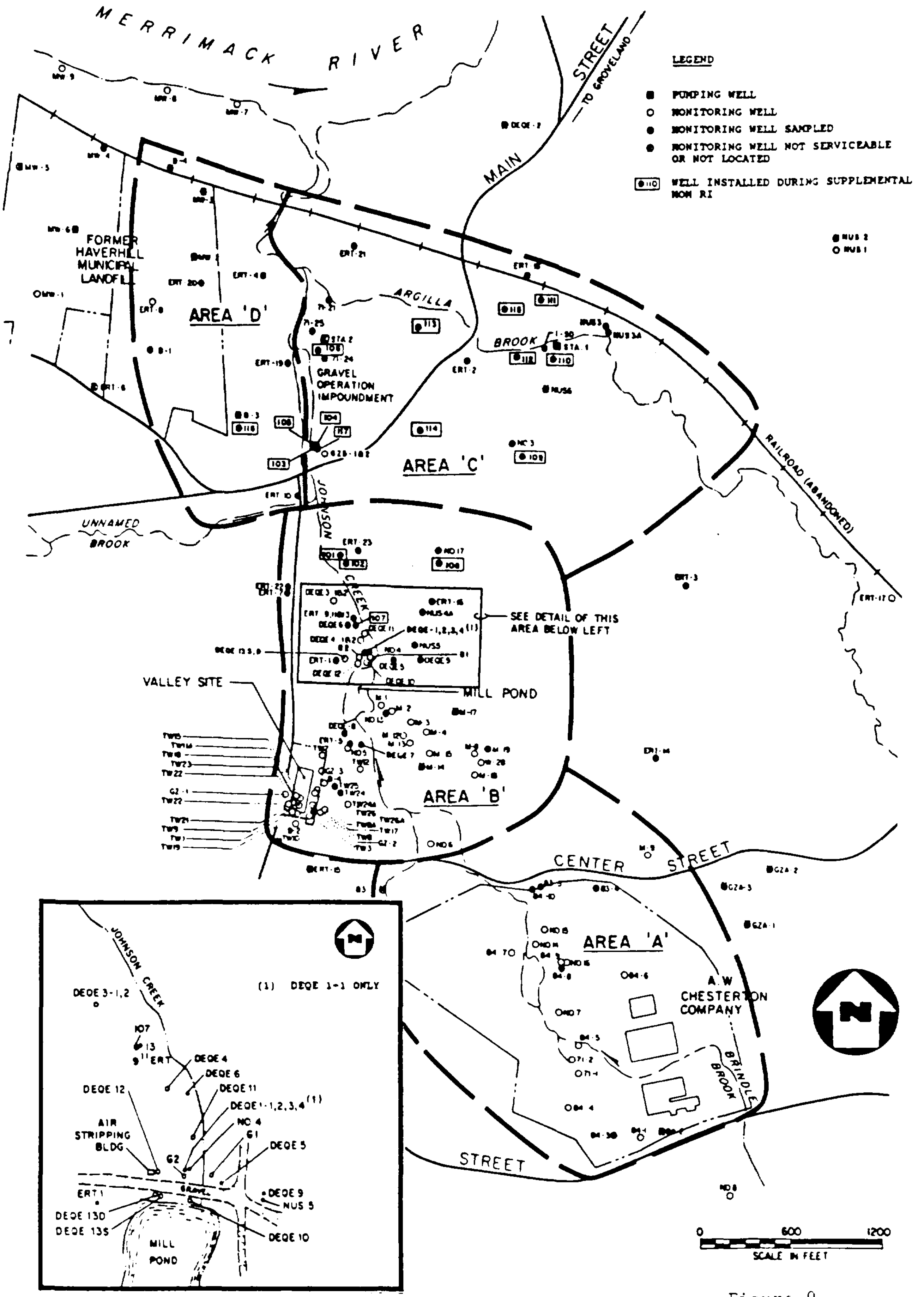


Figure 9

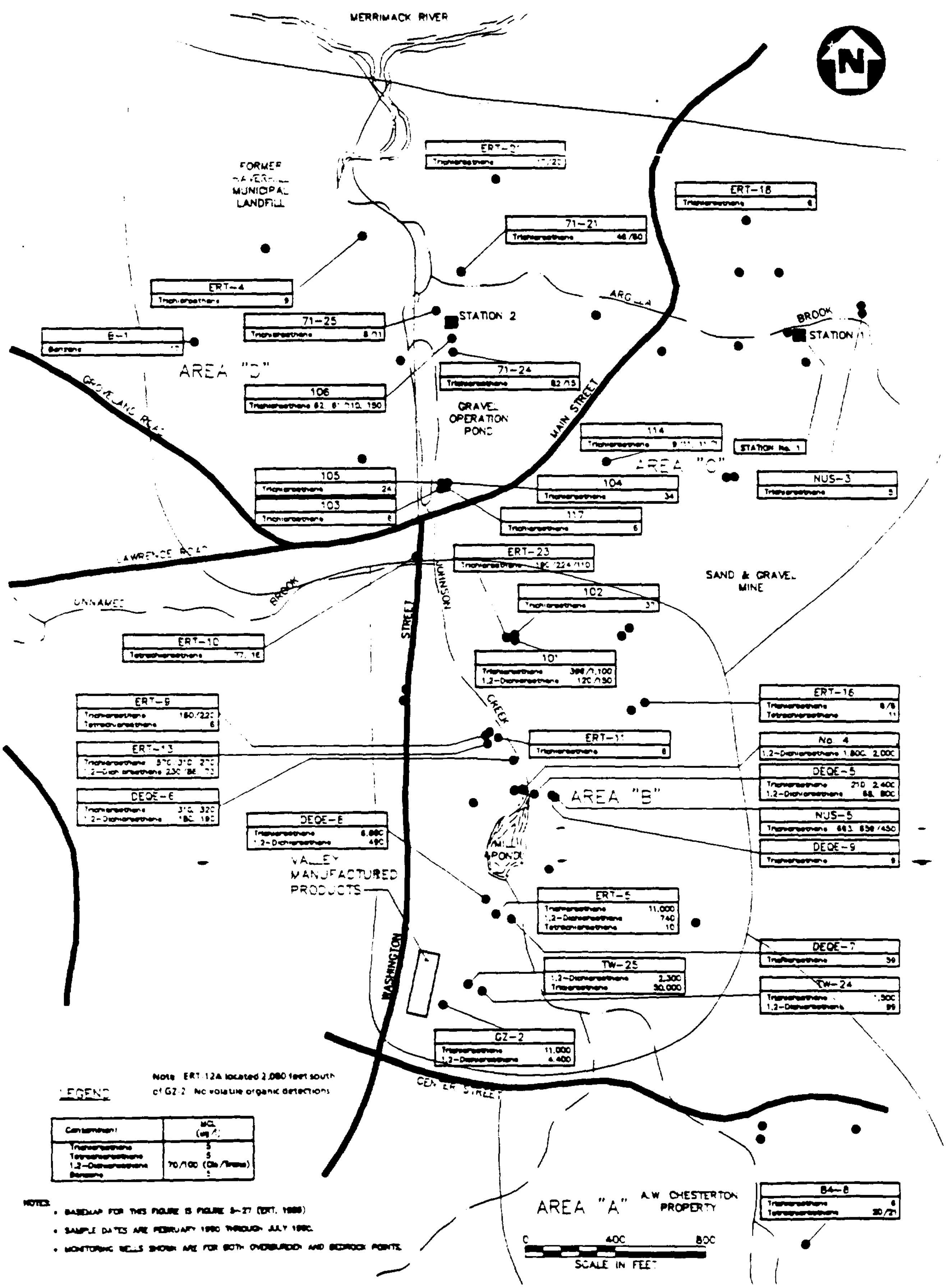
GROUNDWATER CONTAMINATION AREAS OF CONCERN

SUPPLEMENTAL MOM RI/FS

GROVELAND WELLS SITE, GROVELAND, MA

NUS CORPORATION

ACAD: 0218-LB-40C.DWG 8/21/91 MJ



Note: ERT-12A located 2,080 feet south of GZ-2. No volatile organic detections.

LEGEND

Contaminant	MCL (ug/l)
Trichloroethene	5
Tetrachloroethene	5
1,2-Dichloroethene	70/100 (Cis/Trans)
Benzene	5

NOTES:
- BASEMAP FOR THIS FIGURE IS FIGURE 5-27 (ERT, 1988)
- SAMPLE DATES ARE FEBRUARY 1990 THROUGH JULY 1990.
- MONITORING WELLS SHOWN ARE FOR BOTH OVERBURDEN AND BEDROCK POINTS.

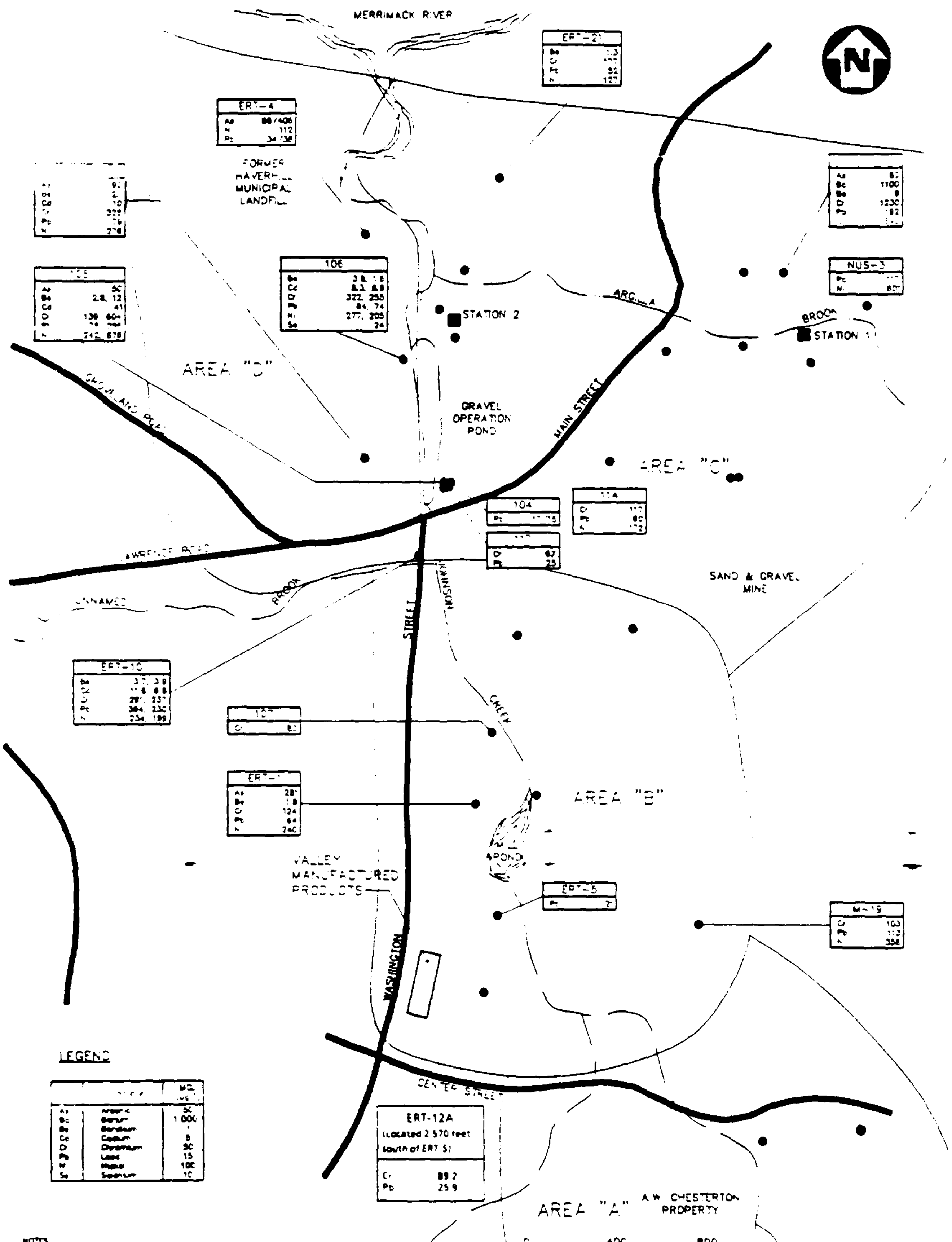
● INDICATES WELL WAS SAMPLED BUT THAT ORGANIC CONTAMINANTS WERE NOT DETECTED AT A CONCENTRATION ABOVE MCLs

Figure 10

ORGANIC CONTAMINANTS DETECTED AT CONCENTRATIONS GREATER THAN MCLs
SUPPLEMENTAL MOM RI/FS
GROVELAND WELLS NOs. 1 AND 2 SITE
GROVELAND, MASSACHUSETTS

NUS CORPORATION

ACAD: 0216 A-400.DWG 9/11/91 [illegible]



LEGEND

	[illegible]	MCL (ppb)
As	Arsenic	50
Ba	Barium	1,000
Be	Beryllium	1
Cd	Cadmium	5
Cr	Chromium	50
Pb	Lead	15
Ni	Nickel	100
Se	Selenium	10

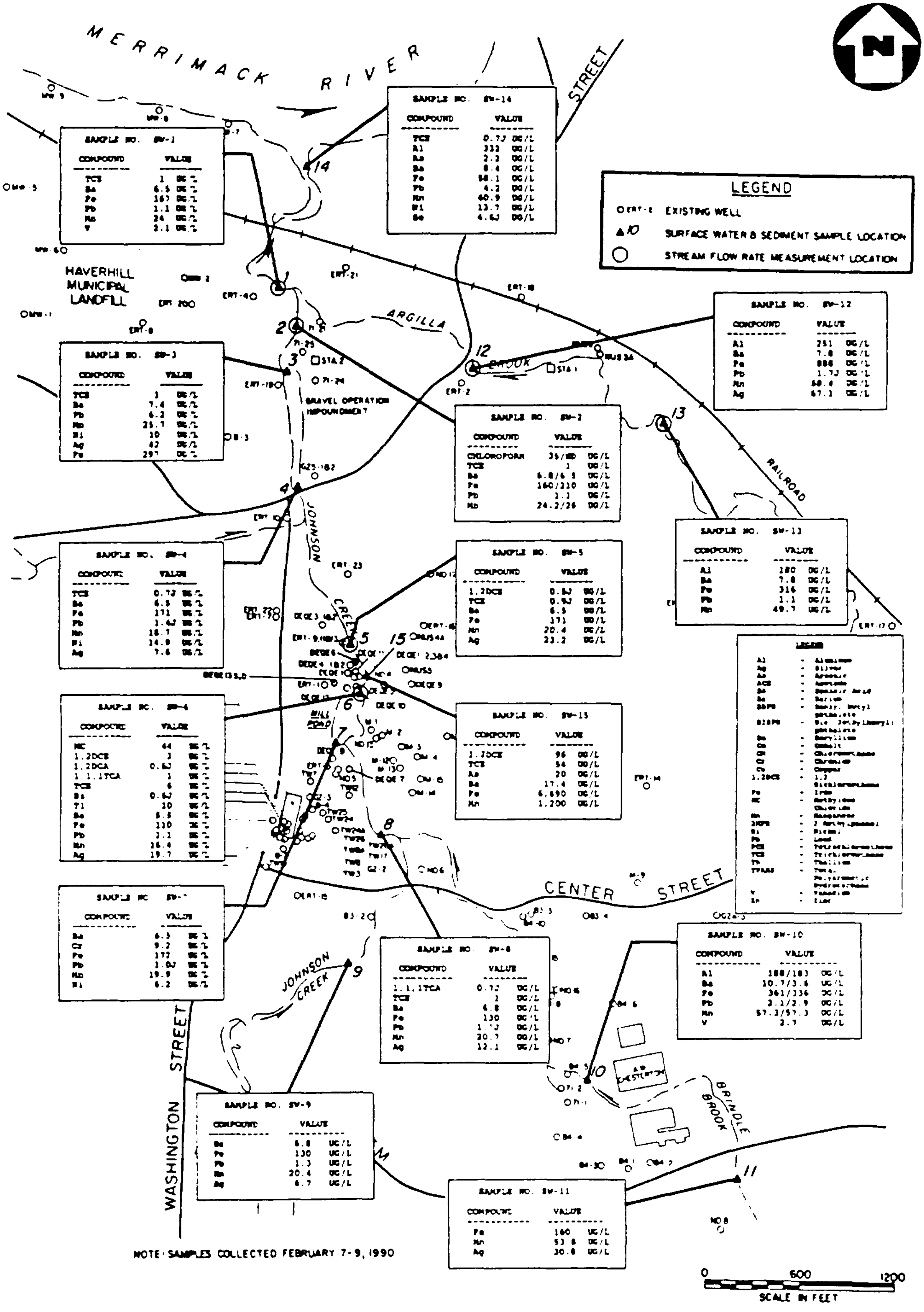
NOTES:

- BASEMAP FOR THIS FIGURE IS FIGURE 5-27 (ERT, 1985)
- SAMPLE DATES ARE FEBRUARY 1990 THROUGH JULY 1990.
- MONITORING WELLS SHOWN ARE FOR BOTH OVERBURDEN AND BEDROCK POINTS.
- ● INDICATES WELL WAS SAMPLED BUT THAT INORGANIC CONTAMINANTS WERE NOT DETECTED AT A CONCENTRATION ABOVE MCLs

Figure 11

INORGANIC CONTAMINANTS DETECTED AT CONCENTRATIONS GREATER THAN MCLs
SUPPLEMENTAL MOM RI/FS
GROVELAND WELLS NOs. 1 AND 2 SITE
GROVELAND, MASSACHUSETTS

NUS CORPORATION



SAMPLE NO. SW-1

COMPOUND	VALUE
TCE	1 UG/L
Ba	6.5 UG/L
Fe	367 UG/L
Pb	1.1 UG/L
Mn	24 UG/L
V	2.1 UG/L

SAMPLE NO. SW-14

COMPOUND	VALUE
TCE	0.7J UG/L
Al	332 UG/L
As	2.2 UG/L
Ba	8.4 UG/L
Fe	98.1 UG/L
Pb	4.2 UG/L
Mn	40.9 UG/L
Ni	13.7 UG/L
Se	4.6J UG/L

SAMPLE NO. SW-3

COMPOUND	VALUE
TCE	1 UG/L
Ba	7.4 UG/L
Pb	6.2 UG/L
Mn	25.7 UG/L
Ni	10 UG/L
Ag	42 UG/L
Fe	297 UG/L

SAMPLE NO. SW-12

COMPOUND	VALUE
Al	251 UG/L
Ba	7.8 UG/L
Fe	888 UG/L
Pb	1.7J UG/L
Mn	60.4 UG/L
Ag	67.1 UG/L

SAMPLE NO. SW-2

COMPOUND	VALUE
CHLOROFORM	35/ND UG/L
TCE	1 UG/L
Ba	6.8/6.5 UG/L
Fe	160/210 UG/L
Pb	1.1 UG/L
Mn	24.2/26 UG/L

SAMPLE NO. SW-4

COMPOUND	VALUE
TCE	0.7J UG/L
Ba	6.8 UG/L
Fe	171 UG/L
Pb	1.6J UG/L
Mn	18.7 UG/L
Ni	14.9 UG/L
Ag	7.6 UG/L

SAMPLE NO. SW-5

COMPOUND	VALUE
1,2DCE	0.5J UG/L
TCE	0.9J UG/L
Ba	6.5 UG/L
Fe	171 UG/L
Mn	20.4 UG/L
Ag	23.2 UG/L

SAMPLE NO. SW-13

COMPOUND	VALUE
Al	180 UG/L
Ba	7.8 UG/L
Fe	316 UG/L
Pb	1.1 UG/L
Mn	49.7 UG/L

LEGEND

Al	-	Aluminum
Ag	-	Silver
As	-	Arsenic
ACE	-	Acetone
BA	-	Benzoic Acid
Ba	-	Barium
BBPH	-	Benzyl Butyl phthalate
B2EPH	-	Bis (2-ethylhexyl) phthalate
Be	-	Beryllium
Co	-	Cobalt
CM	-	Chloromethane
Cr	-	Chromium
Cu	-	Copper
1,2DCE	-	1,2 Dichloroethene
Fe	-	Iron
MC	-	Methylene Chloride
Mn	-	Manganese
2MPH	-	2 Methylphenol
Ni	-	Nickel
Pb	-	Lead
PCE	-	Tetrachloroethene
TCE	-	Trichloroethene
Tl	-	Thallium
TPAHS	-	Total Polyaromatic Hydrocarbons
V	-	Vanadium
Zn	-	Zinc

SAMPLE NO. SW-6

COMPOUND	VALUE
MC	44 UG/L
1,2DCE	3 UG/L
1,2DCA	0.6J UG/L
1,1,1TCA	1 UG/L
TCE	6 UG/L
Be	0.6J UG/L
Tl	10 UG/L
Ba	8.5 UG/L
Fe	110 UG/L
Pb	1.1 UG/L
Mn	16.4 UG/L
Ag	19.7 UG/L

SAMPLE NO. SW-15

COMPOUND	VALUE
1,2DCE	96 UG/L
TCE	54 UG/L
As	20 UG/L
Ba	17.4 UG/L
Fe	6,690 UG/L
Mn	1,200 UG/L

SAMPLE NO. SW-7

COMPOUND	VALUE
Ba	6.3 UG/L
Cr	9.2 UG/L
Fe	172 UG/L
Pb	1.0J UG/L
Mn	19.9 UG/L
Ni	6.2 UG/L

SAMPLE NO. SW-8

COMPOUND	VALUE
1,1,1TCA	0.7J UG/L
TCE	2 UG/L
Ba	6.8 UG/L
Fe	130 UG/L
Pb	1.7J UG/L
Mn	20.7 UG/L
Ag	12.1 UG/L

SAMPLE NO. SW-10

COMPOUND	VALUE
Al	188/183 UG/L
Ba	10.7/3.6 UG/L
Fe	361/336 UG/L
Pb	2.1/2.9 UG/L
Mn	57.3/57.3 UG/L
V	2.7 UG/L

SAMPLE NO. SW-9

COMPOUND	VALUE
Ba	6.8 UG/L
Fe	130 UG/L
Pb	1.3 UG/L
Mn	20.4 UG/L
Ag	6.7 UG/L

SAMPLE NO. SW-11

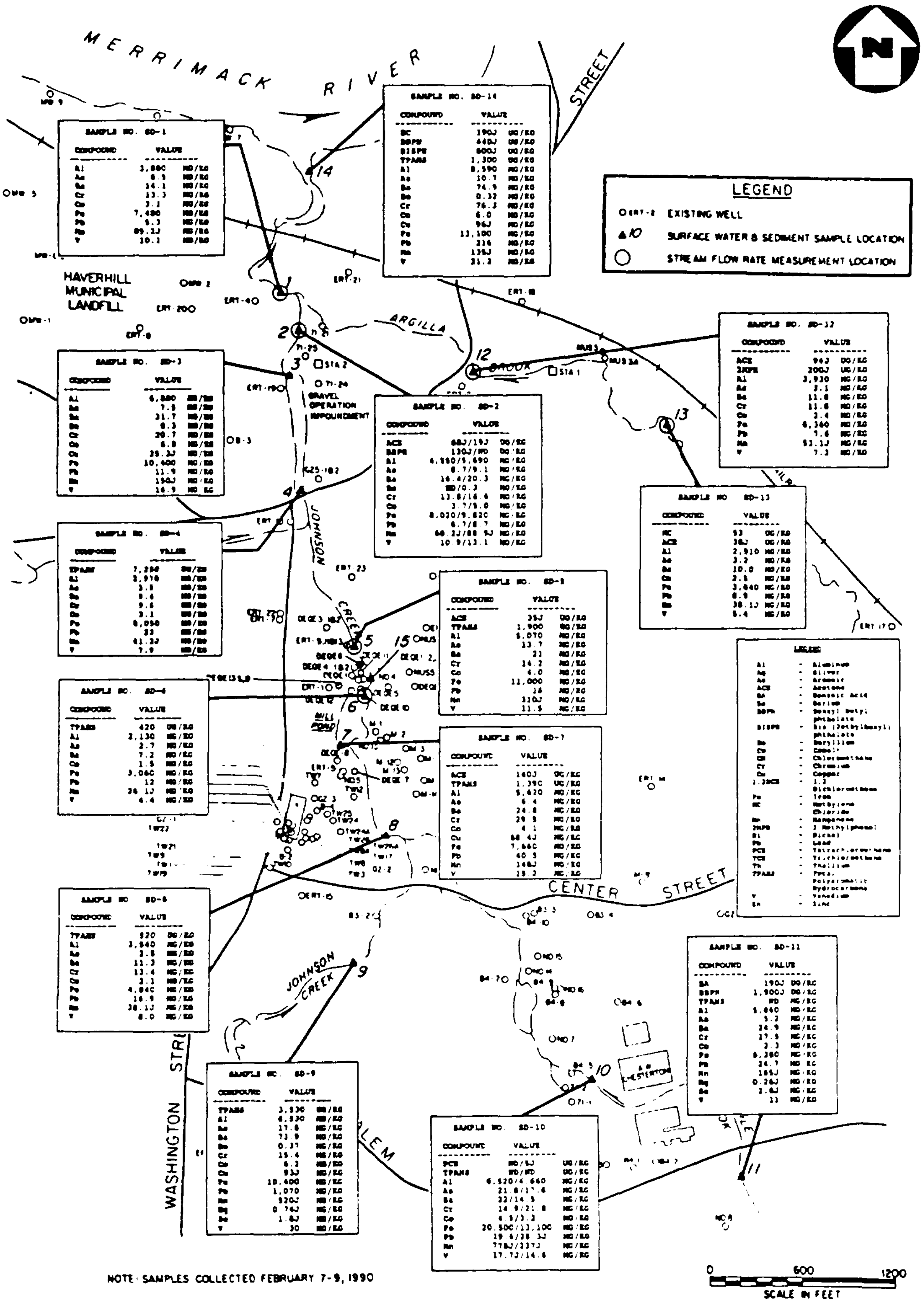
COMPOUND	VALUE
Fe	160 UG/L
Mn	53.8 UG/L
Ag	30.8 UG/L

NOTE: SAMPLES COLLECTED FEBRUARY 7-9, 1990

Figure 12

SELECTED FIRST ROUND SURFACE WATER MONITORING RESULTS
SUPPLEMENTAL MOM RI/FS
GROVELAND WELLS SITE, GROVELAND, MA

NUS CORPORATION



LEGEND

○ERT-2	EXISTING WELL
▲10	SURFACE WATER & SEDIMENT SAMPLE LOCATION
○	STREAM FLOW RATE MEASUREMENT LOCATION

SAMPLE NO. SD-1

COMPOUND	VALUE	
Al	3,880	MG/KG
As	8.5	MG/KG
Ba	14.1	MG/KG
Cr	13.3	MG/KG
Co	3.1	MG/KG
Fe	7,480	MG/KG
Pb	8.3	MG/KG
Mn	89.2J	MG/KG
V	10.1	MG/KG

SAMPLE NO. SD-14

COMPOUND	VALUE	
MC	190J	UG/KG
BBPH	440J	UG/KG
BISPH	600J	UG/KG
TPAHS	1,300	UG/KG
Al	8,590	MG/KG
As	10.7	MG/KG
Ba	74.9	MG/KG
Be	0.32	MG/KG
Cr	76.3	MG/KG
Co	6.0	MG/KG
Cu	96J	MG/KG
Fe	13,100	MG/KG
Pb	216	MG/KG
Mn	139J	MG/KG
V	21.3	MG/KG

SAMPLE NO. SD-3

COMPOUND	VALUE	
Al	6,880	MG/KG
As	7.5	MG/KG
Ba	31.7	MG/KG
Be	0.3	MG/KG
Cr	20.7	MG/KG
Co	6.8	MG/KG
Cu	35.3J	MG/KG
Fe	10,400	MG/KG
Pb	11.9	MG/KG
Mn	190J	MG/KG
V	16.9	MG/KG

SAMPLE NO. SD-2

COMPOUND	VALUE	
ACE	68J/19J	UG/KG
BBPH	130J/ND	UG/KG
Al	6,550/5,690	MG/KG
As	8.7/9.1	MG/KG
Ba	16.4/20.3	MG/KG
Be	ND/0.3	MG/KG
Cr	13.8/16.6	MG/KG
Co	3.7/5.0	MG/KG
Fe	8,030/9,820	MG/KG
Pb	6.7/8.7	MG/KG
Mn	68.2J/88.9J	MG/KG
V	10.9/13.1	MG/KG

SAMPLE NO. SD-12

COMPOUND	VALUE	
ACE	96J	UG/KG
2MPH	200J	UG/KG
Al	3,930	MG/KG
As	3.1	MG/KG
Ba	11.8	MG/KG
Cr	11.8	MG/KG
Co	3.4	MG/KG
Fe	6,360	MG/KG
Pb	7.6	MG/KG
Mn	53.1J	MG/KG
V	7.3	MG/KG

SAMPLE NO. SD-4

COMPOUND	VALUE	
TPAHS	7,290	UG/KG
Al	2,910	MG/KG
As	3.8	MG/KG
Ba	9.4	MG/KG
Cr	9.6	MG/KG
Co	3.1	MG/KG
Fe	6,090	MG/KG
Pb	33	MG/KG
Mn	41.3J	MG/KG
V	7.9	MG/KG

SAMPLE NO. SD-13

COMPOUND	VALUE	
MC	53	UG/KG
ACE	38J	UG/KG
Al	2,910	MG/KG
As	3.2	MG/KG
Ba	10.0	MG/KG
Co	2.5	MG/KG
Fe	3,840	MG/KG
Pb	6.9	MG/KG
Mn	38.1J	MG/KG
V	5.4	MG/KG

SAMPLE NO. SD-5

COMPOUND	VALUE	
ACE	35J	UG/KG
TPAHS	1,900	UG/KG
Al	8,070	MG/KG
As	13.7	MG/KG
Ba	21	MG/KG
Cr	14.2	MG/KG
Co	4.0	MG/KG
Fe	11,000	MG/KG
Pb	18	MG/KG
Mn	310J	MG/KG
V	11.5	MG/KG

SAMPLE NO. SD-6

COMPOUND	VALUE	
TPAHS	420	UG/KG
Al	2,130	MG/KG
As	2.7	MG/KG
Ba	7.2	MG/KG
Co	1.5	MG/KG
Fe	3,060	MG/KG
Pb	12	MG/KG
Mn	26.1J	MG/KG
V	4.4	MG/KG

SAMPLE NO. SD-7

COMPOUND	VALUE	
ACE	140J	UG/KG
TPAHS	1,390	UG/KG
Al	5,620	MG/KG
As	6.4	MG/KG
Ba	24.8	MG/KG
Cr	29.5	MG/KG
Co	4.1	MG/KG
Cu	68.4J	MG/KG
Fe	7,660	MG/KG
Pb	40.5	MG/KG
Mn	148J	MG/KG
V	15.2	MG/KG

LEGEND

Al	-	Aluminum
Ag	-	Silver
As	-	Arsenic
ACE	-	Acetone
BA	-	Benzoic Acid
Ba	-	Barium
BBPH	-	Benzyl butyl phthalate
BISPH	-	Bis (2ethylhexyl) phthalate
Be	-	Beryllium
Co	-	Cobalt
CM	-	Chloromethane
Cr	-	Chromium
Cu	-	Copper
1,2DCE	-	1,2 Dichloroethene
Fe	-	Iron
MC	-	Methylene Chloride
Mn	-	Manganese
2MPH	-	2 Methylphenol
Ni	-	Nickel
Pb	-	Lead
PCE	-	Tetrachloroethene
TCE	-	Trichloroethene
Tl	-	Thallium
TPAHS	-	Total Polyaromatic Hydrocarbons
V	-	Vanadium
Zn	-	Zinc

SAMPLE NO. SD-8

COMPOUND	VALUE	
TPAHS	520	UG/KG
Al	3,540	MG/KG
As	2.5	MG/KG
Ba	11.3	MG/KG
Cr	13.4	MG/KG
Co	2.1	MG/KG
Fe	4,840	MG/KG
Pb	16.9	MG/KG
Mn	38.1J	MG/KG
V	8.0	MG/KG

SAMPLE NO. SD-11

COMPOUND	VALUE	
BA	190J	UG/KG
BBPH	1,900J	UG/KG
TPAHS	ND	MG/KG
Al	5,840	MG/KG
As	5.2	MG/KG
Ba	24.9	MG/KG
Cr	17.5	MG/KG
Co	2.3	MG/KG
Fe	6,280	MG/KG
Pb	24.7	MG/KG
Mn	185J	MG/KG
Hg	0.26J	MG/KG
Se	2.8J	MG/KG
V	11	MG/KG

SAMPLE NO. SD-9

COMPOUND	VALUE	
TPAHS	3,530	UG/KG
Al	6,530	MG/KG
As	17.8	MG/KG
Ba	73.9	MG/KG
Be	0.37	MG/KG
Cr	15.4	MG/KG
Co	6.3	MG/KG
Cu	93J	MG/KG
Fe	10,400	MG/KG
Pb	1,070	MG/KG
Mn	520J	MG/KG
Hg	0.74J	MG/KG
Se	1.8J	MG/KG
V	30	MG/KG

SAMPLE NO. SD-10

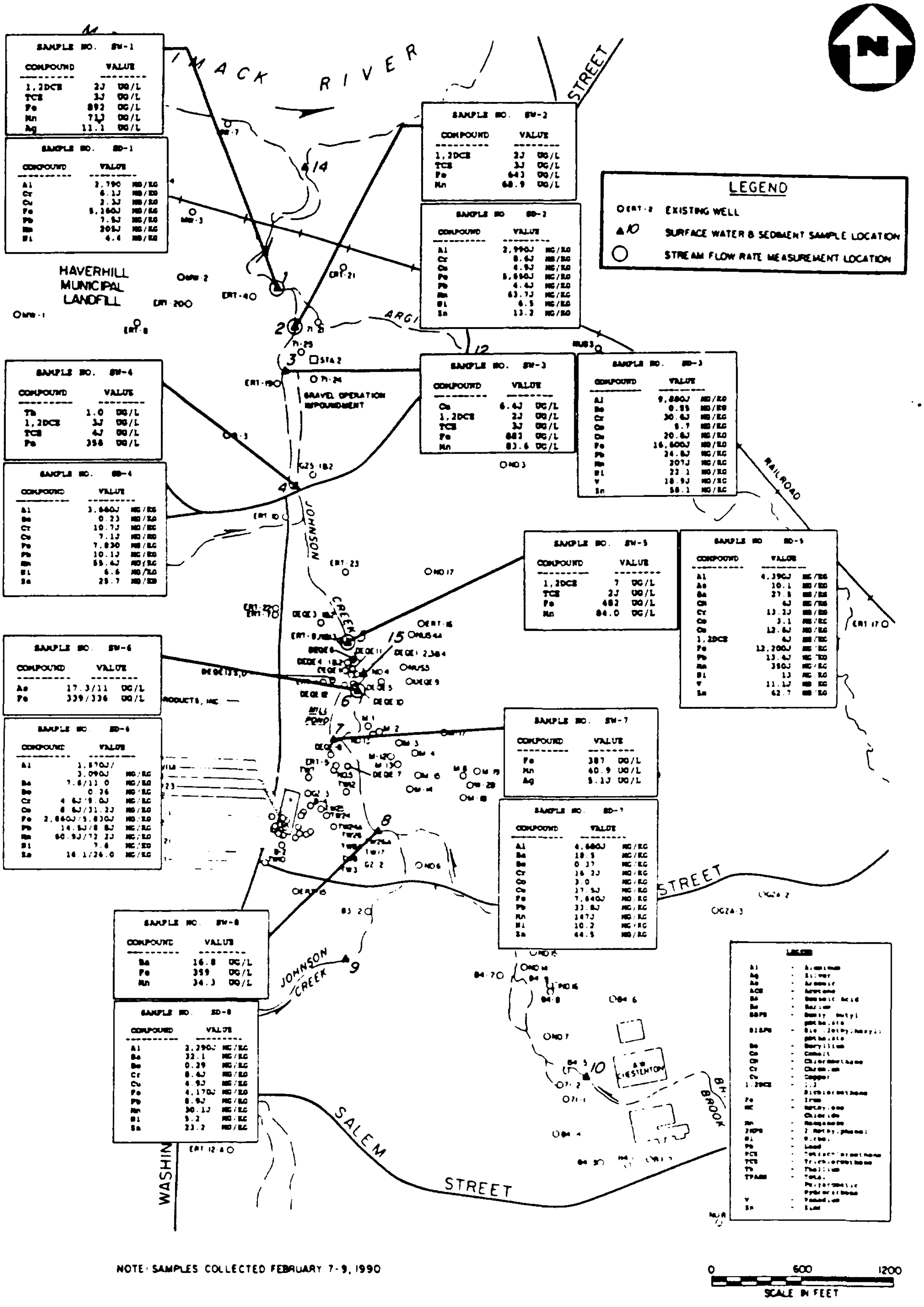
COMPOUND	VALUE	
PCE	ND/5J	UG/KG
TPAHS	ND/ND	UG/KG
Al	6,520/4,660	MG/KG
As	21.8/17.6	MG/KG
Ba	22/14.5	MG/KG
Cr	14.9/21.8	MG/KG
Co	4.5/3.2	MG/KG
Fe	20,500/13,100	MG/KG
Pb	19.6/38.3J	MG/KG
Mn	778J/337J	MG/KG
V	17.7J/14.6	MG/KG

NOTE: SAMPLES COLLECTED FEBRUARY 7-9, 1990

Figure 13

SELECTED FIRST ROUND SEDIMENT MONITORING RESULTS
SUPPLEMENTAL MOM RI/FS
GROVELAND WELLS SITE, GROVELAND, MA

NUS CORPORATION



SAMPLE NO. SW-1

COMPOUND	VALUE
1,2DCE	2J UG/L
TCE	3J UG/L
Fe	892 UG/L
Mn	71J UG/L
Ag	11.1 UG/L

SAMPLE NO. SD-1

COMPOUND	VALUE
Al	2,790 MG/KG
Cr	6.1J MG/KG
Cu	2.3J MG/KG
Fe	5,160J MG/KG
Pb	7.5J MG/KG
Mn	205J MG/KG
Ni	4.4 MG/KG

SAMPLE NO. SW-2

COMPOUND	VALUE
1,2DCE	2J UG/L
TCE	3J UG/L
Fe	643 UG/L
Mn	68.9 UG/L

SAMPLE NO. SD-2

COMPOUND	VALUE
Al	2,990J MG/KG
Cr	8.6J MG/KG
Cu	4.9J MG/KG
Fe	5,690J MG/KG
Pb	4.4J MG/KG
Mn	63.7J MG/KG
Ni	6.5 MG/KG
Zn	13.2 MG/KG

SAMPLE NO. SW-3

COMPOUND	VALUE
Cu	6.6J UG/L
1,2DCE	2J UG/L
TCE	3J UG/L
Fe	883 UG/L
Mn	83.6 UG/L

SAMPLE NO. SD-3

COMPOUND	VALUE
Al	9,880J MG/KG
Be	0.55 MG/KG
Cr	30.6J MG/KG
Co	8.7 MG/KG
Cu	20.6J MG/KG
Fe	16,600J MG/KG
Pb	24.8J MG/KG
Mn	207J MG/KG
Ni	22.1 MG/KG
V	18.9J MG/KG
Zn	58.1 MG/KG

SAMPLE NO. SW-4

COMPOUND	VALUE
Tl	1.0 UG/L
1,2DCE	3J UG/L
TCE	4J UG/L
Fe	358 UG/L

SAMPLE NO. SD-4

COMPOUND	VALUE
Al	3,660J MG/KG
Be	0.23 MG/KG
Cr	10.7J MG/KG
Cu	7.1J MG/KG
Fe	7,830 MG/KG
Pb	10.1J MG/KG
Mn	55.4J MG/KG
Ni	6.6 MG/KG
Zn	25.7 MG/KG

SAMPLE NO. SW-5

COMPOUND	VALUE
1,2DCE	7 UG/L
TCE	2J UG/L
Fe	482 UG/L
Mn	84.0 UG/L

SAMPLE NO. SD-5

COMPOUND	VALUE
Al	4,390J MG/KG
As	10.1 MG/KG
Ba	27.8 MG/KG
CM	4J MG/KG
Cr	13.2J MG/KG
Co	3.1 MG/KG
Cu	12.6J MG/KG
1,2DCE	4J MG/KG
Fe	12,200J MG/KG
Pb	13.4J MG/KG
Mn	380J MG/KG
Ni	13 MG/KG
V	11.1J MG/KG
Zn	62.7 MG/KG

SAMPLE NO. SW-6

COMPOUND	VALUE
As	17.3/11 UG/L
Fe	339/336 UG/L

SAMPLE NO. SD-6

COMPOUND	VALUE
Al	1,870J/ 3,090J MG/KG
Ba	7.8/11.0 MG/KG
Be	0.26 MG/KG
Cr	4.6J/9.0J MG/KG
Cu	8.6J/31.2J MG/KG
Fe	2,660J/5,830J MG/KG
Pb	14.5J/8.8J MG/KG
Mn	60.9J/72.2J MG/KG
Ni	7.6 MG/KG
Zn	16.1/26.0 MG/KG

SAMPLE NO. SW-7

COMPOUND	VALUE
Fe	387 UG/L
Mn	60.9 UG/L
Ag	5.1J UG/L

SAMPLE NO. SD-7

COMPOUND	VALUE
Al	4,680J MG/KG
Ba	18.5 MG/KG
Be	0.37 MG/KG
Cr	16.2J MG/KG
Co	3.0 MG/KG
Cu	17.5J MG/KG
Fe	7,640J MG/KG
Pb	33.8J MG/KG
Mn	147J MG/KG
Ni	10.2 MG/KG
Zn	44.5 MG/KG

SAMPLE NO. SW-8

COMPOUND	VALUE
Ba	16.8 UG/L
Fe	359 UG/L
Mn	34.3 UG/L

SAMPLE NO. SD-8

COMPOUND	VALUE
Al	2,290J MG/KG
Ba	32.1 MG/KG
Be	0.29 MG/KG
Cr	8.6J MG/KG
Cu	4.9J MG/KG
Fe	4,170J MG/KG
Pb	8.9J MG/KG
Mn	30.1J MG/KG
Ni	5.2 MG/KG
Zn	23.2 MG/KG

LEGEND

Al	- Aluminum
Ag	- Silver
As	- Arsenic
ACE	- Acetone
BA	- Benzoic Acid
Ba	- Barium
BBPH	- Benzyl butyl phthalate
BIS2PH	- Bis(2-ethylhexyl) phthalate
Be	- Beryllium
Co	- Cobalt
CM	- Chloromethane
Cr	- Chromium
Cu	- Copper
1,2DCE	- 1,2 Dichloroethene
Fe	- Iron
MC	- Methylene Chloride
Mn	- Manganese
2MPH	- 2 Methylphenol
Ni	- Nickel
Pb	- Lead
PCE	- Tetrachloroethene
TCE	- Trichloroethene
Tl	- Thallium
TPAHS	- Total Polyaromatic Hydrocarbons
V	- Vanadium
Zn	- Zinc

NOTE: SAMPLES COLLECTED FEBRUARY 7-9, 1990

Figure 14

SELECTED SECOND ROUND SURFACE WATER & SEDIMENT MONITORING RESULTS
SUPPLEMENTAL MOM RI/FS
GROVELAND WELLS SITE, GROVELAND, MA

NUS CORPORATION

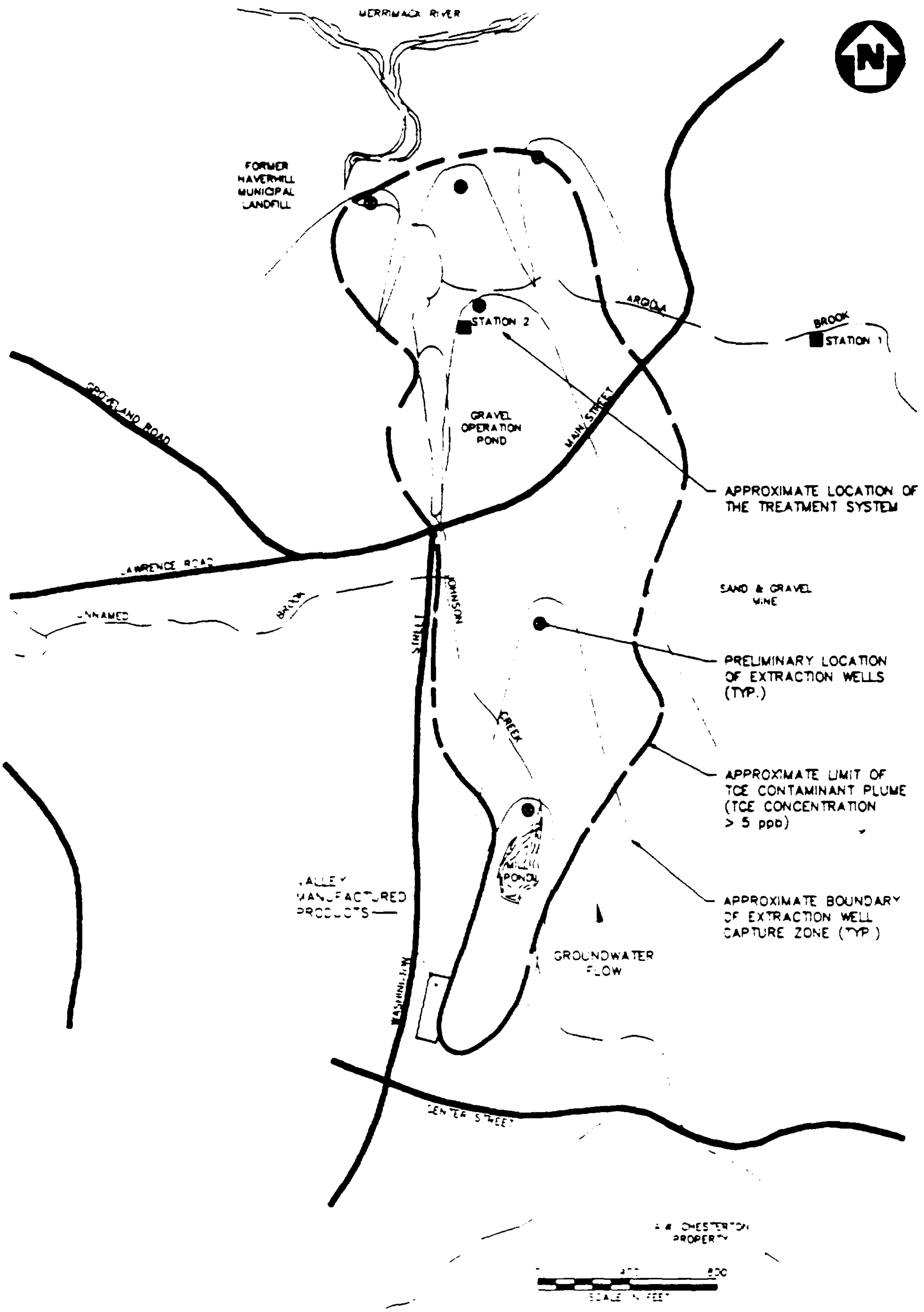
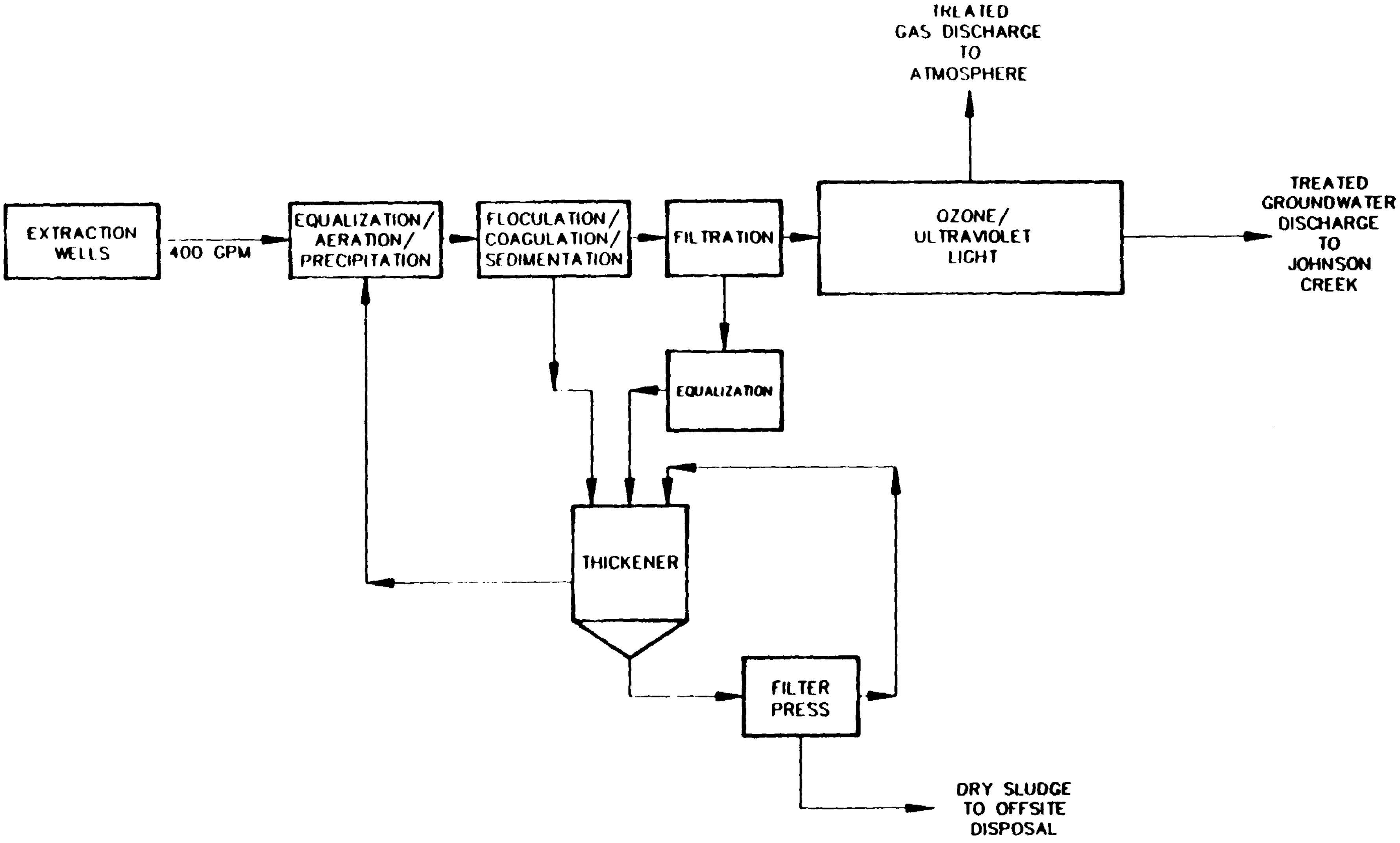


Figure 15

PREFFERRED ALTERNATIVE EXTRACTION WELLS AND
TREATMENT SYSTEM LOCATION
GROVELAND WELLS NOs. 1 AND 2 SITE
GROVELAND, MASSACHUSETTS

NUS CORPORATION



ALTERNATIVE 6
EXTRACTION WELLS, METALS REMOVAL, OZONE/UV,
AND DISCHARGE TO JOHNSON CREEK
GROVELAND WELLS NOs. 1 AND 2 SITE
GROVELAND, MASSACHUSETTS

Figure 16

NUS CORPORATION

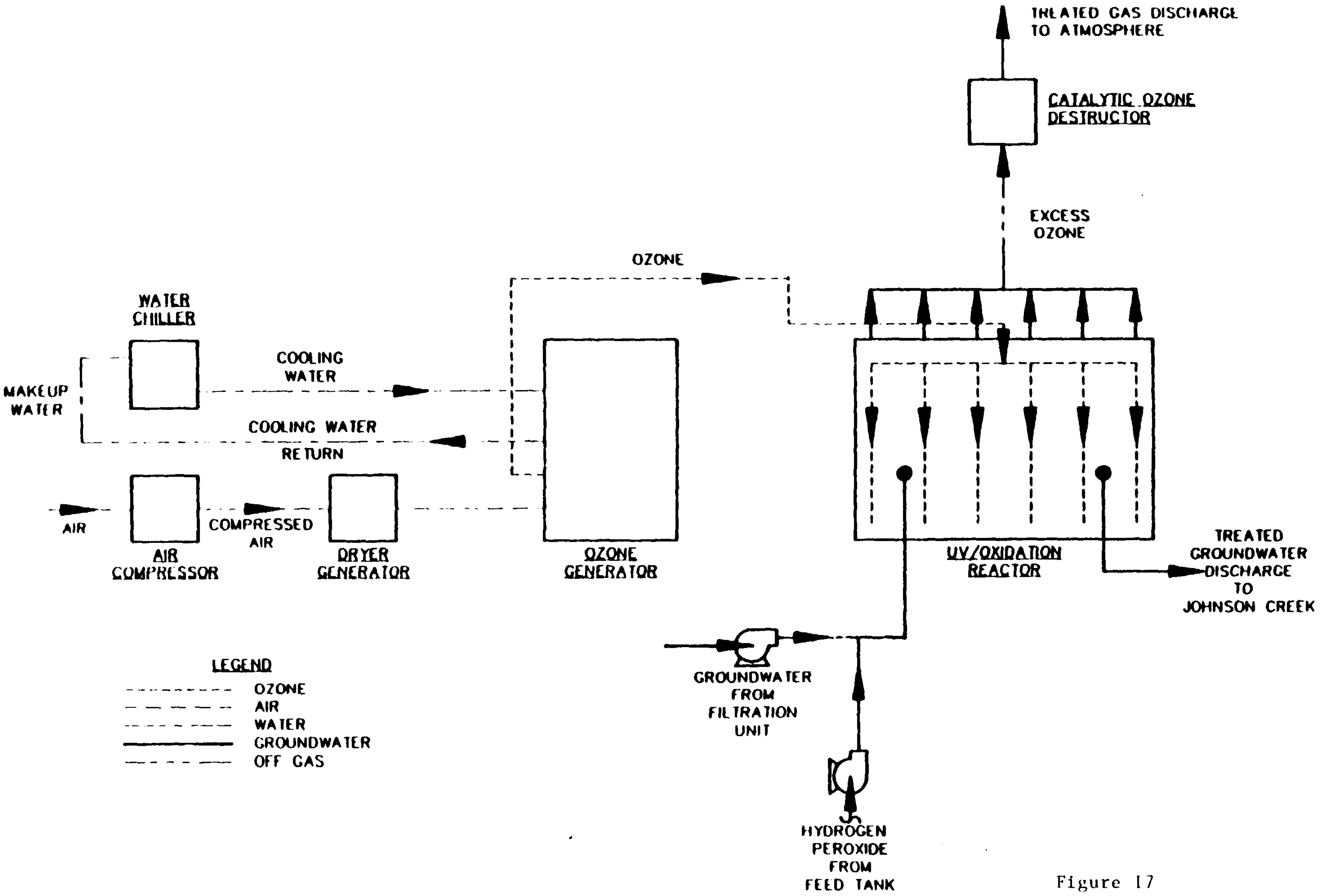


Figure 17

OXIDATION/UV LIGHT TREATMENT
PROCESS SCHEMATIC GROVELAND WELLS NOs. 1 & 2 SITE
GROVELAND, MA

NUS
CORPORATION

Table 1

MONITORING WELLS IN AREA A - THE CHESTERTON FACILITY AREA
SUMMARY OF FIRST ROUND (FEBRUARY 1990) GROUNDWATER MONITORING RESULTS
GROVELAND WELLS SITE
SUPPLEMENTAL MOM RI/FS
GROVELAND, MASSACHUSETTS

Parameter	Background	Shallow Overburden				Shallow Bedrock				Standard/Criteria
		Range of Sample Quantitation Limits(1)	Frequency of Detection	Range of Positive Detections	Average	Range of Sample Quantitation Limits(1)	Frequency of Detection	Range of Positive Detections	Average	
	(ug/L)	(ug/L)		(ug/L)	(ug/L)	(ug/L)		(ug/L)	(ug/L)	(ug/L)
1,1-Dichloroethane	5U	5U	0/1	---	---	5U	1/2	15	8.8 [15]	NAvail
1,2 Dichloroethene	5U	5U	0/1	---	---	5U	1/2	5	3.8 [5]	70/100 Cis/Trans PMCL (P)
1,1,1-Trichloroethane	5U	5U	0/1	---	---	5U	1/2	14-16 (D)	8.8 [15]	200 PMCL (F)
Trichloroethene	5U	5U	0/1	---	---	5U	1/2	4-6 (D)	3.8 [5]	5 PMCL (F)
Tetrachloroethene	5U	5U	0/1	---	---	5U	1/2	20-21 (D)	11.5 [20.5]	5 PMCL (P)
Aluminum	34,500	---	1/1	28,300	28,300	---	2/2	181-25,900	10,466	50-200 SMCL (P)
Arsenic	19.7	---	1/1	37.9	37.9	---	2/2	5.8-55.8	28.2	50 MIPDWR
Barium	177	---	1/1	142	142	---	2/2	38.2-311	145	1,000 MIPDWR
Calcium	41,100	---	1/1	14,000	14,000	---	2/2	42,000-249,000	134,500	NAvail
Chromium	89.2	---	1/1	170	1,170	---	2/2	10.9-227	107.7	50 MIPDWR
Cobalt	32.9	---	1/1	34.1	34.1	---(c)	1/2	10.4-19.6 (D)	20	NAvail
Copper	56.1U	51.8U	0/1	---	---	9.4U-37.2U	1/2	60.3	22	1,300 PMCL (P)
Iron	39,300	---	1/1	64,800	64,800	309U	1/2	27,400-49,000 (D)	19,177	300 SMCL (F)
Lead	25.9	---	1/1	36.6	36.6	3.1U	1/2	59.5-87.4 (D)	37.5	50 MIPDWR; 5 (at source) PMCL (P)
Magnesium	17,600	---	1/1	13,800	13,800	---	2/2	12,700-60,000	32,850	NAvail
Manganese	960	---	1/1	1,310	1,310	6.9U	1/2	368-663 (D)	259	50 SMCL (F)
Nickel	96.3	---	1/1	105	105	---	2/2	10.6-160	73.8	100 PMCL (T)
Potassium	6,970	---	1/1	5,640	5,640	---	2/2	1,830-5,670	3,420	NAvail
Selenium	UJ	UJ	0/1	---	---	UJ(c)	1/2	4.1	259.5	10 PMCL (P)
Sodium	9,140	---	1/1	21,100	21,100	---	2/2	8,140-9,060	8,437	20,000 DWEL
Vanadium	56.3	---	1/1	77.5	77.5	---	1/1	20.8-33.8 (D)	19.9	NAvail
Zinc	449	---	1/1	182	182	12.6U	1/2	205-361 (D)	144.7	5,000 SMCL (F)

Table 1

MONITORING WELLS IN AREA A - THE CHESTERTON FACILITY AREA
SUMMARY OF FIRST ROUND (FEBRUARY 1990) GROUNDWATER MONITORING RESULTS
GROVELAND WELLS SITE
SUPPLEMENTAL MOM RI/FS
GROVELAND, MASSACHUSETTS
PAGE TWO

Parameter	Background	Shallow Overburden				Shallow Bedrock				Standard/Criteria
		Range of Sample Quantitation Limits(1)	Frequency of Detection	Range of Positive Detections	Average	Range of Sample Quantitation Limits(1)	Frequency of Detection	Range of Positive Detections	Average	
	(mg/L)	(mg/L)		(mg/L)	(mg/L)	(mg/L)		(mg/L)	(mg/L)	(mg/L)
Bicarbonate	62	---	1/1	24	24	1.0U	1/2	79	39.8	NAvail
Chloride	12	---	1/1	32	32	---	2/2	22-83	51.3	250 SMCL (F)
Nitrate-Nitrite (as N)	1.9	---	1/1	0.21	0.21	---	2/2	0.12-0.5	0.29	10 PMCL (P)
Sulfate	100U	10U	0/1	---	---	---	2/2	6.5-15	11	400 PMCL (T)
Total Dissolved Solids	129	---	1/1	102	102	---	2/2	112-230	169.5	500 SMCL (F)
Total Suspended Solids	1,440	---	1/1	482	402	---	2/2	143-337	231.0	NAvail

(1) Sample quantitation limits (SQL) presented for parameters reported as 'not detected' in one or more samples in a data group. For inorganics, the only SQLs presented are those which differ from Contract Required Detection Limits (CRDLs). CRDLs are presented in Appendix A.
(c) Results for one or more samples in the data group were reported as non-detected at the CRDL.

(P) Proposed.
(F) Final.
(T) Tentative.
(D) Results of duplicate samples.

U Parameter was not detected. Value presented is the sample quantitation limit.
UJ The parameter was analyzed for, but not detected, in one or more samples. The sample quantitiation limit (the CRDL) is estimated.

NAvail	Not Available.
DWEL	Drinking Water Equivalent Level.
PMCL	Federal Safe Drinking Water Act (SDWA) Primary Maximum Contaminant Level.
SMCL	Federal SDWA Secondary Maximum Contaminant Level.
NIPDWR	National Interim Primary Drinking Water Regulation.

Table 2

SHALLOW OVERBURDEN MONITORING WELLS IN AREA B - THE VALLEY SITE/MILL POND AREA
SUMMARY OF FIRST ROUND (FEBRUARY 1990) GROUNDWATER MONITORING RESULTS
GROVELAND WELLS SITE
SUPPLEMENTAL MOM RI/FS
GROVELAND, MASSACHUSETTS

Parameter	Background	Shallow Overburden, Immediately Downgradient of Valley				Shallow Overburden, Mill Pond Area				Standard/Criteria
		Range of Sample Quantitation Limits(1)	Frequency of Detection	Range of Positive Detections	Average	Range of Sample Quantitation Limits(1)	Frequency of Detection	Range of Positive Detections	Average	
	(ug/L)	(ug/L)		(ug/L)	(ug/L)	(ug/L)		(ug/L)	(ug/L)	(ug/L)
1,2-Dichloro-ethene	5U	4,400	2/2	490-4,400	2,445	5U	3/8	1-4	2.56 [2.7]	70/100 Cis/Trans PMCL (P)
Trichloroethene	5U	---	2/2	6,800-11,000	8,900	5U	5/8	1-59	13.2 [21.0]	5 PMCL (P)
Methylene Chloride	10U	500U 830U	0/2	--	---	5U-10U	1/8	0.9	2.07 [0.9]	NAvail
Aluminum	34,500	NA	---	---	--	---	2/2	251-40,100	20,176	50-200 SMCL (P)
Antimony	---(c)	NA	---	---	---	---(c)	1/2	35.4	32.7	10/5 PMCL (P)
Arsenic	19.7	NA	---	---	---	---(c)	1/2	47.8	28.4	50 MIPDWR
Barium	177	NA	---	---	---	---	2/2	8.3-148	78.2	1,000 MIPDWR
Beryllium	---(c)	NA	---	---	---	---(c)	1/2	7.5	5	1 PMCL (T)
Calcium	41,100	NA	---	---	---	---	2/2	17,100-38,000	27,550	NAvail
Chromium	89.2	NA	---	---	---	---(c)	1/2	103	54	50 MIPDWR
Cobalt	32.9	NA	---	---	---	---(c)	1/2	116	70.5	NAvail
Copper	56.1U	NA	---	---	---	5.4U	1/2	293	148	1,300 PMCL (P)
Iron	39,300	NA	---	---	---	---	2/2	644-229,000	114,822	300 SMCL (P)
Lead	25.9	NA	---	---	---	6.3U	1/2	113	58.1	50 MIPDWR; 5 (at source) PMCL (P)
Magnesium	17,600	NA	---	---	---	---	2/2	3,760-20,200	11,980	NAvail
Manganese	980	NA	---	---	---	---	1/2	923	485.3	50 SMCL (P)
Mercury	---(c)	NA	---	---	---	UJ	0/2	---	---	2 PMCL (P)

Table 2

SHALLOW OVERBURDEN MONITORING WELLS IN AREA B - THE VALLEY SITE/MILL POND AREA
SUMMARY OF FIRST ROUND (FEBRUARY 1990) GROUNDWATER MONITORING RESULTS

GROVELAND WELLS SITE
SUPPLEMENTAL NOM RI/FS
GROVELAND, MASSACHUSETTS
PAGE TWO

Parameter	Background	Shallow Overburden, Immediately Downgradient of Valley				Shallow Overburden, Mill Pond Area				Standard/Criteria
		Range of Sample Quantitation Limits(1)	Frequency of Detection	Range of Positive Detections	Average	Range of Sample Quantitation Limits(1)	Frequency of Detection	Range of Positive Detections	Average	
	(ug/L)	(ug/L)		(ug/L)	(ug/L)	(ug/L)		(ug/L)	(ug/L)	(ug/L)
Nickel	96.3	NA	---	---	-	---(c)	1/2	350	189	100 PMCL (T)
Potassium	6,970	NA	- -	---	- -	---	2/2	1,460-5,330	3,395	NAvail
Selenium	---(c)	NA	--	---	- -	UJ	0/2	---	---	10 PMCL (P)
Silver	--(c)	NA	---	---	---	6.4U-10.3U	0/2	---	---	50 NIPDWR
Sodium	9,140	NA	---	---	---	---	2/2	4,510-7,780	6,145	20,000 DWEL
Vanadium	56.3	NA	---	---	---	---(c)	1/2	94.1	59.6	NAvail
Zinc	449	NA	---	---	---	17.4U	1/2	3,900	1,954.4	5,000 SMCL(F)
	(mg/L)	(mg/L)		(mg/L)	(mg/L)	(mg/L)		(mg/L)	(mg/L)	(mg/L)
Bicarbonate	62	NA	--	--	-	---	2/2	29-66	47.5	NAvail
Chloride	12	NA	--	---	---	5.0U	1/2	20	11.3	250 SMCL(F)
Nitrate-Nitrate	1.9	NA	---	---	- -	---	2/2	0.26-0.6	0.4	10 PMCL(P)
Sulfate	100U	NA	---	---	---	---	2/2	14-65	39.5	400 PMCL (T)
Total Dissolved Solids	129	NA	-	---	---	---	2/2	72-111	91.5	500 SMCL (F)
Total Suspended Solids	1,440	NA		---	---	---	2/2	15-1,610	812.5	NAvail
Total Organic Carbon	NA	NA	---	---	---	---	1/1	4.8	4.8	NAvail

Table 2

SHALLOW OVERBURDEN MONITORING WELLS IN AREA B - THE VALLEY SITE/MILL POND AREA
SUMMARY OF FIRST ROUND (FEBRUARY 1990) GROUNDWATER MONITORING RESULTS
GROVELAND WELLS SITE
SUPPLEMENTAL MOM RI/FS
GROVELAND, MASSACHUSETTS
PAGE THREE

Parameter	Background	Shallow Overburden, Immediately Downgradient of Valley				Shallow Overburden, Mill Pond Area				Standard/Criteria
		Range of Sample Quantitation Limits(1)	Frequency of Detection	Range of Positive Detections	Average	Range of Sample Quantitation Limits(1)	Frequency of Detection	Range of Positive Detections	Average	
	(mg/L)	(mg/L)		(mg/L)	(mg/L)	(mg/L)		(mg/L)	(mg/L)	(mg/L)
COD	NA	NA	--	---	--	---	1/1	33	33	NAvail
BOD$_5$	NA	NA	---	---	--	---	1/1	115	115	NAvail
Hardness, Total	NA	NA	---	---	--	---	1/1	50.1	50.1	NAvail
Total Alkalinity	NA	NA	-	---	---	---	1/1	29	29	NAvail

(1) Sample quantitation limits (SQL) presented for parameters reported as "not detected" in one or more samples in a data group. For inorganics, the only SQLs presented are those which differ from Contract Required Detection Limits (CRDLs). CRDLs are presented in Appendix A.

(c) Results for one or more samples in the data group were reported as non-detected at the CRDL.

U Parameter was not detected. Value presented is the sample quantitation limit.
UJ The parameter was analyzed for, but not detected. The sample quantitation limit (the CRDL) is estimated.

(D) Results of duplicate samples.
(P) Proposed.
(F) Final.
(T) Tentative.

NA	Not analyzed.
NAvail	Not Available.
DWEL	Drinking Water Equivalent Level.
PMCL	Federal Safe Drinking Water Act (SDWA) Primary Maximum Contaminant Level.
SMCL	Federal SDWA Secondary Maximum Contaminant Level.
NIPDWR	National Interium Primary Drinking Water Regulation.

Table 3

DEEP OVERBURDEN/SHALLOW BEDROCK MONITORING WELLS IN AREA B - THE VALLEY SITE/MILL POND AREA
SUMMARY OF FIRST ROUND (FEBRUARY 1990) GROUNDWATER MONITORING RESULTS
GROVELAND WELLS SITE
SUPPLEMENTAL MOM RI/FS
GROVELAND, MASSACHUSETTS

Parameter	Background	Deep Overburden/Shallow Bedrock in the Immediate Vicinity of Valley and the Johnson Creek				Deep Overburden/Shallow Bedrock Beyond the Immediate Vicinity of Johnson Creek				Deep Bedrock Well 107	Standard/Criteria
		Range of Sample Quantitation Limits(1)	Frequency of Detection	Range of Positive Detections	Average	Range of Sample Quantitation Limits(1)	Frequency of Detection	Range of Positive Detections	Average		
		(ug/L)		(ug/L)	(ug/L)	(ug/L)		(ug/L)	(ug/L)	(ug/L)	(ug/L)
1,1-Dichloroethene	5U	5U-500U	1/10	2	54.8 [2]	1U-5U	0/5	----	----	1U	7 PMCL (F)
1,1-Dichloroethane	5U	5U-500U	1/10	0.8	54.4 [0.8]	1U-5U	0/5	----	----	1U	NAvail
1,2-Dichloroethene	5U	----	10/10	20-2,300	609	5U	2/5	0.5 - 1	1.0 [0.8]	1U	70/100 Cis/Trans PMCL (P)
Trichloroethene	5U	1U-710U	10/10	160-50,000	6,577	5U	2/5	3 - 6	3.3 [4.5]	1U	5 PMCL (F)
Benzene	5U	5U-500U	1/10	0.2	54.6 [0.2]	1U-5U	0/5	----	----	1U	5 PMCL (F)
Tetrachloroethene	5U	5U-500U	3/10	0.3-10	53.4 [5.4]	1U-5U	0/5	----	----	1U	5 PMCL (P)
Acetone	10U	10U-1,400U	0/10	----	----	10U	1/5	5	4.0 [5]	5 R	NAvail
Toluene	5U	5U-500U	1/10	2	45.4 [2]	1U 5U	0/5	----	----	1U	2,000 PMCL (P)
Methylene chloride	5U	5U-500U	0/10	----		5U	1/5	0.4	2.1 [0.4]	2U	5 PMCL (T)
Total xylenes	5U	5U-500U	2/10	1-2	54.7 [1.5]	1U-5U	0/5	----	----	1	10,000 PMCL (P)
Aluminum	34,500	----	3/3	515-9,870	4,390	----	1/1	45,300	45,300	567	50-200 SMCL (P)
Arsenic	19.7	----	3/3	7.4-16.1	9.3	----	1/1	201	201	3.0	50 NIPDWR
Barium	177	----	3/3	8.3-30.2	26.9	----	1/1	234	234	37.3	1,000 NIPDWR
Beryllium	----(c)	----(c)	0/3	----	----	----	1/1	1.0	1.0	----(c)	1 PMCL (T)
Cadmium	----(c)	----(c)	1/3	2.7	2.6	----(c)	0/1	----	----	----(c)	5 PMCL (P)
Calcium	41,100	----	3/3	19,000-41,000	29,700	----	1/1	31,400	31,400	24,200	NAvail
Chromium	89.2	----	3/3	8.8-33.9	20.4	----	1/1	124	124	83	50 NIPDWR
Cobalt	32.9	----	3/3	6.9-13.9	10	----	1/1	98.7	98.7	----(c)	NAvail
Copper	56.1U	7.9U-45.3U	0/3	----	----	----	1/1	167	167	12.5U	1,300 PMCL (P)

Table 3

DEEP OVERBURDEN/SHALLOW BEDROCK MONITORING WELLS IN AREA B - THE VALLEY SITE/MILL POND AREA
SUMMARY OF FIRST ROUND (FEBRUARY 1990) GROUNDWATER MONITORING RESULTS
GROVELAND WELLS SITE
SUPPLEMENTAL MOM RI/FS
GROVELAND, MASSACHUSETTS
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Parameter	Background	Deep Overburden/Shallow Bedrock in the Immediate Vicinity of Valley and the Johnson Creek				Deep Overburden/Shallow Bedrock Beyond the Immediate Vicinity of Johnson Creek				Deep Bedrock Well 107	Standard/Criteria
		Range of Sample Quantitation Limits(1)	Frequency of Detection	Range of Positive Detections	Average	Range of Sample Quantitation Limits(1)	Frequency of Detection	Range of Positive Detections	Average		
		(ug/L)		(ug/L)	(ug/L)	(ug/L)		(ug/L)	(ug/L)	(ug/L)	(ug/L)
Iron	39,300	----	3/3	1,250-22,600	10,577	----	1/1	174,000	174,000	1,440	300 SMCL (F)
Lead	25.9	6.5U	2/3	9.0-20.8	11.9	----	1/1	64.2	64.2	2.1U	50 MIPDWR; 5 (at source) PMCL (P)
Magnesium	17,600	----	3/3	4,190-11,700	9,043	----	1/1	25,100	25,100	12,900	NAvail
Manganese	960	----	3/3	271-2,050	952	----	1/1	5,740	5,740	29	50 SMCL (F)
Nickel	96.3	----	3/3	25.7-50.3	38.9	----	1/1	240	240	52.4	100 PMCL (T)
Potassium	6,970	----	3/3	2,510-4,950	3,773	----	1/1	7,800	7,800	1,930	NAvail
Selenium	(c)	----(c)	1/3	3.3	2.6	U.J	0/1	---	----	UJ	10 PMCL (P)
Silver	----(c)	----(c)	0/3	----		7.8U	0/1	----	----	15.6U	50 MIPDWR
Sodium	9,140	----	3/3	23,400-35,900	31,100		1/1	13,300	13,300	34,600	20,000 DWEL
Vanadium	56.3	----(c)	2/3	4.4 36.2	15.2	-	1/1	80.9	80.5	----(c)	NAvail
Zinc	449	28.3U-58U	0/3	----	--	----	1/1	321	321	36U	5,000 SMCL (F)
		(mg/L)		(mg/L)	(mg/L)	(mg/L)		(mg/L)	(mg/L)	(mg/L)	(mg/L)
Bicarbonate	62	----	3/3	29-80	50.3	----	2/2	64-69	66.5	150	NAvail
Chloride	12		3/3	62-66	64.2	5.0U	1/2	6.0	4.3	8.9	250 SMCL (F)
Nitrate-Nitrate	1.9	----	3/3	2.6-7.3	5.6	----	2/2	0.03-0.08	0.05	0.4	10 PMCL (P)
Sulfate	100U	----	3/3	20-24	22.8	----	2/2	22-23	22.5	23	400 PMCL (T)
Total Dissolved Solids	129	----	3/3	165-263	222	----	2/2	94-105	99.5	201	500 SMCL (F)

Table 3

DEEP OVERBURDEN/SHALLOW BEDROCK MONITORING WELLS IN AREA B - THE VALLEY SITE/MILL POND AREA
SUMMARY OF FIRST ROUND (FEBRUARY 1990) GROUNDWATER MONITORING RESULTS
GROVELAND WELLS SITE
SUPPLEMENTAL MOM RI/FS
GROVELAND, MASSACHUSETTS
PAGE THREE

Parameter	Background	Deep Overburden/Shallow Bedrock in the Immediate Vicinity of Valley and the Johnson Creek				Deep Overburden/Shallow Bedrock Beyond the Immediate Vicinity of Johnson Creek				Deep Bedrock Well 107	Standard/Criteria
		Range of Sample Quantitation Limits(1)	Frequency of Detection	Range of Positive Detections	Average	Range of Sample Quantitation Limits(1)	Frequency of Detection	Range of Positive Detections	Average		
		(mg/L)		(mg/L)	(mg/L)	(mg/L)		(mg/L)	(mg/L)	(mg/L)	(mg/L)
Total Suspended Solids	1,440	----	3/3	6.0-264	111	-	2/2	23-1,280	651.5	362	NAvail
Total Organic Carbon	NA	NA		----		---	1/1	2.1	2.1	NA	NAvail
COD	NA	NA	----	----	----	----	1/1	22	22	NA	NAvail
BOD_5	NA	NA	----	----	- -	----	1/1	8	8	NA	NAvail
Total alkalinity	NA	NA	----	----	----	----	1/1	69	69	NA	NAvail
Sulfides	NA	NA	----	----	----	1.0U	0/1	----	----	NA	NAvail

(1) Sample quantitation limits (SQL) presented for parameters reported as 'not detected' in a sample. For inorganics, the only SQLs presented are those which differ from Contract Required Detection Limits (CRDLs). CRDLs are presented in Appendix A.
(c) One or more samples in the data group were reported as non-detected at the CRDL.

(D) Results of duplicate samples.
(P) Proposed.
(F) Final.
(T) Tentative.

U Parameter was not detected. Value presented is the sample quantitation limit.
R Data rejected during validation.
UJ The parameter was analyzed for, but not detected, in one or more samples. The sample quantitation limit (the CRDL) is estimated.

NAvail	Not Available.
DWEL	Drinking Water Equivalent Level.
PMCL	Federal Safe Drinking Water Act (SDWA) Primary Maximum Contaminant Level.
SMCL	Federal SDWA Secondary Maximum Contaminant Level.
NIPDWR	National Interim Primary Drinking Water Regulation.

Table 4

MONITORING WELLS IN AREA B - THE VALLEY SITE/MILL POND AREA
SUMMARY OF SECOND ROUND (JULY 1990)
GROUNDWATER MONITORING RESULTS (ug/L)
GROVELAND WELLS SITE
SUPPLEMENTAL MOM RI/FS
GROVELAND, MASSACHUSETTS

SUBAREA/STRATA/ LOCATION Parameter	Range of Sample Quantitation Limits	Frequency of Detection	Range of Positive Detections	Average
B-2/SHALLOW OVERBURDEN/ ADJACENT MILL POND				
Trichloroethene (TCE)	----	2/2	2-6	4
1,2-Dichloroethene (1,2-DCE)	5U	0/2	----	----
Wells Sampled: ERT-11, 102				
B-3/DEEP OVERBURDEN/SHALLOW BEDROCK/ ADJACENT JOHNSON CREEK				
Trichloroethene (TCE)	----	3/3	220-1,100	537
1,2-Dichloroethene (1,2-DCE)	----	3/3	31-150	87
Wells Sampled: ERT-13, ERT-9, 101				
B-4/DEEP OVERBURDEN/SHALLOW BEDROCK/ NOT ADJACENT JOHNSON CREEK				
Trichloroethene (TCE)	----	1/1	4	4
1,2-Dichloroethene (1,2-DCE)	5U	0/1	----	----
Well Sampled: 108				
B-5/DEEP BEDROCK				
Trichloroethene (TCE)	5U	0/1	----	----
1,2-Dichloroethene (1,2-DCE)	5U	0/1	----	----
Wells Sampled: 107				

----	Not detected
U	Parameter was not detected. Value presented is the sample quantitation limit.
Note:	No wells in Subarea B-1 were sampled in the second round.

Table 5

SHALLOW/DEEP OVERBURDEN MONITORING WELLS IN AREA C - THE AREA NORTH OF MILL POND
SUMMARY OF FIRST ROUND (FEBRUARY 1990) GROUNDWATER MONITORING RESULTS
GROVELAND WELLS SITE
SUPPLEMENTAL MOM RI/FS
GROVELAND, MASSACHUSETTS

Parameter	Upgradient Well	Shallow/Deep Overburden in the Vicinity of Johnson Creek				Shallow/Deep Overburden Beyond Johnson Creek Toward Argilla Brook				Standard/Criteria
		Range of Sample Quantitation Limits	Frequency of Detection	Range of Positive Detections	Average	Range of Sample Quantitation Limits	Frequency of Detection	Range of Positive Detections	Average	
	(ug/L)	(ug/L)		(ug/L)	(ug/L)	(ug/L)		(ug/L)	(ug/L)	(ug/L)
1,1,1-Trichloroethane	5U	1U-5U	0/7	----	---	1U-5U	1/10	1	1.4 [1.0]	200 PMCL (P)
1,2-Dichloroethane	5U	1U-5U	0/7	----		1U-5U	1/10	3	1.6 [3]	NAvail
1,2-Dichloroethene	5U	2U-5U	3/7	5-40	8.8 [17.3]	1U-5U	1/10	2	1.6 [2]	70/100 Cis/Trans PMCL (P)
Trichloroethene	5U	5U-10U	4/7	8-62	21.2 [33.1]	1U-5U	3/10	1-9	2.3 [5]	5 PMCL (F)
Toluene	5U	1U-5U	1/7	1	1.4 [0.5]	1U-5U	0/10	----	----	2,000 PMCL (P)
Ethylbenzene	5U	1U-5U	1/7	0.6	1.4 [0.6]	1U-5U	0/10	----	----	700 PMCL (P)
Total xylenes	5U	1U-5U	2/7	0.5-2	1.6 [1.3]	1U-5U	0/10	----	----	10,000 PMCL (P)
Di-n-butyl phthalate	NA	10U	1/1	7	7	10U	0/4	----	----	NAvail
Aluminum	34,500	----	5/5	101-52,200	12,967	126U	6/8	201-200,000	36,892	50-200 SMCL (P)
Antimony	----(c)	----	0/5	----	----	----(c)	2/8	19.2-21.6	27.6	10/5 PMCL (P)
Arsenic	19.7	----(c)	3/5	2.4-50.4	14.2	----(c)	5/8	2.1-79.6	13.3	50 MIPDWR
Barium	177	----	5/5	12.3-222	67.8	6.5U-7.3U	5/8	7.7-1,100	158.4	1,000 MIPDWR
Beryllium	----(c)	----(c)	1/5	2.8	2.6	----(c)	2/8	4.5-9.0	3.6	1 PMCL (T)
Cadmium	----(c)	----(c)	1/5	57.3	13.5	----(c)	0/8	----	----	5 PMCL (P)
Calcium	41,100	----	5/5	19,000-30,000	29,450	----	8/8	11,400-256,000	57,375	NAvail
Chromium	89.2	----(c)	4/5	6.6-139	41.6	----(c)	4/8	8.2-1,230	161.3	50 MIPDWR
Cobalt	32.9	9.6U(c)	1/5	60.9	29.7	----(c)	2/8	27.9-176	44.2	NAvail
Copper	56.1U	8.0U-25.1U	1/5	109	20.2	4.8U-10.6U	2/8	151-647	103	1,300 PMCL (P)

Table 5

SHALLOW/DEEP OVERBURDEN MONITORING WELLS IN AREA C - THE AREA NORTH OF MILL POND
SUMMARY OF FIRST ROUND (FEBRUARY 1990) GROUNDWATER MONITORING RESULTS
GROVELAND WELLS SITE
SUPPLEMENTAL MOM RI/FS
GROVELAND, MASSACHUSETTS
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Parameter	Upgradient Well	Shallow/Deep Overburden in the Vicinity of Johnson Creek				Shallow/Deep Overburden Beyond Johnson Creek Toward Argilla Brook				Standard/Criteria
		Range of Sample Quantitation Limits	Frequency of Detection	Range of Positive Detections	Average	Range of Sample Quantitation Limits	Frequency of Detection	Range of Positive Detections	Average	
	(ug/L)	(ug/L)		(ug/L)	(ug/L)	(ug/L)		(ug/L)	(ug/L)	(ug/L)
Iron	39,300	----	5/5	807-111,000	31,314	----	8/8	479-482,000	70,995	300 SMCL (F)
Lead	25.9	2.8U-11.3U	2/5	17.1-77.7	21.7	1.9U-9.0U	3/8	14.1-192	57	50 MIPDWR; 5 at source PMCL (P)
Magnesium	17,600	----	5/5	5,160-21,800	10,434	----	8/8	2,280-203,000	31,398	NAvail
Manganese	960	----	5/5	163-1,790	660	----	8/8	8.9-6,760	990	50 SMCL (F)
Mercury	----(c)	UJ(c)	1/5	0.2	0.1	UJ(c)	0/8	----	----	2 PMCL (P)
Nickel	96.3	----(c)	5/5	6.5-242	61.8	7.7U(c)	4/8	6.5-845	192	100 PMCL (T)
Potassium	6,970	----	5/5	1,860-9,410	4,798	----(c)	7/8	1,210-48,200	8,234	NAvail
Selenium	UJ	UJ(c)	2/5	4.7-23.5	5.0	UJ(c)	2/8	3.1-3.3	3.1	10 PMCL (P)
Silver	----(c)	5.5U-22.5U	0/5	----	--	5.1U-8.5U(c)	0/8	----	----	50 MIPDWR
Sodium	9,140	----	5/5	8,200-121,000	32,275	----	8/8	3,250-47,500	13,191.9	20,000 DWEL
Vanadium	56.3	----(c)	2/5	20.8-110	41.1	----(c)	3/8	2.2-482	79.6	NAvail
Zinc	449	29.1U-32U	3/5	84.2-202	86.3	13.8U-38U	4/8	77.1-1,480	237	5,000 SMCL (F)
	(mg/L)	(mg/L)		(mg/L)	(mg/L)	(mg/L)		(mg/L)	(mg/L)	(mg/L)
Bicarbonate	62	----	5/5	40-86	63.9	----	7/7	31-460	148	NAvail
Chloride	12	5U	3/5	11-18	8	5U	4/6	9.9-23	12.2	250 SMCL (F)
Nitrate-Nitrite	1.9	0.01U	3/6	0.02-0.21	0.05	0.01U	6/7	0.02-0.8	0.2	10 PMCL (P)
Sulfate	100U	----	5/5	21-78	34.6	100U	6/7	16-28	22.7	400 PMCL (P)
Total Dissolved Solids	129	----	5/5	109-224	149	----	7/7	70-173	128.4	500 SMCL (F)

Table 5

SHALLOW/DEEP OVERBURDEN MONITORING WELLS IN AREA C - THE AREA NORTH OF MILL POND
SUMMARY OF FIRST ROUND (FEBRUARY 1990) GROUNDWATER MONITORING RESULTS
GROVELAND WELLS SITE
SUPPLEMENTAL NOM RI/FS
GROVELAND, MASSACHUSETTS
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Parameter	Upgradient Well	Shallow/Deep Overburden in the Vicinity of Johnson Creek				Shallow/Deep Overburden Beyond Johnson Creek Toward Argilla Brook				Standard/Criteria
		Range of Sample Quantitation Limits	Frequency of Detection	Range of Positive Detections	Average	Range of Sample Quantitation Limits	Frequency of Detection	Range of Positive Detections	Average	
	(mg/L)	(mg/L)		(mg/L)	(mg/L)	(mg/L)		(mg/L)	(mg/L)	(mg/L)
Total Suspended Solids	1,440	----	5/5	4.0 1,290	379	4.0U	5/1	6.0 - 4,050	545	NAvail
Total Organic Carbon	NA	0.1U	1/1	0.1	0.1	0.1U	0/1	----	----	NAvail
COD	NA	----	1/1	5-66 (D)	35.5	----	1/1	69	69	NAvail
BOD_5	NA	----	1/1	2-3 (D)	2.5	1U	0/1	----	----	NAvail
Hardness	NA	----	1/1	96.5-101	98.8	----	1/1	62.1	62.1	NAvail
Total Alkalinity	NA	----	1/1	73-86	79.5	----	1/1	460	460	NAvail

(1) Sample quantitation limits (SQL) presented for parameters reported as 'not detected' in a sample. For inorganics, the only SQLs presented are those which differ from Contract Required Detection Limits (CRDLs). CRDLs are presented in Appendix A.
(2) Second-round groundwater samples for well 114.
(c) Results for one or more samples in the data group were reported as non-detected at the CRDL.

U Parameter was not detected. Value presented is the sample quantitation limit.
UJ The parameter was analyzed for, but not detected in, one or more samples. The sample quantitation limit (the CRDL) is estimated.

(D) Results of duplicate samples.
(P) Proposed.
(F) Final.
(T) Tentative.

NAvail Not Available.
DWEL Drinking Water Equivalent Level.
PMCL Federal Safe Drinking Water Act (SDWA) Primary Maximum Contaminant Level.
SMCL Federal SDWA Secondary Maximum Contaminant Level.
NIPDWR National Interium Primary Drinking Water Regulation.

Table 6

SHALLOW/DEEP OVERBURDEN MONITORING WELLS IN AREA C - THE AREA NORTH OF MILL POND
SUMMARY OF SECOND ROUND (JULY 1990) GROUNDWATER MONITORING RESULTS
GROVELAND WELLS SITE
SUPPLEMENTAL MOM RI/FS
GROVELAND, MASSACHUSETTS

Parameter		Shallow/Deep Overburden in the Vicinity of Johnson Creek				Shallow/Deep Overburden Beyond Johnson Creek Toward Argilla Brook				Standard/Criteria
		Range of Sample Quantitation Limits	Frequency of Detection	Range of Positive Detections	Average	Range of Sample Quantitation Limits	Frequency of Detection	Range of Positive Detections	Average	
		(ug/L)		(ug/L)	(ug/L)	(ug/L)		(ug/L)	(ug/L)	(ug/L)
1,2-Dichloroethene (total)		5U	7/8	5-47	15.9	5U	1/3	3	2.7	70/100 Cis/Trans PMCL (P)
Trichloroethene		5U	7/8	6-150	35.9	5U	2/3	2-7	3.8	5 PMCL (F)
Tetrachloroethene		5U	1/8	16-77(D)	8	5U	0/3	----	----	5 PMCL (P)
Aluminum	Unfiltered	200U	7/8	68.4-260,000	64,769	----	1/1	34,700	34,700	50-200 SMCL (P)
	Filtered	154U-165U	1/8	.98.0	101	----	0/1	----	----	
Arsenic	Unfiltered	UJ (c)	6/8	8.3-36.6	18.6	----	1/1	21.3	21.3	50 NIPDWR
	Filtered	3.2U-3.5U	0/8	----	----	----	0/1	----	----	
Barium	Unfiltered	28.4U	7/8	18.5-1,030	318.7	----	1/1	188	188	1,000 NIPDWR
	Filtered	17.2U-31.4	4/8	11.0-35.8	15	----	1/1	13	13	
Beryllium	Unfiltered	----	4/8	1.3-12.0	3.8	----	0/1	----	----	1 PMCL (T)
	Filtered	----	0/8	----	----	----	0/1	----	----	
Cadmium	Unfiltered	----	3/8	6.8-41.0	8.9	----	0/1	----	----	5 PMCL (P)
	Filtered	----	0/8	----	----	----	0/1	----	----	
Calcium	Unfiltered	----	8/8	17,600-64,400	38,025	----	1/1	30,400	30,400	NAvail
	Filtered	----	8/8	12,500-44,000	26,181	----	1/1	19,700	19,700	
Chromium	Unfiltered	----(c)	6/8	28.1-604	111	----	1/1	117	117	50 NIPDWR
	Filtered	----	0/8	----	----	----	0/1	----	----	
Cobalt	Unfiltered	----(c)	5/8	16.5-374	79.3	----	1/1	51.3	51.3	NAvail
	Filtered	----	0/8	----	----	----	0/1	----	----	
Copper	Unfiltered	----(c)	6/8	42.2-529	146.1	----	1/1	173	173	1,300 PMCL (P)
	Filtered	5.8U-5.9U (c)	2/8	5.2-6.9	8.1 [6.1]	----	0/1	----	----	

Table 6

SHALLOW/DEEP OVERBURDEN MONITORING WELLS IN AREA C - THE AREA NORTH OF MILL POND
SUMMARY OF SECOND ROUND (JULY 1990) GROUNDWATER MONITORING RESULTS
GROVELAND WELLS SITE
SUPPLEMENTAL MOM RI/FS
GROVELAND, MASSACHUSETTS
PAGE TWO

Parameter		Shallow/Deep Overburden in the Vicinity of Johnson Creek				Shallow/Deep Overburden Beyond Johnson Creek Toward Argilla Brook				Standard/Criteria
		Range of Sample Quantitation Limits	Frequency of Detection	Range of Positive Detections	Average	Range of Sample Quantitation Limits	Frequency of Detection	Range of Positive Detections	Average	
		(ug/L)		(ug/L)	(ug/L)	(ug/L)		(ug/L)	(ug/L)	(ug/L)
Iron	Unfiltered	----	8/8	16,700-742,000	148,719	----	1/1	78,800	----	300 SMCL (F)
	Filtered	37.6U (c)	6/8	26-8,180	1,210	45.2U	0/1	----	----	
Lead	Unfiltered	----	8/8	1.4 364	96.4	----	1/1	60.0	60.0	50 NIPDWR; 5 (at source) PMCL (F)
	Filtered	----(c)	2/8	1.2	1.4 [1.2]	----	0/1	----	----	
Magnesium	Unfiltered	----	8/8	3,650-85,800	30,911	----	1/1	20,200	20,200	NAvail
	Filtered	----	8/8	2,320-9,120	5,396	----	1/1	4,300	4,300	
Manganese	Unfiltered	----	8/8	89.1-7,550	1,740	----	1/1	879	879	50 SMCL (F)
	Filtered	----	8/8	29.9-844	252	----	1/1	142	142	
Nickel	Unfiltered	----(c)	7/8	17-876	197.4	----	1/1	172	172	100 PMCL (T)
	Filtered	----	0/8	----	----	----	0/1	----	----	
Potassium	Unfiltered	3,000U-2,790U	6/8	4,640-36,500	13,820.6	----	1/1	9,700	9,700	NAvail
	Filtered	2,390U-5,500U	0/8	----	----	1,980U	0/1	----	----	
Selenium	Unfiltered	----(c)	1/8	2.2 J	2.5 [2.2]	----	0/1	----	----	10 PMCL (F)
	Filtered	----(c)	0/8	----	----	----	0/1	----	----	
Sodium	Unfiltered	----	8/8	8,160-16,500	12,053.8	----	1/1	7,930	7,930	20,000 DWEL
	Filtered	----	8/8	6,290-14,000	9,191.3	----	1/1	4,190	4,190	
Thallium	Unfiltered	1.4U-2.1U (c)	0/8	----	----	1.6U	0/1	----	----	NAvail
	Filtered	----	0/8	----	----	1.1U	0/1	----	----	
Vanadium	Unfiltered	----(c)	6/8	14.2-565	137.7	----	1/1	58.0	58.0	NAvail
	Filtered	17.1U	0/8	----	----	----	0/1	----	----	
Zinc	Unfiltered	----	8/8	112-932	337.2	----	1/1	183	183	5,000 SMCL (F)
	Filtered	12.5U-20.1U (c)	2/8	36-37.9	13.2	----	0/1	----	----	

Table 6

SHALLOW/DEEP OVERBURDEN MONITORING WELLS IN AREA C - THE AREA NORTH OF MILL POND
SUMMARY OF SECOND ROUND (JULY 1990) GROUNDWATER MONITORING RESULTS
GROVELAND WELLS SITE
SUPPLEMENTAL MOM RI/FS
GROVELAND, MASSACHUSETTS
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Parameter	Shallow/Deep Overburden in the Vicinity of Johnson Creek				Shallow/Deep Overburden Beyond Johnson Creek Toward Argilla Brook				Standard/Criteria
	Range of Sample Quantitation Limits	Frequency of Detection	Range of Positive Detections	Average	Range of Sample Quantitation Limits	Frequency of Detection	Range of Positive Detections	Average	
	(mg/L)		(mg/L)	(mg/L)	(mg/L)		(mg/L)	(mg/L)	(mg/L)
Chloride	----	8/8	4.7-29.1	11.8	----	1/1	6.46	6.46	250 SMCL (F)
Nitrate-nitrite	----	8/8	0.037-0.853	0.27	----	1/1	0.27	0.27	10 PMCL (F)
Ortho-Phosphate	----(c)	7/8	0.024-1.73	0.34	----	1/1	0.024	0.024	NAvail
Total Phosphate	----(c)	6/8	0.013-1.36	0.198	----	1/1	0.57	0.57	NAvail
Total Dissolved Solids	----	8/8	50.0-246	153	----	1/1	160	160	500 SMCL (F)
Sulfate	----(c)	4/8	13.4-60.5	15.6	----	0/1	----	----	400 PMCL (P)
Bicarbonate	----	8/8	29.0-94.5	62.2	----	1/1	86.1	86.1	NAvail
Alkalinity	----	8/8	29.0-94.5	62.2	----	1/1	86.1	86.1	NAvail

U Parameter was not detected. Value presented is the sample quantitation limit.
(c) Results for one or more samples in the data group were reported as nondetected at or below the Contract Required Detection Limit (CRDL).

(P) Proposed.
(F) Final.
(T) Tentative.

NAvail Not available.
PMCL Federal Safe Drinking Water Act (SDWA) Primary Maximum Contaminant Level (MCL).
SMCL Federal SDWA Secondary MCL.
NIPDWR National Interim Primary Drinking Water Regulation.

Table 7

SHALLOW BEDROCK MONITORING WELLS IN AREA C - THE AREA NORTH OF MILL POND
SUMMARY OF FIRST ROUND (FEBRUARY 1990) GROUNDWATER MONITORING RESULTS
GROVELAND WELLS SITE
SUPPLEMENTAL MOM RI/FS
GROVELAND, MASSACHUSETTS

Parameter	Upgradient Well	Shallow Bedrock				Standard/Criteria
		Range of Sample Quantitation Limits	Frequency of Detection	Range of Positive Detections	Average	
	(ug/L)	(ug/L)		(ug/L)	(ug/L)	(ug/L)
Aluminum	34,500	----	2/2	201-294	247.5	50-200 SMCL (P)
Arsenic	19.7	----(c)	1/2	4.4	4.7	50 NIPDWR
Barium	177	----	2/2	7.7- 14.2	11	1,000 NIPDWR
Calcium	41,100	----	2/2	18,700-39,400	29,050	NAvail
Chromium	89.2	----(c)	1/2	4.1	4.6	50 NIPDWR
Copper	56.1U	6.4U-18.9U	0/2	----	----	1,300 PMCL (P)
Iron	39,300	----	2/2	707-2,080	1,393.5	300 SMCL (F)
Lead	25.9	5.9U	1/2	8.1	5.5	50 NIPDWR; 5 (at source) PMCL (P)
Magnesium	17,600	----	2/2	6,410-7,200	6,805	NAvail
Manganese	960	----(c)	2/2	80.6-267	173.8	50 SMCL (F)
Mercury	----(c)	- UJ(c)	0/2	----	----	2 PMCL (P)
Nickel	96.3	----	2/2	5.3-6.8	6.05	100 PMCL (T)
Potassium	6,970	----	2/2	1,980-2,310	2,145	NAvail
Selenium	UJ(c)	----(c)	0/2	----	----	10 PMCL (P)
Silver	----(c)	10.3 U(c)	0/2	----	----	50 NIPDWR
Sodium	9,140	----	2/2	6,670-7,340	7,005	20,000 DWEL
Vanadium	56.3	----(c)	0/2	----	----	NAvail
Zinc	449	37.5U-29.0U	0/2	----	----	5,000 SMCL (F)

Table 7

SHALLOW BEDROCK MONITORING WELLS IN AREA C - THE AREA NORTH OF MILL POND
SUMMARY OF FIRST ROUND (FEBRUARY 1990) GROUNDWATER MONITORING RESULTS
GROVELAND WELLS SITE
SUPPLEMENTAL MOM RI/FS
GROVELAND, MASSACHUSETTS
PAGE TWO

Parameter	Upgradient Well	Deep Overburden				Standard/Criteria
		Range of Sample Quantitation Limits	Frequency of Detection	Range of Positive Detections	Average	
	(mg/L)	(mg/L)		(mg/L)	(mg/L)	(mg/L)
Bicarbonate	62	----	2/2	75	75	NAvail
Chloride	12	----	2/2	5.0-26	15.5	250 SMCL (F)
Nitrate-Nitrite	1.9	0.01U	1/2	0.01	0.01	10 PMCL (P)
Sulfate	100U	----	2/2	16-29	22.5	400 PMCL (P)
Total Dissolved Solids	129	----	2/2	65-185	125	500 SMCL (F)
Total Suspended Solids	1,440	----	2/2	4.0-7.0	5.5	NAvail

(D) Results of duplicate samples.
(P) Proposed.
(F) Final.
(T) Tentative.

U Parameter was not detected. Value presented is the sample quantitation limit.
UJ The parameter was analyzed for, but not detected in, one or more samples. The sample quantitation limit (the CRDL) is estimated.

NAvail Not Available.
DWEL Drinking Water Equivalent Level.
PMCL Federal Safe Drinking Water Act (SDWA) Primary Maximum Contaminant Level.
SMCL Federal SDWA Secondary Maximum Contaminant Level.
NIPDWR National Interium Primary Drinking Water Regulation.

Table 7

SHALLOW BEDROCK MONITORING WELLS IN AREA C - THE AREA NORTH OF MILL POND
SUMMARY OF FIRST ROUND (FEBRUARY 1990) GROUNDWATER MONITORING RESULTS
GROVELAND WELLS SITE
SUPPLEMENTAL MOM RI/FS
GROVELAND, MASSACHUSETTS

(c) Results for one or more samples in the data group were reported as non-detected at the CRDL.

(2) Wells 103 and 109 were sampled during the second round. 1,2-DCE (1 ug/L) and TCE (6 ug/L) were detected in well 103. Inorganic results (total/dissolved) for well 103 are as follows:

Aluminum	4,900/137U
Barium	84/20.8U
Calcium	37,100/34,200
Chromium	20.7/ND
Copper	33.7/ND
Iron	9,860/ND
Lead	13.6/ND
Magnesium	9,870/6,790
Manganese	420/280
Nickel	17.1/ND
Potassium	3,250U/2,470U
Sodium	6,600/6,500
Zinc	490/ND

ND Not detected

U The compound was analyzed for, but not detected. The associated numerical value is the sample quantitation limit.

Table

MONITORING WELLS IN AREA D - THE HAVERHILL MUNICIPAL LANDFILL AREA
SUMMARY OF FIRST ROUND (FEBRUARY 1990) GROUNDWATER MONITORING RESULTS
GROVELAND WELLS SITE
SUPPLEMENTAL MOM RI/FS
GROVELAND, MASSACHUSETTS

Parameter	Background	Deep Overburden				Standard/Criteria
		Range of Sample Quantitation Limits(1)	Frequency of Detection	Range of Positive Detections	Average	
	(ug/L)	(ug/L)		(ug/L)	(ug/L)	(ug/L)
Chloroethane	10U	1U-10U	1/5	3	3.9 [1.5]	NAvail
Trichloroethene	5U	1U-5U	1/5	4	2.4 [4]	5 PMCL (P)
Benzene	5U	1U-5U	1/5	17	5 [17]	5 PMCL (P)
Toluene	5U	1U-5U	1/5	5	2.6 [5]	2,000 PMCL (P)
Chlorobenzene	5U	1U-5U	1/5	19-20 (D)	5.5 [19.5]	100 PMCL (P)
Ethylbenzene	5U	1U-5U	1/5	18	5.2 [18]	700 PMCL (P)
Total xylenes	5U	1U-5U	1/5	86	18.8 [86]	10,000 PMCL (P)
Aluminum	34,500	----	2/2	579-2,270	1,425	50-200 SMCL (P)
Arsenic	19.7	----(c)	1/2	97.7	51.4	50 NIPDWR
Barium	177	----	2/2	49.2-50.5	50	1,000 NIPDWR
Calcium	41,100	----	2/2	31,600-53,700	42,650	NAvail
Chromium	89.2	----	2/2	10.7-10.9	10.8	50 NIPDWR
Cobalt	32.9	8.0U-10.1U	0/2	----	----	NAvail
Copper	56.1U	10.8U-17.5U	0/2	----	----	1,300 PMCL (P)

Table 8

MONITORING WELLS IN AREA D - THE HAVERHILL MUNICIPAL LANDFILL AREA
SUMMARY OF FIRST ROUND (FEBRUARY 1990) GROUNDWATER MONITORING RESULTS
GROVELAND WELLS SITE
SUPPLEMENTAL MOM RI/FS
GROVELAND, MASSACHUSETTS
PAGE TWO

Parameter	Background	Deep Overburden				Standard/Criteria
		Range of Sample Quantitation Limits(1)	Frequency of Detection	Range of Positive Detections	Average	
	(ug/L)	(ug/L)		(ug/L)	(ug/L)	(ug/L)
Iron	39,300	----	2/2	5,070-9,150	7,110	300 SMCL (F)
Lead	25.9	5.0U	1/2	34	18.3	50 NIPDWR; 5 at source PMCL (P)
Magnesium	17,600	----	2/2	6,280-11,900	9,090	NAvail
Manganese	960	----	2/2	72-544	308	50 SMCL (F)
Mercury	ND	UJ(c)	0/2	----	----	2 PMCL (P)
Nickel	963	----	2/2	16.8-21.6	19.2	100 PMCL (T)
Potassium	6,970	----	2/2	4,550-24,700	14,625	NAvail
Selenium	UJ	UJ(c)	0/2	----	----	10 PMCL (P)
Silver	ND	8.6U-14.3U	0/2	----	----	50 NIPDWR
Sodium	9,140	----	2/2	10,100-44,100	27,100	20,000 DWEL
Vanadium	56.3	----(c)	1/2	6.3	6.3	NAvail
Zinc	449	35.1U-40U	0/2	----	----	5,000 SMCL (F)

Table 8

MONITORING WELLS IN AREA D - THE HAVERHILL MUNICIPAL LANDFILL AREA
SUMMARY OF FIRST ROUND (FEBRUARY 1990) GROUNDWATER MONITORING RESULTS
GROVELAND WELLS SITE
SUPPLEMENTAL MOM RI/FS
GROVELAND, MASSACHUSETTS
PAGE THREE

Parameter	Background	Deep Overburden				Standard/Criteria
		Range of Sample Quantitation Limits(1)	Frequency of Detection	Range of Positive Detections	Average	
	(mg/L)	(mg/L)		(mg/L)	(mg/L)	(mg/L)
Bicarbonate	62	----	2/2	42-200	121	NAvail
Chloride	12	----	2/2	17-28	23	250 SMCL (F)
Nitrate-Nitrite	1.9	----	2/2	0.3-1.8	1.1	10 PMCL (P)
Sulfate	100U	----	2/2	52-58	55	400 PMCL (P)
Total Dissolved Solids	129	----	2/2	192-388	290	500 SMCL (F)
Total Suspended Solids	1,440	----	2/2	25-1,340	683	NAvail

(1) Sample quantitation limits (SQL) presented for parameters reported as "not detected" in a sample. For inorganics, the only SQLs presented are those which differ from Contract Required Detection Limits (CRDLs). CRDLs are presented in Appendix A.
(c) Results for one or more samples in the data group were reported as non-detected at the CRDL.

U Parameter was not detected. Value presented is the sample quantitation limit.
UJ The parameter was analyzed for, but not detected in, one or more samples. The sample quantitation limit (the CRDL) is estimated.

(D) Results of duplicate samples.
(P) Proposed.
(F) Final.
(T) Tentative.

NAvail Not Available.
DWEL Drinking Water Equivalent Level.
PMCL Federal Safe Drinking Water Act (SDWA) Primary Maximum Contaminant Level.
SMCL Federal SDWA Secondary Maximum Contaminant Level.
NIPDWR National Interim Primary Drinking Water Regulation.

Table 9

MONITORING WELLS IN AREA D - THE HAVERHILL MUNICIPAL LANDFILL AREA
SUMMARY OF SECOND ROUND (JULY 1990) GROUNDWATER MONITORING RESULTS
GROVELAND WELLS SITE
SUPPLEMENTAL NOM RI/FS
GROVELAND, MASSACHUSETTS

Parameter		Deep Overburden				Standard/Criteria
		Range of Sample Quantitation Limits	Frequency of Detection	Range of Positive Detections	Average	
		ug/L		ug/L	ug/L	ug/L
1,2-Dichloroethene (total)		5U	1/3	2	2.3 [2]	70/100 Cis/Trans PMCL (P)
Trichloroethene		5U	1/3	9	4.7	5 PMCL (F)
Aluminum	Unfiltered	----	3/3	3,160-96,400	37,887	50-200 SMCL (P)
	Filtered	----(c)	0/3	----	----	
Arsenic	Unfiltered	UJ (c)	2/3	91.6-406	167.5	50 NIPDWR
	Filtered	UJ (c)	1/3	233	81	
Barium	Unfiltered	----	3/3	54.3-377	183	1,000 NIPDWR
	Filtered	----	3/3	21.0-54.9	39	
Beryllium	Unfiltered	----(c)	1/3	2.1	2.4 [2.1]	1 PMCL (T)
	Filtered	----(c)	0/3	----	----	
Cadmium	Unfiltered	----(c)	1/3	10.1	5.0	5 PMCL (P)
	Filtered	----(c)	0/3	----	----	
Calcium	Unfiltered	----	3/3	32,300-57,700	44,467	NAvail
	Filtered	----	3/3	27,800-54,300	39,167	
Chromium	Unfiltered	----	3/3	10.1-328	127	50 NIPDWR
	Filtered	----(c)	0/3	----	----	
Cobalt	Unfiltered	----(c)	2/3	28.7-75.9	43.2	NAvail
	Filtered	----(c)	0/3	----	----	
Copper	Unfiltered	10.2U	2/3	159-197	120	1,300 PMCL (P)
	Filtered	----(c)	0/3	----	----	
Iron	Unfiltered	----(c)	3/3	5,060-186,000	79,720	300 SMCL (F)
	Filtered	18.0U (c)	1/3	20,700	6,920	

Table 9

MONITORING WELLS IN AREA D - THE HAVERHILL MUNICIPAL LANDFILL AREA
SUMMARY SECOND OF ROUND (JULY 1990) GROUNDWATER MONITORING RESULTS
GROVELAND WELLS SITE
SUPPLEMENTAL MOM RI/FS
GROVELAND, MASSACHUSETTS
PAGE TWO

Parameter		Deep Overburden				Standard/Criteria
		Range of Sample Quantitation Limits	Frequency of Detection	Range of Positive Detections	Average	
		ug/L		ug/L	ug/L	ug/L
Lead	Unfiltered	----	3/3	10.3-79.4	42.7	50 NIPDWR; 5 (at source) PMCL (P)
	Filtered	UJ (c)	2/3	1.5-2.0	1.7	
Magnesium	Unfiltered	----	3/3	5,600-17,400	10,090	NAvail
	Filtered	----	3/3	6,270-12,600	8,543	
Manganese	Unfiltered	----	3/3	45.1-2,600	1,068	50 SMCL (F)
	Filtered	----(c)	2/3	171-367	182	
Nickel	Unfiltered	----	3/3	14-276	134	100 PMCL (T)
	Filtered	----(c)	2/3	15.1-20.0	18.4	
Potassium	Unfiltered	4,820U	2/3	13,400-23,300	13,037	NAvail
	Filtered	3,790U-4,460U	1/3	11,600	5,242	
Sodium	Unfiltered	----	3/3	10,300-39,500	24,267	20,000 DWEL
	Filtered	-----	3/3	10,600-37,000	21,333	
Thallium	Unfiltered	1.4U-1.6U	0/3	----	----	NAvail
	Filtered	1.5U, UJ(c)	0/3	----	----	
Vanadium	Unfiltered	----(c)	2/3	17.6-158	67	NAvail
	Filtered	----(c)	0/3	----	----	
Zinc	Unfiltered	----	3/3	14.9-442	260	5,000 SMCL (F)
	Filtered	----(c)	1/3	23.8		

Table 9

MONITORING WELLS IN AREA D - THE HAVERHILL MUNICIPAL LANDFILL AREA
SUMMARY SECOND OF ROUND (JULY 1990) GROUNDWATER MONITORING RESULTS
GROVELAND WELLS SITE
SUPPLEMENTAL MOM RI/FS
GROVELAND, MASSACHUSETTS
PAGE THREE

Parameter	Deep Overburden				Standard/Criteria
	Range of Sample Quantitation Limits	Frequency of Detection	Range of Positive Detections	Average	
	mg/L		mg/L	mg/L	mg/L
Bicarbonate	----	3/3	31.4-186	87.8	NAvail
Chloride	----	3/3	14.7-35.2	26.2	250 SMCL (F)
Nitrate-nitrite	----	3/3	0.115-2.29	1.34	10 PMCL (P)
Sulfate	----(c)	2/3	50-53		400 PMCL (P)
Total Dissolved Solids	----	3/3	188-403	273	500 SMCL (F)
Total Phosphate	----	3/3	0.047-0.18	0.095	NAvail
Ortho-Phosphate	----	3/3	0.055-0.292	0.173	NAvail
Alkalinity	----	3/3	31.4-186	87.9	NAvail

(c) Results for one or more samples in the data group were reported as nondetected at or below the Contract Required Detection Limit (CRDL).

(P) Proposed.
(F) Final.
(T) Tentative.

U Parameter was not detected. Value presented is the sample quantitation limit.

NAvail	Not available.
PMCL	Federal Safe Drinking Water Act (SDWA) Primary Maximum Contaminant Level (MCL).
SMCL	Federal SDWA Secondary MCL.
NIPDWR	National Interim Primary Drinking Water Regulation.

Table 10

SUMMARY OF SURFACE WATER MONITORING RESULTS(1)(2)
GROVELAND WELLS SITE
SUPPLEMENTAL MOM RI/FS
GROVELAND, MASSACHUSETTS

Parameter	Johnson Creek	Brindle Brook		Johnson Creek/Valley Site/Mill Pond Area				Johnson Creek Below Pond		
	Upstream of Valley SW-9	Upstream of Chesterton SW-11	Downstream of Chesterton SW-10	Upstream of Pond SW-8	Mill Pond Inlet SW-7	Mill Pond Outlet SW-6	Arithmetic Average(1)	Treatment System Discharge SW-15	Downstream of Mill Pond SW-5	Arithmetic Average(1)
	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)
Methylene chloride	1U	1U	1U/1U	2U	1U	44	15.2	5U	1U	----
1,2-Dichloroethene (Total)	1U	1U	1U/1U	1U	1U	3	1.3	96	0.5 J [7]	48.3
Chloroform	1U	1U	1U/1U	1U	1U	1U	----	1U	1U	----
1,2-Dichloroethane	1U	1U	1U/1U	1U	1U	0.6 J	0.5	1U	1U	----
1,1,1-Trichloroethane	1U	1U	1U/1U	0.7J	1U	1	0.7	1U	1U	----
Trichloroethene	1U	1U	1U/1U	1	1U	6	2.5	54	0.9J [2 J]	27.5
Benzene	1U	1U	1U/1U	1U	1U	0.6J	0.5	1U	1U	----
Toluene	1U	1U	1U/1U	1U	1U	10	3.7	2U	1U	----
Aluminum	45.4U	38.6U	188/183	58.6U	64.9U	43.4U	----	12U	54.6U [87.0U]	----
Arsenic				[2.1U]			----	20		12.5
Barium	6.8		10.7/3.6	6.8 [16.8]	6.5 [12.5U]	5.5 [17.3/11.0U]	6.3 [10.0]	17.4	6.5 [10.3U]	12
Calcium	10,400	7,770	6,890/6,990	10,200 [15,300]	10,200 [15,600]	10,100 [14,200/14,600]	10,167 [15,100]	20,500	10,200 [14,200]	15,350
Chromium					9.2		6.4			----
Iron	130	160	361/336	130 [359]	172 [387]	110 [339/336]	137.3 [361]	6,690	171 [482]	3,430.5
Lead	1.3		2.1/2.9	1.1J	1.0J	1.1	1.1			----
Magnesium	2,420	1,130	1,050/1,050	2,350 [3,330]	2,330 [3,410]	2,330 [3,170/3,180]	2,336.7 [3,305]	4,640	2,370 [3,100J]	3,505
Manganese	20.4	53.8	57.3/57.3	20.7 [34.3]	19.9 [40.9]	16.4 [18.0/14.9]	19 [30.6]	1,200	20.4 [84.0]	610.2

Table 10

SUMMARY OF SURFACE WATER MONITORING RESULTS(1)(2)
GROVELAND WELLS SITE
SUPPLEMENTAL MOM RI/FS
GROVELAND, MASSACHUSETTS
PAGE TWO

Parameter	Johnson Creek	Brindle Brook		Johnson Creek/Valley Site/Mill Pond Area				Johnson Creek Below Pond		
	Upstream of Valley SW-9	Upstream of Chesterton SW-11	Downstream of Chesterton SW-10	Upstream of Pond SW-8	Mill Pond Inlet SW-7	Mill Pond Outlet SW-6	Arithmetic Average(1)	Treatment System Discharge SW-15	Downstream of Mill Pond SW-5	Arithmetic Average(1)
	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)
Nickel					6.2		15.4			----
Potassium	1,000	384	441/396	1,660 [1,680U]	1,700 [1,560U]	1,620 [1,410U/1,370U]	1,660	3,970	1,770 [1,850U]	2,870
Selenium							----			----
Silver	6.7	30.8		12.1	[5.1J]	19.7	12.3 [5.0]		23.2	14.1
Sodium	9,390	5,910	10,600/10,500	9,030 [14,400]	9,080 [14,500]	8,790 [13,100/14,000]	8,966.7 [14,150]	26,900	9,470 [13,300]	18,185
Vanadium			2.7				----			----
Chloride (CL) (mg/L)	18	12	20/18	6.2 [33.5]	18 [36.4]	18 [34.4/52.4]	14.1 [37.8]	42	18 [38.2]	30
Nitrate-Nitrite (NO_2 + NO_3) (mg/L)	0.4	0.08	0.09/0.09	0.4 [0.34]	0.4 [1.11]	0.4 [0.24/0.81]	0.4 [0.66]	1.5	0.5 [0.21]	1.0
Ortho Phosphate (OPO_4) (mg/L)	0.01U	0.01U	0.01U/0.01U	0.01U [0.019]	0.01U [0.019]	0.01U [0.02/0.028]	---- [0.02]	0.01U	0.01 [0.024]	0.008
Sulfate (mg/L)	11	7.5	6.5/6.5	11 [6.62]	11 [6.58]	12 [6.31/6.64]	11.3 [6.6]	24	12 [8.13]	18
Total Dissolved Solids (TDS) (mg/L)	69	53	62/58	75 [387]	76 [238]	69 [200/187]	73.3 [273]	170	72 [240]	121
Total Suspended Solids (TSS) (mg/L)	4U	4U	4U/4U	NA [ND]	4U [8.8]	4U [7.9/ND]	----	8	4U [10]	5
Total Phosphate				ND	[ND]	[0.013]			[0.024]	

Table 10

SUMMARY OF SURFACE WATER MONITORING RESULTS(1)(2)
GROVELAND WELLS SITE
SUPPLEMENTAL MOM RI/FS
GROVELAND, MASSACHUSETTS
PAGE THREE

Parameter	Johnson Creek Below Unnamed Tributary				Argilla Brook			Johnson Creek Below Argilla Brook		
	SW-4	SW-3	SW-2	Arithmetic Average(1)	SW-13	SW-12	Arithmetic Average(1)	SW-1	SW-14	Arithmetic Average(1)
	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)
Methylene chloride	1U	1U	1U/1U	----	1U	1U	----	1U	1U	----
Trichloroethene	0.7J [4J]	1 [3J]	1U/1 [3J]	0.8 [3.3]	1U	1U	----	1 [3J]	0.7J	0.9
Benzene	1U	1U	1U/1U	----	1U	1U	----	1U	1U	----
Toluene	1U	1U	1U/1U	----	1U	1U	----	1U	1U	----
Aluminum	56.6U [121U]	74.5U [314U]	61U/69.7U [231U]	----	180	251	215.5	65.8U [247U]	332	182.5
Arsenic				----			----		2.2	3.6
Barium	6.5 [12.1U]	7.4 [12.6U]	6.8/6.5 [14.5U]	6.9	7.8	7.8	7.8	6.5 [30.7U]	8.4	7.5
Calcium	9,860 [15,700]	10,600 [16,200]	10,700/10,600 [16,300]	10,370 [16,067]	14,600	15,000	14,800	10,600 [16,800]	11,200	10,900
Chromium				----			----			----
1,2-Dichloroethene (Total)	1U [3J]	1U [2J]	1U/1U [2J]	---- [2.3]	1U	1U	----	1U [2J]	1U	----
Chloroform	1U	1U	3J/1UJ	1	1U	1U	----	1U	1U	----
1,2-Dichloroethane	1U	1U	1U/1U	----	1U	1U	----	1U	1U	----
1,1,1-Trichloroethene	1U	1U	1U/1U	----	1U	1U	----	1U	1U	----
Iron	171 [358]	297 [882]	160/210 [643]	217.7 [627]	316	888	602	187 [892]	581	374
Lead	1.4J	6.2	1.1	2.9	1.1	1.7J	1.4	1.1	4.2	2.7

Table 10

SUMMARY OF SURFACE WATER MONITORING RESULTS(1)(2)
GROVELAND WELLS SITE
SUPPLEMENTAL MOM RI/FS
GROVELAND, MASSACHUSETTS
PAGE FOUR

Parameter	Johnson Creek Below Unnamed Tributary				Argilla Brook			Johnson Creek Below Argilla Brook		
	SW-4	SW-3	SW-2	Arithmetic Average(1)	SW-13	SW-12	Arithmetic Average(1)	SW-1	SW-14	Arithmetic Average(1)
	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)
Magnesium	2,230 [3,330J]	2,440 [3,490J]	2,400/2,380 [3,400J]	2,353 [3,406]	3,660	3,840	3,750	2,360 [3,540J]	2,650	2,505
Manganese	18.7 [42.8]	25.7 [83.6]	24.2/26 [68.9]	23.2 [65.1]	49.7	68.4	59.1	24 [71.3]	40.9	32.5
Nickel	14.9	10		14.9			----		13.7	16.9
Potassium	1,610 [1,850U]	1,830 [1,790U]	1,750/1,770 [1,960U]	1,733	1,270	1,220	1,245	1,680 [2,130U]	1,720	1,700
Selenium				----			----		4.6J	3.6
Silver	7.6	42		18.2		67.1	36.1	[11.1]		----
Sodium	8,680 [16,500]	10,600 [17,800]	10,000/10,200 [17,200]	9,793.3 [17,167]	28,200	22,600	25,400	9,830 [17,600]	11,100	10,465
Vanadium				----			----	2.1		13.6
Chloride (CL) (mg/L)	29 [44.4]	30 [58.7]	18/18 [40.9]	25.7 [48]	50	42	46	21 [43.7]	21	21
Nitrate-Nitrite ($NO_2 + NO_3$) (mg/L)	0.5 [0.33]	0.5 [0.3]	0.5/0.5 [0.8]	0.5 [0.47]	0.8	0.4	0.6	0.5 [0.9]	0.5	0.5
Ortho Phosphate (OPO_4) (mg/L)	0.01U [0.024]	0.01U [0.028]	0.01U/0.01U [0.04]	---- [0.03]	0.11	0.01U	0.06	0.01U [0.04]	0.01U	----
Sulfate (mg/L)	10 [10.3]	12 [10.8]	12/12 [10.5]	11.3 [10.5]	15	16	15.5	12 [11.2]	13	12.5
Total Dissolved Solids (TDS) (mg/L)	71 [214]	74 [201]	74/70 [262]	72.3 [226]	55	133	94	80 [248]	78	79
Total Suspended Solids (TSS) (mg/L)	4U [7.7]	4U [17]	4U/4U [12.2]	----	4U	9	5.5	4U [8.5]	8	5
Total Phosphate	ND	ND	[0.013]					[0.024]		

Table 10

SUMMARY OF SEDIMENT SURFACE WATER MONITORING RESULTS(1)(2)
GROVELAND WELLS SITE
SUPPLEMENTAL MOM RI/FS
GROVELAND, MASSACHUSETTS
PAGE FIVE

(1) Arithmetic average calculated using one-half the sample quantitation limit (SQL) for nondetect values. Averages are calculated for data groups that have at least one positive detection for a parameter. A blank space indicates that the parameter was not detected and that the SQL for the sample is the Contract Required Detection Limit (CRDL).

(2) Surface water samples were collected from locations 1 through 8 during the second sampling round. Only the positive detections are presented in Table 4-18 in brackets [ ]. The sample quantitation limit for the nondetect VOCs ranged from 5 to 8 ug/L.

(3) Thallium and copper were detected in second-round samples SW-4 and SW-3 at 1 ug/L and 6.4J ug/L, respectively.

U Parameter was not detected. Value presented is the sample quantitation limit.

J The analytical result presented was qualified as an estimated concentration based on validation of the analytical data.

----Arithmetic average was not calculated because positive detections were not reported for the data group.

Table 11

SUMMARY OF SEDIMENT MONITORING RESULTS(1)(2)
GROVELAND WELLS SITE
SUPPLEMENTAL MOM RI/FS
GROVELAND, MASSACHUSETTS

Parameter	Johnson Creek	Brindle Brook		Arithmetic Average(1)	Johnson Creek/Valley Site/Mill Pond Area				Johnson Creek Below Pond		
	Upstream of Valley SD-9	Upstream of Chesterton SD-11	Downstream of Chesterton SD-10		Upstream of Pond SD-8	Mill Pond Inlet SD-7	Mill Pond Outlet SD 6	Arithmetic Average(1)	Treatment System Discharge SD-15	Downstream of Mill Pond SD-5	Arithmetic Average(1)
	(ug/Kg)	(ug/Kg)	(ug/Kg)	(ug/Kg)	(ug/Kg)	(ug/Kg)	(ug/Kg)	(ug/Kg)	(ug/Kg)	(ug/Kg)	(ug/Kg)
Methylene chloride	7 U	11 U	7 U/6 U	----	7U	20 U	11 U	----	NS	15 U	----
Acetone	14 U	21 UJ	14 UJ/13 UJ	----	14 UJ	140 J	13 UJ	51.2	NS	35 J	35
Tetrachloroethene	7 U	11 UJ	7 U/5 J	4.9	7U	10 UJ	6 U	----	NS	7 U	----
Toluene	7 U	11 UJ	7 U/6 U	----	7U	10 UJ	6 U	----	NS	7 U	----
1,2-Dichloroethene										[4 J]	
Chloromethane										[4 J]	
2-Methylphenol	1,900 UJ	2,900 UJ	2,000 UJ/1,700 UJ	----	1,800 UJ	2,800 UJ	1,700 UJ	----	NS	2,000 UJ	----
Benzoic acid	9,100 UJ	190 J	9,700 UJ/8,300 UJ	4595 (190)	8,900 UJ	14,000 UJ	8,000 UJ	----	NS	9,800 UJ	----
Phenanthrene	290 J	2,900 UJ	2,000 UJ/1,700 UJ	----	140 J	280 J	1,700 UJ	423 (210)	NS	250 J	250
Anthracene	1,900 UJ	2,900 UJ	2,000 UJ/1,700 UJ	----	1,800 UJ	2,800 UJ	1,700 UJ	----	NS	2,000 UJ	----
Fluoranthene	480 J	2,900 UJ	2,000 UJ/1,700 UJ	----	170 J	370 J	180 J	240	NS	380 J	380
Pyrene	640 J	2,900 UJ	2,000 UJ/1,700 UJ	----	210 J	490 J	240 J	313	NS	480 J	480
Benzyl butyl phthalate	1,900 UJ	1,900 J	2,000 UJ/1,700 UJ	79 (1900)	1,800 UJ	2,800 UJ	1,700 UJ	----	NS	2,000 UJ	----
Benzo(a)anthracene	360 J	2,900 UJ	2,000 UJ/1,700 UJ	----	1,800 UJ	250 J	1,700 UJ	667 (250)	NS	330 J	330
Chrysene	420 J	2,900 UJ	2,000 UJ/1,700 UJ	----	1,800 UJ	2,800 UJ	1,700 UJ	----	NS	250 J	250
Bis(2-ethylhexyl) phthalate	1,900 UJ	310 U	2,000 UJ/1,700 UJ	----	1,800 UJ	2,800 UJ	270 U	----	NS	300 U	----
Benzo(b)fluoranthene	510 J	2,900 UJ	2,000 UJ/1,700 UJ	----	1,800 UJ	2,800 UJ	1,700 UJ	----	NS	2,000 UJ	----
Benzo(k)fluoranthene	430 J	2,900 UJ	2,000 UJ/1,700 UJ	----	1,800 UJ	2,800 UJ	1,700 UJ	----	NS	2,000 UJ	----
Benzo(a)pyrene	400 J	2,900 UJ	2,000 UJ/1,700 UJ	----	1,800 UJ	2,800 UJ	1,700 UJ	----	NS	210 J	210
Indeno(1,2,3-cd) pyrene	1,900 UJ	2,900 UJ	2,000 UJ/1,700 UJ	----	1,800 UJ	2,800 UJ	1,700 UJ	----	NS	2,000 UJ	----
Benzo(g,h,i)perylene	1,900 UJ	2,900 UJ	2,000 UJ/1,700 UJ	----	1,800 UJ	2,800 UJ	1,700 UJ	----	NS	2,000 UJ	----

Table 11

SUMMARY OF SEDIMENT MONITORING RESULTS(1)(2)
GROVELAND WELLS SITE
SUPPLEMENTAL MOM RI/FS
GROVELAND, MASSACHUSETTS
PAGE TWO

Parameter	Johnson Creek	Brindle Brook			Johnson Creek/Valley Site/Mill Pond Area				Johnson Creek Below Pond		
	Upstream of Valley SD-9	Upstream of Chesterton SD-11	Downstream of Chesterton SD-10	Arithmetic Average(1)	Upstream of Pond SD-8	Mill Pond Inlet SD-7	Mill Pond Outlet SD-6	Arithmetic Average(1)	Treatment System Discharge SD-15	Downstream of Mill Pond SD-5	Arithmetic Average(1)
	(mg/Kg)	(mg/Kg)	(mg/Kg)	(mg/Kg)	(mg/Kg)	(mg/Kg)	(mg/Kg)	(mg/Kg)	(mg/Kg)	(mg/Kg)	(mg/Kg)
Aluminum	6,530	5,860	6,520/4,660	5725	3,540 [2,290J]	5,620 [4,680 J]	2,130 [1,570 J/3,090 J]	3,763 [3,100]	NS	5,070 [4,390 J]	5,070
Arsenic	17.8	5.2	21.8/17.6	12.5	2.5 [2.0U]	6.4 [2.3 U]	2.7 [2.1 U/1.5 U]	3.9	NS	13.7 [10.1]	13.7
Barium	73.9	24.9	22/14 5	21.6	11.3 [32.1]	24.8 [18.5]	7.2 [7.6/11.0]	14.4 [19.9]	NS	21 [27.5]	21
Beryllium	0.37			----	[0 29]	[0.37]	[0.26]	[0.3]	NS		----
Calcium	4,600 J	2,850 J	2,510 J/1,100 J	2328	780 J [431]	2,040 J [873]	561 J [526/771]	1,127 [722]	NS	1,340 J [807]	1,340
Chromium	15.4	17.5	14.9/21.8	17.9	13.4 [8.4J]	29.5 [16.2J]	6.5 U [4.6 J/9.0 J]	15.6 [10.5]	NS	14.2 [13.2 J]	14.2
Cobalt	6.2	2.3	4.5/1.2	3.1	2.1	4.1 [3.0]	1.5	2.6 [4.3]	NS	4.0 [3.1]	4.0
Copper	93 J	18 U	23.6 U/17.4 U	----	16.5 U [4.9J]	68.4 J [17.5 J]	18.6 U [8.6 J/31.2 J]	28.7 [14.7]	NS	25 U [12.6 J]	----
Iron	10,400	6,280	20,500/13,100	1540	4,840 [4,170J]	7,660 [7,640 J]	3,060 [2,860 J/5,830 J]	5,186.7 [5,385]	NS	11,000 [12,200 J]	11,000
Lead	1,070	24.7	19.6/28.3 J	24.3	16.9 [8.9J]	40.5 [33.8 J]	12 [14.5 J/8.7 J]	23.1 [18.1]	NS	16 [13.4 J]	16
Magnesium	4,450 J	1,440 J	1,720 J/2,550 J	1788	1,670 J [1,120]	2,200 J [2,120]	847 J [701/1,680]	1,572 [1,477]	NS	1,970 J [2,230]	1,970
Manganese	520 J	165 J	778 J/237 J	336	38.1 J [30.1J]	148 J [147 J]	26.1 J [60.9 J/72.2 J]	70.7 [81.2]	NS	310 J [350 J]	310
Mercury	0.74 J	0.26 J	-UJ/-UJ	0.15	-UJ	-UJ	-UJ	----	NS	-UJ	----
Nickel	14.3 U	7.8 U	18.7 U/12.8 U	----	7.4 U [5.2]	13.6 U [10.2]	4.4 U [7.6]	[7.7]	NS	11.9 U [13]	----
Potassium	1,010	155	294/481	271	270 [380U]	347 [547U/544U]	255 [366 U/547 U]	290.7	NS	492 [682 U]	492
Selenium	1.8 J	2.8 J	-UJ/-UJ	1.9	-UJ	-UJ	-UJ	----	NS	-UJ	----
Silver	-UJ	4.8 U	-UJ/-UJ	----	-UJ	-UJ	-UJ	----	NS	-UJ	----
Sodium	191 U	97.8 U	152 U/64.9 U	----	68.2 U [104U]	97.6 U [121 U]	49.8 U [98.2 U/110 U]	----	NS	61.8 U [104 U]	----
Vanadium	30	11	17.7 J/14.6	13.6	8.0 [2.8U]	15.2 [19.2 U]	4.4 [3.6 U/9.6 U]	9.2	NS	11.5 [11.1 J]	11.5
Zinc	166 U	29.9 U	57.2 U/42.4 U	----	27.7 U [23.2]	62.2 U [44.5]	14.2 U [16.1/26.0]	---- [29.6]	NS	36.9 U [42.7]	----

Table II

SUMMARY OF SEDIMENT MONITORING RESULTS(1)(2)
GROVELAND WELLS SITE
SUPPLEMENTAL MOM RI/FS
GROVELAND, MASSACHUSETTS
PAGE THREE

Parameter	Johnson Creek Below Unnamed Tributary				Argilla Brook			Johnson Creek Below Argilla Brook		
	SD 4	SD 3	SD 2	Arithmetic Average(1)	SD 13	SD-12	Arithmetic Average(1)	SD-1	SD 14	Arithmetic Average(1)
	(ug/Kg)	(ug/Kg)	(ug/Kg)	(ug/Kg)	(ug/Kg)	(ug/Kg)	(ug/Kg)	(ug/Kg)	(ug/Kg)	(ug/Kg)
Methylene chloride	16 U	6 U	11 U/7 U	----	53	11 U	29.3	8 U	9 U	----
Acetone	121 UJ	12 UJ	68 J/19 J	36.7	38 J	94 J	66	13 UJ	15 UJ	----
Tetrachloroethene	6 U	6 U	7 U/6 U	----	8 U	8 U	----	7 U	7 U	----
Toluene	6 U	6 U	7 U/6 U	----	8 U	8 U	----	7 U	7 U	----
2 Methylphenol	1,600 UJ	2,000 UJ	1,700 UJ/1,700 UJ	---	2,000 UJ	200 J	600 (200)	1,700 UJ	1,900 UJ	----
Benzoic acid	8,000 UJ	9,600 UJ	8,400 UJ/8,500 UJ	- -	9,900 UJ	9,000 UJ	----	8,200 UJ	190 J	2,145 (190)
Phenanthrene	670 J	2,000 UJ	1,700 UJ/1,700 UJ	840 (670)	2,000 UJ	1,900 UJ	----	1,700 UJ	140 J	495 (140)
Anthracene	120 J	2,000 UJ	1,700 UJ/1,700 UJ	657 (120)	2,000 UJ	1,900 UJ	----	1,700 UJ	1,900 UJ	----
Fluoranthene	1,200 J	2,000 UJ	1,700 UJ/1,700 UJ	1,017 (1,200)	2,000 UJ	1,900 UJ	----	1,700 UJ	300 J	575 (300)
Pyrene	1,400 J	2,000 UJ	1,700 UJ/1,700 UJ	1,083 (1,400)	2,000 UJ	1,900 UJ	----	1,700 UJ	300 J	575 (300)
Benzyl butyl phthalate	1,600 UJ	2,000 UJ	130 J/1,700 UJ	763 (130)	2,000 UJ	1,900 UJ	----	1,700 UJ	440 J	645 (440)
Benzo(a)anthracene	730 J	2,000 UJ	1,700 UJ/1,700 UJ	449 (730)	2,000 UJ	1,900 UJ	----	1,700 UJ	1,900 UJ	----
Chrysene	730 J	2,000 UJ	1,700 UJ/1,700 UJ	860 (730)	2,000 UJ	1,900 UJ	----	1,700 UJ	220 J	535 (220)
Bis(2-ethylhexyl) phthalate	140 U	2,000 UJ	130 U/1,700 UJ	-	170 U	1,900 UJ	----	1,700 UJ	800 J	725 (800)
Benzo(b)fluoranthene	610 J	2,000 UJ	1,700 UJ/1,700 UJ	820 (610)	2,000 UJ	1,900 UJ	----	1,700 UJ	340 J	595 (340)
Benzo(k)fluoranthene	670 J	2,000 UJ	1,700 UJ/1,700 UJ	840 (670)	2,000 UJ	1,900 UJ	----	1,700 UJ	1,900 UJ	----
Benzo(a)pyrene	640 J	2,000 UJ	1,700 UJ/1,700 UJ	830 (640)	2,000 UJ	1,900 UJ	----	1,700 UJ	1,900 UJ	----
Indeno(1,2,3-cd)pyrene	260 J	2,000 UJ	1,700 UJ/1,700 UJ	703 (260)	2,000 UJ	1,900 UJ	----	1,700 UJ	1,900 UJ	----
Benzo(g,h,i)perylene	220 J	2,000 UJ	1,700 UJ/1,700 UJ	690 (220)	2,000 UJ	1,900 UJ	----	1,700 UJ	1,900 UJ	----

Table 11

SUMMARY OF SEDIMENT MONITORING RESULTS(1)(2)
GROVELAND WELLS SITE
SUPPLEMENTAL MOM RI/FS
GROVELAND, MASSACHUSETTS
PAGE FOUR

Parameter	Johnson Creek Below Unnamed Tributary				Argilla Brook			Johnson Creek Below Argilla Brook		
	SD-4	SD-3	SD 2	Arithmetic Average(1)	SD-13	SD-12	Arithmetic Average(1)	SD-1	SD-14	Arithmetic Average(1)
	(mg/Kg)	(mg/Kg)	(mg/Kg)	(mg/Kg)	(mg/Kg)	(mg/Kg)	(mg/Kg)	(mg/Kg)	(mg/Kg)	(mg/Kg)
Aluminum	2,970 [3,660 J]	6,880 [9,880 J]	4,550/5,690 [2,990J]	4,990 [5,510]	2,910	3,930	3,420	3,880 [2,790]	8,590	6,235
Arsenic	3.5 [2.5 U]	7.5 [5.1 U]	8.7/9.1 [4.1 U]	6.6	3.2	3.1	3.1	8.5 [4.7 U]	10.7	9.6
Barium	9.4 [11.8]	31.7 [35.2]	16.4/20.5 [10.2]	19.8 [19.1]	10.0	11.8	10.9	14.1 [13.4]	74.9	44.5
Beryllium	[0.23]	0.3 [0.55]	70.3	0.4 [0.4]			----		0.32	0.41
Calcium	564 J [808]	1,380 J [2,220]	930 J/1,230 J [705]	1,008 [1,244]	1,160 J	761 J	961	1,080 J [3,350]	2,160 J	1,620
Chromium	9.6 [10.7 J]	20.7 [30.6 J]	13.8/16.6 [8.6 J]	15.2 [16.6]	7.6 U	11.8	7.8	13.3 [6.1 J]	76.3	44.8
Cobalt	2.1	6.8 [5.7]	3.7/5.0	4.4 [5.2]	2.5	2.4	2.45	3.1	6.0	4.6
Copper	12.4 U [7.1 J]	35.3 J [20.8 J]	18.3 U/19.9 U [4.9 J]	17.1 [10.9]	8.7 U	8.5 U	----	19.8 U [2.3 J]	96 J	53
Iron	5,050 [7,830]	10,400 [16,600 J]	8,020/9,820 [5,650 J]	8,123 [10,026]	3,840	6,360	5,100	7,480 [5,160 J]	13,100	10,290
Lead	22 [10.1 J]	11.9 [24.8 J]	6.7/8.7 [4.4 J]	13.9 [13.1]	8.9	7.6	8.3	5.3 [7.5 J]	216	110.7
Magnesium	1,410 J [1,690]	3,340 J [4,950]	1,890 J/2,520 J [1,280]	2,318 [2,640]	1,060 J	1,710 J	1,385	1,840 J [1,150]	3,730 J	2,785
Manganene	41.2 J [55.4 J]	150 J [207 J]	68.2 J/88.9 J [63.7 J]	89.9 [108.7]	38.1 J	53.1 J	45.6	89.2 J [205 J]	135 J	112.1
Mercury	-UJ	-UJ	-UJ/-UJ	----	-UJ	-UJ	----	-UJ	0.2 J	0.1
Nickel	6.9 U [6.6]	19.2 U [22.1]	11.2 U/13.9 U [6.5]	---- [11.7]	7.7 U	9.5 U	----	9.4 U [4.4]	22.2 U	----
Potassium	326 [353 J]	1,380 [1,220]	658/744 [514 U]	802 [610]	150	249	200	631 [448 U]	1,330	981
Selenium	-UJ	-UJ	-UJ/-UJ	----	-R	-UJ	----	-UJ	-UJ	----
Silver	-UJ	-UJ	-UJ/-UJ	----	-UJ	2.5 U	----	-UJ	-UJ	----
Sodium	96.6 U [101 U]	123 U [201]	78.6 U/95.4 U [96.0 U]	---- [99.8]	89.2 U	61.4 U	----	84.5 U [110 U]	169 U	----
Vanadium	7.9 [7.8 U]	16.9 [18.9 J]	10.9/13.1 [6.7 U]	12.3 [8.7]	5.4	7.3	6.4	10.1 [5.1 U]	21.2	15.7
Zinc	22.7 U [25.7]	35.8 U [58.1]	21 U/26.6 U [13.2]	---- [32.3]	18.6 U	25.4 U	----	18.9 U	177 U	----

Table 11

SUMMARY OF FIRST ROUND SEDIMENT MONITORING RESULTS
GROVELAND WELLS SITE
SUPPLEMENTAL MOM RI/FS
GROVELAND, MASSACHUSETTS
PAGE FIVE

(1)	Arithmetic average calculated using one-half the sample quantitation limit (SQL) for nondetect values. Averages are calculated for data groups that have at least one positive detection for a parameter. A blank space indicates that the parameter was not detected and that the SQL for the sample is the Contract Required Detection Limit (CRDL).
(2)	Sediment samples were collected for locations 1 through 8. Only the positive detections are presented in Table 4-19 in brackets [ ]. The sample quantitation limit for the nondetect VOCs ranged from 6 to 18 ug/kg. All second-round metals results are presented in brackets.
( )	Because the sample quantitation limits for polynuclear aromatic hydrocarbons (PAHs) are frequently higher than actual positive detections, the average of the positive detection (for thePAHs only) are presented in parentheses.
U	Parameter was not detected. Value presented is the sample quantitation limit.
J	The analytical result presented was qualified as an estimated concentration based on validation of the analytical data.
UJ	The value presented is the estimated sample quantitation limit.
NS	Not sampled.
----	Arithmetic average was not calculated because positive detections were not reported for the data group.

Table 12

CHEMICALS OF CONCERN (COC) - GROUNDWATER
GROVELAND WELLS SITE
SUPPLEMENTAL MOM RI/FS
GROVELAND, MASSACHUSETTS

PARAMETER	NO. OF POSITIVE DETECTIONS/ NO. OF SAMPLES	RANGE OF POSITIVE DETECTIONS (ug/L)	AVERAGE$^{(1)}$ (ug/L)	BACKGROUND CONCENTRATION	RELATIVE RISK FACTORS - NONCARCINOGENS	RELATIVE RISK FACTORS - CARCINOGENS	RATIONALE
Trichloroethene	56/118	1-50,000	744.3 (1538.4)	---	TNA	0.415	Principal site contaminant.
1,2-Dichloroethene	44/118	0.3-4400	106.7 (270.4)	---	0.169	TNA	Principal site contaminant.
Tetrachloroethene	7/118	0.3-77	13.8 (20.1)	---	0.006	0.003	B-2 carcinogen.
Toluene	4/118	1-5	12.8 (2.25)	---	0.00001	TNA	Low concentrations and infrequently detected; however, a contaminant of concern for the Valley Site Source Control Operable Unit.
Methylene Chloride	2/118	0.4-0.9	13.4 (0.65)	---	0.00001	0.000005	B-2 carcinogen.
1,1-Dichloroethane	2/118	0.8-15	13.0 (7.90)	---	0.0001	---	C carcinogen.
1,1,1-Trichloroethane	2/118	1-16	13.0 (8.0)	---	0.0001	TNA	Historical data indicates compound is a principal site contaminant.
Benzene	2/118	0.2-17	13.0 (8.6)	---	TNA	0.0004	A carcinogen.
Acetone	1/118	5	32.7 (5.0)	---	0.00004	TNA	Low concentrations in groundwater; however detected in surface waters at 140 ug/L.
1,1-Dichloroethene	1/118	2	12.9 (2.0)	---	0.0002	0.0009	C carcinogen.
Chlorobenzene	1/118	20	13.1 (19.5)	---	0.0008	TNA	RRF approaches 0.001.
Vinyl Chloride	0/118	NA	NA	---	TNA	NA$^{(2)}$	Not detected, however, a contaminant of concern for the Valley Site Source Control Operable Unit.
Antimony	3/42	19.2-35.4	29.7 (25.4)	---	0.0638	TNA	RRF > 0.001; Conc > PMCL.
Arsenic	30/42	2.1-406	34.5 (46.3)	19.7	0.313	0.55	RRF > 0.001; Conc > MCL.

Table 12

CHEMICALS OF CONCERN (COC) - GROUNDWATER
GROVELAND WELLS SITE
SUPPLEMENTAL MOM RI/FS
GROVELAND, MASSACHUSETTS
PAGE TWO

PARAMETER	NO. OF POSITIVE DETECTIONS/ NO. OF SAMPLES	RANGE OF POSITIVE DETECTIONS (ug/L)	AVERAGE (ug/L)	BACKGROUND CONCENTRATION (ug/L)	RELATIVE RISK FACTORS - NONCARCINOGENS	RELATIVE RISK FACTORS - CARCINOGENS	RATIONALE
Barium	38/42	7.7-1100	148.2 (163.1)	177	0.019	TNA	RRF > 0.001
Beryllium	10/42	1.6-9.0	3.0 (4.8)	---	0.0013	0.029	RRF > 0.001; Conc > PMCL.
Cadmium	6/42	2.7-57.3	5.2 (21.5)	---	0.0826	TNA	RRF > 0.001; Conc > MCL.
Chromium	32/42	4.1-1230	103.4 (134.4)	89.2	0.177	TNA	RRF > 0.001; Conc > MCL.
Lead	27/42	1.4-364	43.4 (61.6)	25.9	TNA	TNA	Conc. > MCL.
Magnanese	40/42	8.9 7550	1024.6 (1024.6)	960	0.027	TNA	RRF > 0.001.
Mercury	1/42	0.2	0.1 (0.2)	---	0.005	TNA	RRF < 0.001; however, a contaminant of concern for the Valley Site Source Control Operable Unit.
Nickel	36/42	5.3-876	123.5 (141.4)	96.3	0.0316	TNA	RRF > 0.001.; Conc > PMCL.
Selenium	6/42	3.1-23.5	2.9 (6.3)	---	0.0056	TNA	RRF > 0.001; however, Conc < PMCL.
Silver	---	---	---	---	---	TNA	Detected in surface water at Conc. > MCL; not detected in groundwater.
Vanadium	22/42	2.2-565	66.8 (104.2)	56.3	0.0582	TNA	RRF > 0.001.
Zinc	25/42	14.9-3900	280.5 (489.8)	449	0.014	TNA	RRF > 0.001.

(1) - Arithmetic average calculated using one-half of the sample quantitation for nondetect values (Arithmetic average of positive detections).
(2) - Not calculated because this chemical was not detected in the Supplemental MOM RI.
TNA - Toxicity Criteria are not available for this chemical.
RRF - Relative Risk Factor
TC - Toxicity Criteria
MCL - Federal Safe Drinking Water Act Maximum Contaminant Level
PMCL - Federal Safe Drinking Water Act Proposed Maximum Contaminant Level

TABLE 13
CUMULATIVE CARCINOGENIC RISK ESTIMATES AND HAZARD INDICES
INGESTION OF GROUNDWATER (1)

Well Groupings	Cancer Risk Estimates		Hazard Indices	
	Ave	RME (2)	Ave	RME
AREA A				
Shallow overburden	1.9E-03	(3)	2.9	(3)
Shallow bedrock	1.5E-03	3.0E-03	1.9	3.7
AREA B				
Shallow overburden, (downgradient Valley)	2.8E-03	3.5E-03	7	12.6
Shallow overburden, (Mill Pond Area)	2.0E-03	3.4E-03	4.3	6.1
Deep over/shallow bed (vicinity Valley, Johnson)	2.6E-03	1.7E-02	2.5	7.9
Deep over/shallow bed (beyond Johnson Cr.)	1.5E-02	1.5E-02	10.5	10.5
AREA C				
Shallow/deep overburden (vicinity Johnson Cr.)	1.1E-03	3.0E-03	1.9	6.9
Shallow/deep overburden (beyond Johnson Cr.)	1.1E-03	5.2E-03	3.8	15.9
AREA D				
Deep overburden (1st round)	3.0E-03	5.0E-03	1.9	3
Deep overburden (2nd round)	9.0E-03	2.1E-02	6.5	15.7

NOTES:

(1) The risks presented in this table may be underestimated by one-half because the contribution of volatile organic compounds through the inhalation pathway is not included in the risk assessment.

(2) RME - Reasonable Maximum Exposure

(3) The reasonable maximum exposure scenario is not presented for the shallow overburden because only one shallow overburden well was sampled.

Table 14

SUMMARY OF EXCESS LIFETIME CANCER RISK POSED BY THE CURRENT POTENTIAL ACCIDENTAL INGESTION OF ORGANIC CHEMICALS IN SURFACE WATER
GROVELAND WELLS SITE
SUPPLEMENTAL MOM RI/FS
GROVELAND, MASSACHUSETTS

Carcinogenic Contaminants of Concern	Cancer Weight of Evidence	Cancer Slope Factor $(mg/kg/day)^{-1}$	Maximum Concentration (ug/L)	Exposure Dose	Cancer Risk
				Reasonable Worst Case (mg/kg/day)	Reasonable Worst Case
Methylene chloride	B2	7.5×10^{-3}	44	4.1×10^{-6}	3.1×10^{-8}
Trichloroethene	B2	1.1×10^{-2}	54	5.1×10^{-6}	5.5×10^{-8}
Benzene	A	2.9×10^{-2}	0.6	5.6×10^{-8}	1.6×10^{-9}
Total Cancer Risk:					8.8×10^{-8}

Table 15

SUMMARY OF NONCARCINOGENIC RISKS POSED BY THE CURRENT POTENTIAL ACCIDENTAL INGESTION OF ORGANIC CHEMICALS IN SURFACE WATER
GROVELAND WELLS SITE
SUPPLEMENTAL MOM RI/FS
GROVELAND, MASSACHUSETTS

Noncarcinogenic Contaminants of Concern	Reference Dose (mg/kg/day)	Endpoint of Concern	Maximum Concentration (ug/L)	Exposure Dose	Hazard Quotient
				Reasonable Worst Case (mg/kg/day)	Reasonable Worst Case
Methylene chloride	6×10^{-2}	Liver	44	4.1×10^{-6}	6.9×10^{-5}
1,2-Dichloroethene	1×10^{-2} (cis) [2×10^{-2} (trans)]	Blood	96	9.0×10^{-6}	9.0×10^{-4} [4.5×10^{-4}]
1,1,1-Trichloroethane	9×10^{-2}	Liver	1	9.4×10^{-8}	1.04×10^{-6}
Total (Hazard Index):					9.7×10^{-4} (1)

(1) Hazard Index based on cis-1,2-dichloroethene.

Table 16

SUMMARY OF EXCESS LIFETIME CANCER RISK POSED BY THE CURRENT POTENTIAL DERMAL CONTACT WITH ORGANIC CHEMICALS IN SURFACE WATER
GROVELAND WELLS SITE
SUPPLEMENTAL MOM RI/FS
GROVELAND, MASSACHUSETTS

Carcinogenic Contaminants of Concern	Cancer Weight of Evidence	Cancer Slope Factor $(mg/kg/day)^{-1}$	Maximum Concentration (ug/L)	Exposure Dose	Cancer Risk
				Reasonable Worst Case (mg/kg/day)	Reasonable Worst Case
Methylene chloride	B2	7.5×10^{-3}	44	1.4×10^{-6}	1.1×10^{-8}
Trichloroethene	B2	1.1×10^{-2}	54	1.7×10^{-6}	1.9×10^{-8}
Benzene	A	2.9×10^{-2}	0.6	1.8×10^{-8}	5.2×10^{-10}
Total Cancer Risk:					3.1×10^{-8}

(1) The excess lifetime cancer risk calculated for benzene using a Permeability Constant of 1.11×10^{-1} is 7.0×10^{-8}

Table 17

SUMMARY OF NONCARCINOGENIC RISKS POSED BY THE CURRENT POTENTIAL DERMAL CONTACT WITH ORGANIC CHEMICALS IN SURFACE WATER
GROVELAND WELLS SITE
SUPPLEMENTAL MOM RI/FS
GROVELAND, MASSACHUSETTS

Noncarcinogenic Contaminants of Concern	Reference Dose (mg/kg/day)	Endpoint of Concern	Maximum Concentration (ug/L)	Exposure Dose	Hazard Quotient
				Reasonable Worst Case (mg/kg/day)	Reasonable Worst Case
Methylene chloride	6×10^{-2}	Liver	44	1.4×10^{-6}	2.3×10^{-5}
1,2-Dichloroethene	1×10^{-2} (cis) [2×10^{-2} (trans)]	Blood	96	3.0×10^{-6}	3.0×10^{-4} [1.5×10^{-4}]
1,1,1-Trichloroethane	9×10^{-2}	Liver	1	3.1×10^{-8}	3.4×10^{-7}
Total (Hazard Index):					3.2×10^{-4} (1)

(1) Hazard Index based on cis-1,2-dichloroethene. The receptor of concern is a 70-kg adult.

Table 18

SUMMARY OF EXCESS LIFETIME CANCER RISK POSED BY THE CURRENT POTENTIAL DERMAL CONTACT WITH ORGANIC CHEMICALS IN SEDIMENTS AT THE LOWER JOHNSON CREEK WATERSHED
GROVELAND WELLS SITE
SUPPLEMENTAL MOM RI/FS
GROVELAND, MASSACHUSETTS

Carcinogenic Contaminants of Concern	Cancer Weight of Evidence	Cancer Slope Factor (mg/kg/day)$^{-1}$	Maximum Concentration (ug/L)	Exposure Dose	Cancer Risk
				Reasonable Worst Case (mg/kg/day)	Reasonable Worst Case
Methylene chloride	B2	7.5 x 10^{-3}	53	1.3 x 10^{-8}	9.8 x 10^{-11}
Tetrachloroethene	B2	5.1 x 10^{-2}	5	1.2 x 10^{-9}	6.0 x 10^{-11}
Total Cancer Risk:					1.6 x 10^{-10}

Table 19

SUMMARY OF NONCARCINOGENIC RISKS POSED BY THE CURRENT POTENTIAL DERMAL CONTACT WITH ORGANIC CHEMICALS IN SEDIMENTS OF THE LOWER JOHNSON CREEK WATERSHED
GROVELAND WELLS SITE
SUPPLEMENTAL MOM RI/FS
GROVELAND, MASSACHUSETTS

Noncarcinogenic Contaminants of Concern	Reference Dose (mg/kg/day)	Endpoint of Concern	Maximum Concentration (ug/L)	Exposure Dose	Hazard Quotient
				Reasonable Worst Case (mg/kg/day)	Reasonable Worst Case
Methylene chloride	6 x 10^{-2}	Liver	53	1.25 x 10^{-8}	2.1 x 10^{-7}
Tetrachloroethene	1 x 10^{-2}	Liver	5	1.18 x 10^{-9}	1.2 x 10^{-7}
1,2-Dichloroethene	1 x 10^{-2} (cis) [2 x 10^{-2} (trans)]	Blood	4	9.4 x 10^{-10}	9.4 x 10^{-8} [4.7 x 10^{-8}]
Acetone	1 x 10^{-1}	Liver, kidney	140	3.3 x 10^{-8}	3.3 x 10^{-7}
Total (Hazard Index):					7.5 x 10^{-7} (1)

(1) Hazard index based on cis-1,2-dichloroethene. The receptor of concern is a 70-kg adult.

Table 20

SUMMARY OF EXCESS LIFETIME CANCER RISK POSED BY THE CURRENT POTENTIAL CONSUMPTION OF FISH TAKEN FROM SURFACE WATERS IN THE LOWER JOHNSON CREEK WATERSHED
GROVELAND WELLS SITE
SUPPLEMENTAL MOM RI/FS
GROVELAND, MASSACHUSETTS

Carcinogenic Contaminants of Concern	Cancer Weight of Evidence	Cancer Slope Factor (mg/kg/day)-1	Maximum Concentration (ug/L)	Bioconcentration Factor (L/kg)	Exposure Dose	Cancer Risk
					Reasonable Worst Case/ Average Case (mg/kg/day)	Reasonable Worst Case/ Average Case
Methylene chloride	B2	7.5×10^{-3}	44/3.6	5	4.2×10^{-6}/ 3.4×10^{-7}	3.1×10^{-8}/ 2.6×10^{-9}
Trichloroethene	B2	1.1×10^{-2}	54/4.6	17	1.7×10^{-5}/ 1.5×10^{-6}	1.9×10^{-7}/ 1.6×10^{-8}
Benzene	A	2.9×10^{-2}	0.6/0.5	24	2.7×10^{-7}/ 2.3×10^{-7}	7.9×10^{-9}/ 6.6×10^{-9}
Total Cancer Risk:						2.3×10^{-7}/ 2.5×10^{-8}

Table 21

SUMMARY OF NONCARCINOGENIC RISKS POSED BY THE CURRENT POTENTIAL CONSUMPTION OF FISH TAKEN FROM SURFACE WATERS IN THE LOWER JOHNSON CREEK WATERSHED
GROVELAND WELLS SITE
SUPPLEMENTAL MOM RI/FS
GROVELAND, MASSACHUSETTS

Noncarcinogenic Contaminants of Concern	Reference Dose (mg/kg/day)	Endpoint of Concern	Maximum Concentration (ug/L)	Bioconcentration Factor (L/kg)	Exposure Dose	Hazard Quotient
					Reasonable Worst Case (mg/kg/day)	Reasonable Worst Case
Methylene chloride	6×10^{-2}	Liver	44	5	4.62×10^{-5}	7.7×10^{-4}
1,2-Dichloroethene	1×10^{-2} (cis) [2×10^{-2} (trans)]	Blood	96	22	4.4×10^{-4}	4.4×10^{-2} [2.2×10^{-2}]
1,1,1-Trichloroethane	9×10^{-2}	Liver	1	5.6	1.1×10^{-7}	1.2×10^{-6}
Total (Hazard Index):						4.5×10^{-2} (1)

(1) Hazard Index based on cis-1,2-dichloroethene.

Table 22

SURFACE WATER METALS RANGES AND STANDARDS
GROVELAND WELLS SITE
SUPPLEMENTAL MOM RI/FS
GROVELAND, MASSACHUSETTS

PARAMETER	BACKGROUND ug/L	RANGE(1) ug/L	AWQC(2) FRESH-WATER CHRONIC ug/L	NO. OF POSITIVE DETECTIONS/NO. OF SAMPLES
Aluminum	ND	183.0-332	150	3/15
Arsenic	ND	2.2-20	48(4)	2/15
Barium	6.8	5.5-17.4	NA	14/15
Calcium	7,770-10,400	6,890-20,500	NA	15/15
Chromium	ND	9.2	11	1/15
Iron	130-160	130-6,690	1,000	15/15
Lead	1.3	1.0-6.2	3.2	12/15
Magnesium	1,130-2,420	1,050-4,640	NA	15/15
Manganese	20.4-53.8	16.4-1,200	NA	15/15
Nickel	ND	6.2-14.9	160	4/15
Potassium	384-1,800	384-3,970	NA	15/15
Selenium	ND	ND	5	ND
Silver	6.7-30.8	6.7-67.1	0.12(3)	8/15
Sodium	5,910-9,390	5,910-26,900	NA	15/15
Vanadium	ND	2.1-2.7	NA	2/15

(1) First-round data presented.

(2) AWQC for several metals are dependent on the oxidation state of the metal and hardness level of the surface water body of concern.

(3) AWQC lowest-observed-effect level (LOEL). An actual criterion has not been established for this compound.

Table 24

ONSITE ACTION-SPECIFIC ARARs AND TBCs FOR ALTERNATIVE 6 - EXTRACTION WELLS, METALS REMOVAL, UV/OXIDATION AND DISCHARGE TO JOHNSON CREEK
SUPPLEMENTAL MOM FS
GROVELAND WELLS SITE
GROVELAND, MASSACHUSETTS

Requirement	Actions Taken to Meet Requirements
FEDERAL	
CWA - Section 402 (Applicable)	Substantive requirements are applicable to the treatment system discharge. The treatment system will be designed and operated to achieve Clean Water Act requirements.
CAA - National Air Quality Standards (40 CFR Part 50) (Relevant and Appropriate)	Substantive requirements will be relevant and appropriate during the construction activities. Dust suppressants will be used as required during construction to minimize fugitive dust emissions.
OSHA - General Industry Standards (29 CFR Part 1910) (Not ARAR)	Substantive requirements will be met during the construction activities. Construction workers and operators will be trained, and appropriate health and safety practices will be employed as required for each specific task. Note this requirement is not an ARAR, but must be complied with.
OSHA - Safety and health standards for Federal service contracts (29 CFR Part 1926) (Not ARAR)	Substantive requirements will be applicable during the construction activities. Note this requirement is not an ARAR, but must be complied with
OSHA - Record keeping, reporting, and related regulations (Not ARAR)	Substantive requirements will be applicable during the construction activities. Note this requirement is not an ARAR, but must complied with.

Table 24

ONSITE ACTION-SPECIFIC ARARs AND TBCs FOR ALTERNATIVE 6 - EXTRACTION WELLS, METALS REMOVAL, UV/OXIDATION AND DISCHARGE TO JOHNSON CREEK
SUPPLEMENTAL MOM FS
GROVELAND WELLS SITE
GROVELAND, MASSACHUSETTS

Requirement	Actions Taken to Meet Requirements
COMMONWEALTH OF MASSACHUSETTS	
Ambient Air Quality Standards (310 CMR 6.00) (Relevant and Appropriate)	Substantive requirements will be relevant and appropriate during the construction activities. Dust suppressants will be used as required during construction to minimize fugitive dust emissions.
Air Pollution Control (310 CMR 7.00) (Applicable)	Substantive requirements will be applicable to the air discharge from the treatment system.
Surface Water Discharge Permit Program (314 CMR 3.00) (Applicable)	Substantive requirements are applicable to the treatment system discharge. The treatment system will be designed and operated to meet these dischage requirements.
Operation and Maintenance and Pretreatment Standards for Wastewater, Treatment Works and Indirect Discharge (314 CMR 12.00)	Substantive requirements related to pretreatment of the sludge will be met.
Surface Water Quality Standards (310 CMR 4.00) (Applicable)	Substantive requirements will be applicable to the treatment system discharge. Treatment system will be constructed to ensure that water quality standards are met.
Supplemental Requirements for Hazardous Waste Management Facilities (314 CMR 8.00) (Applicable)	These regulations apply to wastewater treatment facilities exempted from M.G.L. c.21C, which treat, store, or dispose of hazardous wastes. The treatment plant will meet the substantive requirements of 314 CMR 8.05.

Table 24

ONSITE ACTION-SPECIFIC ARARs AND TBCs FOR ALTERNATIVE 6 - EXTRACTION WELLS, METALS REMOVAL, UV/OXIDATION AND DISCHARGE TO JOHNSON CREEK
SUPPLEMENTAL MOM FS
GROVELAND WELLS SITE
GROVELAND, MASSACHUSETTS
PAGE THREE

Requirement	Actions Taken to Meet Requirements
COMMONWEALTH OF MASSACHUSETTS (CONTINUED)	
Hazardous Waste Regulations (310 CMR 30.00) (Applicable)	These regulations will be looked to to determine the appropriate disposal method for the sludge. Sludge will be evaluated as to whether it is a listed (characteristic) waste to determine appropriate disposal methods. If hazardous, it will be stored in accordance with these regulations. If DNAPL were discovered and determined to be hazardous, it will be stored in accordance with these regulations.
Ambient Air Levels (To Be Considered)	Monitoring will be conducted to ensure that standards are not exceeded at the wells and the treatment plant. If standards are exceeded, action will be taken to ensure that the standards will be met.

Table 4

LOCATION-SPECIFIC ARARs AND TBCs FOR ALTERNATIVE 6 - EXTRACTION WELLS, METALS REMOVAL, UV/OXIDATION AND DISCHARGE TO JOHNSON CREEK
SUPPLEMENTAL MOM FS
GROVELAND WELLS SITE
GROVELAND, MASSACHUSETTS

Requirement	Actions Taken to Meet Requirements
FEDERAL	
CWA - Section 404 (Applicable)	Potentially applicable to construction of discharge piping and outfall near the creek. The routing of the treatment system effluent piping to the creek will avoid wetlands if possible. If passage through a wetland is necessary,the requirement in 33 CFR 330.5(a)(12) and 330.6 shall be met.
Wetlands executive order (EO 11990) 40 CFR, Part 6, Appendix A (Applicable)	Federal agencies are required to minimize destruction, loss or degradation of wetlands and preserve and enhance natural and beneficial value of wetlands. Activities impacting wetlands are prohibited unless there is no practical alternative. The discharge pipe will not be located in wetlands if a practical alternative exists. Impacts will be minimized.
Floodplains executive order (EO 11988) 40 CFR, Part 6, Appendix A (Applicable)	Federal agencies are required to reduce risk of flood loss, to minimize impact of floods and to restore and preserve the natural and beneficial value of floodplains. No practical alternative exists for placement of wells and discharge outfall in floodplain. Impacts will be minimized. Will have minimal displacement and will be built to withstand 100 year flood event.
COMMONWEALTH OF MASSACHUSETTS	
Wetlands Protection (310 CMR 10.00) (Applicable)	Any regulated area disturbed by the remedial action will be restored to original conditions. All practical means will be used to minimize wetlands disturbance.

Table 24

LOCATION-SPECIFIC ARARs AND TBCs FOR ALTERNATIVE 6 - EXTRACTION WELLS, METALS REMOVAL, UV/OXIDATION AND DISCHARGE TO JOHNSON CREEK

SUPPLEMENTAL MOM FS
GROVELAND WELLS SITE
GROVELAND, MASSACHUSETTS
PAGE TWO

Requirement	Actions Taken to Meet Requirements
LOCAL	
Town of Groveland, Wetlands By-laws (Section 8-19) (To Be Considered)	Applicable to construction of discharge piping near the creek. The routing of the treatment system effluent to the creek will avoid potential wetlands if possible. If passage through a wetlands is necessary, appropriate mitigation measures will be taken.

Table 24

CHEMICAL-SPECIFIC REQUIREMENTS FOR ALTERNATIVE 6 - EXTRACTION WELLS, METALS REMOVAL, UV/OXIDATION AND DISCHARGE TO JOHNSON CREEK
SUPPLEMENTAL MOM FS
GROVELAND WELLS SITE
GROVELAND, MASSACHUSETTS

Requirement	Actions Taken to Meet Requirements
FEDERAL	
SDWA - Maximum Contaminant Levels (MCLs) and non-zero maximum contaminant level goals (MCLGs) 40 CFR 141.11 - 141.16 and 141.50 - 141.52. (Relevant and appropriate)	These requirements will be attained by the selected alternative in the groundwater beneath the Site.
EPA Risk Reference Doses (RfDs) (To Be Considered)	EPA RfDs were used to characterize risks due to exposure to contaminants in groundwater, as well other media.
EPA Carcinogen Assessment Group Potency Factors (To Be Considered)	These factors were used to assess health risks from carcinogens present at the Site.
EPA Health Advisories and Acceptable Intake Health Assessment Documents (To Be Considered)	To be used, if adequate data exist, in assessing health risks from ingesting groundwater at the Site.
EPA Groundwater Protection Strategy (To Be Considered)	This strategy is considered in conjunction with the Federal SDWA and Massachusetts Water Quality Standards.
COMMONWEALTH OF MASSACHUSETTS	
Groundwater Quality Standards 314 CMR 6.00 (Applicable)	Groundwater quality standards exist for a number of contaminants in the groundwater. When state levels are more stringent than the federal levels, the state levels will be used. This remedial action will meet these standards in the groundwater beneath the Site.
Massachusetts Drinking Water Maximum Contaminant Levels - 310 CMR 22.00 (Relevant and Appropriate)	These state drinking water standards will be compared to the federal standards. If more stringent, the state standards will be used. This remedial action will meet these standards in the groundwater beneath the Site.

APPENDIX B

DECLARATION OF CONCURRENCE

COMMONWEALTH OF MASSACHUSETTS

Commonwealth of Massachusetts
Executive Office of Environmental Affairs
Department of Environmental Protection

Daniel S. Greenbaum
Commissioner

September 27, 1991

Ms. Julie Belaga
Regional Administrator
U.S. EPA Region I
JFK Federal Building
Boston, MA 02103

RE: Groveland Wells Federal
Superfund Site - OU2
Management of Migration
ROD Concurrence

Dear Ms. Belaga:

The Department of Environmental Protection (the Department) has reviewed the preferred remedial action alternative recommended by EPA for the Management of Migration, Operable Unit 2, at the Groveland Wells Federal Superfund Site. The Department concurs with EPA's selected alternative.

The Department has evaluated EPA's preferred alternative for consistency with M.G.L Chapter 21E and the Massachusetts Contingency Plan 310 CMR 40.00 (MCP) and has determined that the alternative of UV/Oxidation with metals removal is consistent with the overall permanency requirements of the MCP. However, a permanent solution determination cannot be made until it has been demonstrated that the remedial measure or combination of measures will meet the Total Site Risk Limits as defined in 310 CMR 40.00 for the entire site.

The Department encourages EPA to use alternative treatment technologies that eliminate media transfer of contaminants as a remedy, and supports EPA's decision to conduct treatability studies for UV/Oxidation as an alternative groundwater treatment technology to air stripping at this site.

The Department generally identifies the MCP as an applicable requirement for sites in Massachusetts while reserving the right to argue that Chapter 21E constitutes an independent enforcement authority that is not subject to the waiver provisions of CERCLA section 121 (d) (4). The Department identifies the MCP and Chapter 21E as applicable requirements, within the meaning of CERCLA, for operable unit 2, of the Groveland Wells Nos. 1 and 2, Superfund Site.

The Proposed Remedy appears to meet all Massachusetts state ARARs. This will continue to be evaluated as remedial design progresses and during implementation and operation.

The Department looks forward to working with you in implementing the preferred alternative. If you have any questions or require additional information, please contact Charles Tuttle at 292-5903.

Very truly yours,

Daniel S. Greenbaum, Commissioner
Massachusetts Department of
Environmental Protection

Cc: Richard Chalpin, NERO

RESPONSIVENESS SUMMARY
MANAGEMENT OF MIGRATION OPERABLE UNIT

GROVELAND WELLS NOS. 1 AND 2 SUPERFUND SITE

GROVELAND, MASSACHUSETTS

September 1991

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PREFACE

The U. S. Environmental Protection Agency ("EPA") held a 61-day public comment period, from July 10, 1991 to September 9, 1991, to provide an opportunity for interested parties to comment on the Supplemental Management of Migration Feasibility Study ("Supplemental MOM FS") and the Proposed Plan prepared for the Groveland Wells Nos. 1 and 2 Superfund Site in Groveland, Massachusetts (the "Groveland Site" or the "Site"). The Supplemental MOM FS examined and evaluated various options, called remedial alternatives, for addressing groundwater contamination. EPA identified its preliminary recommendation of a preferred alternative for the Site cleanup in the Proposed Plan, issued in early July 1991, and then requested comments during a public comment period. On July 31, 1991, EPA held an informal public hearing at which two commenters spoke. A total of eight commenters responded during the public comment period, one of which responded both in writing and through testimony at the public hearing.

The purpose of this Responsiveness Summary is to document EPA responses to the comments and questions raised during the public comment period. EPA has considered all of the comments summarized in this document before selecting a final remedial alternative for the groundwater contamination at the Groveland Site.

The Responsiveness Summary is divided into the following sections:

Section I. Overview. This section discusses the Site history, outlines the objectives of the Supplemental Management of Migration Remedial Investigation and Feasibility Study ("Supplement MOM RI/FS"), identifies the remedial alternatives evaluated in the Supplemental MOM FS, and identifies and summarizes general reaction to EPA's Preferred Alternative.

Section II. Background on Community Involvement and Concerns. This section contains a summary of the history of community interest and concerns regarding the Groveland Site.

Section III. Summary of Major Comments Received During the Pubic Comment Period and EPA's Response to those Comments. Written and oral comments from the public, interested parties and potentially responsible parties ("PRPs") on the extent of contamination, the Supplemental MOM FS, and Proposed Plan, along with EPA's responses, are presented according to topic.

Section IV. Comments Received Prior to the Comment Period. This section presents community concerns raised prior to the public comment period and EPA responses to those expressed concerns.

ATTACHMENT A - This attachment provides a list of the community relations activities that EPA has conducted for the Groveland Site.

ATTACHMENT B - This attachment is the transcript of the July 31, 1991, informal public hearing held in Groveland, Massachusetts.

I. OVERVIEW

The Groveland Site is a nearly 850 acre parcel, located mostly in southwestern Groveland, Massachusetts, that contains two municipal water supply wells, Station Nos. 1 and 2. In 1979, these wells were closed when high levels of trichloroethene ("TCE"), a volatile organic compound ("VOC"), were discovered. The Town of Groveland established a new supply well, Station No. 3, outside the Site aquifer, and reopened Station No. 1 in 1987 after a granular activated carbon treatment system was installed. Station No. 2 remains closed. The Site was placed on the National Priorities List ("NPL") in 1982, making it eligible for federal action under Superfund.

EPA's Supplemental Management of Migration Remedial Investigation ("Supplemental MOM RI"), a study that investigates the nature and extent of Site contamination, determined that a large, elongated contaminant plume extends from the Valley Manufactured Products Company ("Valley") property to just south of the Merrimack River. This finding, together with the Risk Assessment, which assesses potential risks to human health and the environment associated with Site contamination, resulted in the development of remedial objectives for the Site cleanup approach. These objectives, generally stated, are to prevent people from drinking groundwater in the contaminated plume area until carcinogenic and noncarcinogenic contaminant levels meet Federal and State drinking water standards, as well as other applicable or relevant and appropriate requirements ("ARARs") and cleanup levels, and to restore the groundwater quality to meet Federal and State drinking water standards or goals, as well as other ARARs and cleanup levels.

From these objectives, EPA developed and evaluated cleanup alternatives in the Supplemental MOM FS. This report describes the alternatives considered for addressing the groundwater contamination and the criteria EPA used to identify six remedial alternatives. These alternatives are described briefly below.

A. Remedial Alternatives

Alternative 1: No Action

This alternative was evaluated to serve as a baseline for comparison with the other remedial alternatives under consideration. The only cost is the provision for monitoring every 5 years.

Alternative 2: Institutional Controls

This alternative involves the use of institutional controls, such as deed restrictions prohibiting installation of private wells in the plume. The cost includes quarterly sampling of monitoring wells.

Alternative 3: Extraction Wells, Partial Inorganics Removal, and Discharge to the Haverhill Sewage Treatment System

This alternative includes the components of Alternative 2 (institutional controls), and also includes: the construction of a network of approximately six groundwater extraction wells to intercept the entire width and depth of the plume; a treatment system composed of equalization/aeration, sedimentation, and sludge dewatering and disposal for removing inorganics from the extracted groundwater; and discharge of the treated groundwater to the Haverhill publicly owned sewage treatment system. During remedial design, the existing Mill Pond extraction system would be considered for use to supplement or replace one of the six new extraction wells proposed for this area. An additional component of this alternative is semi-annual surface water and sediment sampling of Johnson Creek and other nearby streams.

Alternative 4: Extraction Wells, Inorganics Removal, Air Stripping, and Discharge to Johnson Creek

This alternative includes the components of Alternative 2 plus portions of Alternative 3 (installation of a groundwater extraction network and equalization/aeration and sedimentation to remove inorganics). A new component of the metal removal scheme is filtration, which provides additional removal of suspended solids, which would be necessary to achieve the metals discharge standards and to allow for the efficient operation of the treatment equipment. TCE and other volatile organics would then be removed from the filtered groundwater by a 25 foot air stripping tower. Emissions from the tower would be captured by a granular activated carbon unit. Spent carbon would be transported off-site for regeneration and destruction of the organics. The treated groundwater would finally be discharged into Johnson Creek near Station No. 2. This alternative also includes the semi-annual surface water and sediment sampling.

Alternative 5: Extraction Wells, Inorganics Removal, Carbon Adsorption, and Discharge to Johnson Creek

This alternative includes the components of Alternative 2 plus portions of Alternative 4 (installation of a groundwater extraction network and equalization/aeration, sedimentation and filtration to remove inorganics). The filtered groundwater would then be transferred to granular carbon adsorption units to remove TCE and other organic volatiles. Spent carbon would be transported off-site for regeneration and destruction of the organics. The treated groundwater would be discharged to Johnson Creek. This alternative also includes the semi-annual surface water and sediment sampling.

Alternative 6: Extraction Wells, Metals Removal, UV/Oxidation and Discharge to Johnson Creek

This alternative includes the components of Alternative 2 (institutional controls). A groundwater extraction network of approximately six wells, located throughout the plume, would be cited to intercept contaminated groundwater along its entire width and depth, including contamination in the shallow bedrock. The total estimated flow rate needed to intercept the plume is about 400 gallons per minute ("gpm"). The contaminated groundwater would be subject to an inorganics treatment process involving equalization/aeration, sedimentation and filtration. The resulting sludge would be disposed of off-site. The filtered water would then be subjected to a process involving ultraviolet ("UV") light and oxidation to destroy TCE and other volatile organics. The treated groundwater would be discharged to Johnson Creek near Station No. 2. The estimated discharge flow rate of about 400 gpm is within the normal flow rate that the existing stream channel can accommodate. The discharge structure would include measures to minimize potential erosion of the river bed and be designed to ensure that it will not cause physical disruption of wetlands (if any) near the discharge point. This alternative includes the semi-annual surface water and sediment sampling.

During remedial design, the existing Mill Pond extraction system would be considered for use to supplement or replace one of the six new extraction wells proposed for this area.

The July 1991 Proposed Plan presented EPA's preferred alternative, Alternative 6, discussed above.

B. General Reaction to the Preferred Alternative

There was a mixed reaction to the Preferred Alternative. Two commenters (Carlson and Goodwin) specifically supported Alternative 6. Of those commenters that offered an opinion on the Preferred Alternative, however, most suggested (including Carlson) that a more sensible and cost-effective solution would scale back the scope to focus on locating extraction wells only in the most contaminated portion of the plume. The Groveland Well Pollution Committee contends that an air stripping technology should be selected while Citizen Argyros and Valley Manufactured Products Company contend that institutional controls alone should be applied.

II. BACKGROUND ON COMMUNITY INVOLVEMENT AND CONCERNS

Community interest in the Groveland Wells Nos. 1 and 2 Superfund Site arose as soon as TCE was discovered in 1979. The loss of these sources of potable water resulted in the imposition by the

Town of Groveland of an area-wide water ban until Station No. 1 was restored in 1987. Throughout this period, interest by local officials and Groveland residents in efforts to remediate the Site has been high. It has continued to be high during the subsequent Remedial Investigation, Feasibility Study and the development of the remedial alternatives.

During September, 1983, EPA released a community relations plan that outlined a program to address community concerns and keep citizens informed about, and involved in, response activities. This original plan has been updated as necessary. On July 24, 1989, EPA held an informational meeting in the Town of Groveland to describe the plans for the Remedial Investigation and Feasibility Study. On April 3, 1991, EPA held an informational meeting in the Town of Groveland to discuss the results of the Supplemental MOM RI.

On July 10, 1991, EPA made the administrative record available for public review at EPA's offices in Boston and the Langley-Adams Library in Groveland, Massachusetts. EPA published a notice and brief analysis of the Proposed Plan in the <u>Haverhill Gazette</u> on July 1, 1991 and made the plan available to the public at the Langley-Adams Library.

On July 9, 1991, EPA held an informational meeting to discuss the results of the Supplemental MOM Remedial Investigation and clean-up alternatives presented in the Feasibility Study and to present the Agency's Proposed Plan. Also during this meeting, the Agency answered questions from the public. From July 10 to August 8, 1991, the Agency held a 30-day public comment period to accept public comments on the alternatives presented in the Supplemental MOM FS, the Proposed Plan, and on any other documents previously released to the public. During the comment period, EPA received two requests to extend the public comment period an additional 30 days. EPA extended the public comment period to September 9, 1991. On July 31, 1991, the Agency held a public hearing to accept any oral comments on the Proposed Plan. A transcript of this meeting and the comments and the Agency's response to comments are included in this responsiveness summary.

III. COMMENTS RECEIVED DURING THE PUBLIC COMMENT PERIOD AND EPA RESPONSES

Comments raised during the Groveland Wells Nos. 1 and 2 Superfund Site public comment period (from July 10 through September 9, 1991) are summarized and addressed below. Section III identifies and responds to comments offered either in writing during the public comment period or orally at the public hearing on July 31, 1991.

A. Inorganics (metals)

COMMENT: One commenter stated that there is no engineering basis to believe that the Preferred Alternative or any other treatment scheme will reduce inorganic contamination in the aquifer to drinking water standards.

EPA RESPONSE: During the design stage of the remedy, a comprehensive background groundwater sampling program will be conducted. If study results indicate that certain Site inorganic chemicals are present at background concentrations, then those inorganics will no longer be identified as Site-related contaminants and standards for those inorganics would not need to be met. If study results indicate that certain inorganic concentrations are not representative of background, then the remedy will be designed to attain inorganic interim cleanup levels for those chemicals.

COMMENT: One commenter questions the need for metals treatment and the costs associated with this treatment. The commenter also identifies the potential requirements for treatment of sludge.

EPA RESPONSE: The treatment for metals may be required for the groundwater prior to discharge, at least initially. It is possible, after a period of time, that the metals concentration will decrease to below potential Clean Water Act requirements. The estimated quantities of sludge generated are expected to be approximate maximum quantities rather than "no less than" quantities, because they are, in part, based on current turbidity in monitoring wells. Also, if remediation is completed much sooner than estimated in the Supplemental MOM FS as indicated by some commenters, this quantity would be significantly reduced.

The sludge will be evaluated during RD/RD to determine whether it is a hazardous waste. If it is determined to be hazardous, it will be disposed of in accordance with applicable requirements

COMMENT: Several commenters believe that "arsenic is naturally associated with the Site at background levels" and that the presence of arsenic in the groundwater "should not drive the remedy." Adequate sedimentation and filtration, together with the addition of a sulfide mixture greater than that discussed in Appendix E to precipitate the arsenic, will achieve the FS-identified arsenic tolerance level of 50 ug/l.

EPA RESPONSE: EPA partially agrees with this comment. Some level of arsenic and other metals appear to be natural for the area. However, background levels for those contaminants need to be determined. This determination can proceed concurrent with the design of the selected alternative, so as to not delay the remediation any longer. This is discussed in more detail in a previous comment.

The system proposed by the commenter mirrors that proposed by the Supplemental MOM FS. During the design, the suggestions provided by the commenter will certainly be considered. Exact requirements for sulfide (if any, because of co-precipitation) will be determined during a treatability study.

COMMENT: Several commenters suggest that a method of inorganics reduction not studied in the Supplemental MOM FS could result in considerable cost savings which could then be applied to supporting the purchase of a technology like thermal oxidation. This method of constructing the extraction well reduces the suspended solids in the groundwater thereby allowing iron and manganese to oxidize in the air stripper column. Such an approach could eliminate the need for a precipitation and sedimentation treatment phase.

EPA RESPONSE: The design of extraction wells would consider techniques to minimize the production of suspended solids. Inorganics of concern are those that migrate through the aquifer in a soluble or colloidal form.

COMMENT: One commenter conducted an economic analysis of the feasibility of removing inorganics in the groundwater to the level specified in the Supplemental MOM FS. It concluded that treating the naturally occurring inorganic contaminants of concern in this Class III area is not economically feasible.

EPA RESPONSE: The treatment for metals, whether natural or man-made, is economically feasible. Also, it is likely that the costs associated with treatment of metals will decrease significantly in a period of six months to two years. This is based on the consideration that much of the metal contaminants identified during the Supplemental MOM RI are likely to be insoluble. The metals in the extraction wells would rapidly washout, whereas those inorganics away from the extraction wells would remain in place. It should be noted that this is not a Class III aquifer area.

COMMENT: One commenter states that EPA guidelines for groundwater characterization classify this area as Class III, unfit for drinking water use, unless the inorganics can be reasonably removed by public water supply systems (reasonable treatment). The commenter's position is that the inorganics cannot be removed by reasonable treatment.

EPA RESPONSE: The statement that EPA's classification for the aquifer should be Class III at the Site is incorrect. EPA believes that in the absence of manmade contamination, the groundwater could be used as a drinking water source, without treatment. Even if treatment were necessary, the types of contaminants in the aquifer are types that could be reasonably treated.

COMMENT: One commenter contends that there is no basis to conclude that the secondary maximum contamination levels identified in the

FS for manganese and zinc constitute "relevant and appropriate" cleanup standards for the situation.

EPA RESPONSE: EPA has determined that the use of secondary maximum contamination limits ("SMCLs") is unnecessary to remediate contamination at the Site to health based levels. No reference is made in this Management of Migration ROD to SMCLs as a basis for setting cleanup levels, and manganese and zinc, to which cleanup levels based upon SMCLs were assigned in the FS, are no longer identified as contaminants of concern.

COMMENT: One commenter states that the objective of cleaning up the contaminated groundwater (aquifer restoration) extending from the Valley property is beyond EPA's authority, probably is impossible because the inorganic contamination detected is naturally occurring and its sources are unknown, and is too costly.

EPA RESPONSE: EPA has not determined whether unacceptably high concentrations of inorganics detected in some monitoring wells are naturally occurring. During the design stage of the remedy, a comprehensive background groundwater sampling program will be conducted. If study results indicate that certain Site inorganic chemicals are present at background concentrations, then those inorganics will no longer be identified as Site-related contaminants and standards for those inorganics would not need to be met. If study results indicate that certain inorganic concentrations are not representative of background, then the remedy will be designed to attain inorganic interim cleanup levels for those chemicals.

If remediation of inorganics is necessary, the cost associated with operating the inorganic treatment system will be dependent on the severity of inorganic contamination encountered. If minimal inorganic contamination is encountered, or the contaminant concentration decreases significantly during operation, then the costs would decrease correspondingly.

The aquifer has been and continues to be used as a major source of municipal water by the Town of Groveland and should be viewed as a valuable resource. This aquifer is classified as Class II (a potential source of drinking water) by EPA and a Class I aquifer (potable water source) by the Commonwealth of Massachusetts. Restoration of this aquifer is consistent with these classifications. See 55 Fed. Reg. 8732. Remediating Site-related inorganic contamination falls squarely within EPA's statutory authority under the Comprehensive Environmental Response, Compensation and Liability Act of 1980 ("CERCLA").

B. Extent and Sources of Contamination

COMMENT: One commenter cites the fact that all previous investigations that found TCE in surface water samples from Johnson

Creek below Mill Pond were taken prior to the installation of the Mill Pond interceptor discharge. The commenter cites this as evidence that groundwater discharges to Johnson Creek in this area.

EPA RESPONSE: EPA does not dispute the first sentence of the comment. EPA does not agree that this is "evidence" that "all" contaminated groundwater discharges to the stream in this area. Field data indicate the TCE plume is present downstream of this area and water level data indicate a northerly groundwater flow. The investigations cited found TCE in surface water from Mill Pond to the Station No. 2 area. Surface water samples collected north of Lawrence Road in 1982 and in 1983 had levels of TCE as high as 55 micrograms per liter ("ug/L") and levels in samples north of Mill Pond and south of Lawrence Road as high as 82 ug/L. The first MOM RI detected TCE levels as high as 30 ug/L in Johnson Creek north of Lawrence Road and as high as 48 ug/L south of Lawrence Road.

Surface water samples collected during the Supplemental MOM RI from Johnson Creek north of Lawrence Road yield only low level (< 5 ug/L) detection of TCE while samples collected from Johnson Creek north of Mill Pond were also at low level (< 5 ug/L) except for the sample collected immediately downstream of the Mill Pond extraction/treatment system discharge. The level of TCE in this February 8, 1990 sample was 54 ug/L. It is noted that TCE levels from samples of the Mill Pond system effluent collected for discharge monitoring purposes were reported at 200 ug/L for January 24, 1990 and 38 ug/L for February 15, 1990.

COMMENT: One commenter contends that the contaminated groundwater will not have a significant impact on Johnson Creek and the Merrimack River in the future. The commenter further states that the contaminated plume is discharged to Johnson Creek where its concentration is dissipated by volatilization and other mechanisms. Also, the commenter assumes the concentrations in the Creek will decrease with time.

EPA RESPONSE: EPA assumes that "other mechanisms" include dilution. The Supplemental MOM FS addresses concerns with possible future contamination of Johnson Creek and the Merrimack River based on low flow conditions where periodically, not on the average, higher concentrations of contaminated groundwater may be found in the streams. Under seasonal low flow conditions and lower ambient temperatures, the benefits from dilution and volatilization would be significantly reduced.

COMMENT: One commenter states that there has not been sufficient time for contamination to reach Station No. 2 from Station No. 1.

EPA RESPONSE: This comment disregards the path of overall contaminant migration. Data from all investigations performed at the Site to date show that the main body of the contaminant plume migrates northward, parallel to Johnson Creek. Pre-1979 pumping of the Station No. 1 well may have redirected an outlying portion of the plume towards that well, but the main body of the plume likely continued to migrate towards Station No. 2. Pumping of the Station No. 2 well would accelerate the migration of this main portion of the plume towards this well, thus contaminant travel times from Station No. 1 to Station No. 2 are beside the point. The contamination of Station No. 2 likely came from the main body of the plume and not from the portion that may have been pulled northeastward by Station No. 1.

COMMENT: One commenter states that sediment sampling data for Station SD-13, showing a detection of methylene chloride ("M/C") of 53 ug/kg, is indicative of possible sources of contamination other than Valley, Chesterton, or the Haverhill Landfill.

EPA RESPONSE: The emphasis in EPA's studies of the Site was to identify the nature and extent of contamination the affected aquifer. EPA believes they have identified all major sources of contamination to the aquifer within the Site boundaries. EPA does not believe that the data cited by the commenter demonstrates that a major source of contamination has been overlooked. Sediment sample locations downstream of SD-13 (SD-12 on Argilla Brook and SD-1 on Johnson Creek) did not yield any detections of methylene chloride. The only surface water sample with a detection of M/C was collected at SW-6 located at the north (outlet) end of Mill Pond. It is noted that (M/C) was a contaminant detected in soils at the Valley property. Sporadic detection of M/C and other organics at low levels is to be expected in a suburban stream basin. However, the data do not indicate that a new round of investigations for new "sources" is warranted.

COMMENT: One commenter questions the potential for vinyl chloride to be present in the groundwater near Station No. 1. The commenter further states that it has never been detected at the Site.

EPA RESPONSE: The Supplemental MOM FS presented the potential formation of vinyl chloride as a concern because of its highly toxic nature and the implications to human health if it is present or does form in the future. Also, it should be noted that the contract-required detection limit for vinyl chloride is 10 ug/l and the maximum contaminant level ("MCL") for vinyl chloride is 2 ug/l. Therefore, vinyl chloride may be present at concentrations above the MCL and yet not be detected. Also, data obtained during the first MOM RI (1984) indicate vinyl chloride was detected at the Site and the concentrations ranged from 4.5 to 5.0 ug/l.

COMMENT: One commenter states the Supplemental MOM RI does not contribute any additional information regarding the aquifer behavior or the source of contamination.

EPA RESPONSE: Geologic, hydrologic, and water quality data were needed by EPA to support its Record of Decision and proceed with groundwater remediation. The pumping test performed during the Supplemental MOM RI provided a great deal of information regarding aquifer behavior and its relation to contaminant migration. It provides an evaluation of the aquifer stresses from pumping Station No. 1 and some understanding of the hydrologic impacts of physical changes that occurred in the study area since the 1980 test. Based on data gathered during the first MOM RI and the Supplemental MOM RI, EPA maintains its support of the position that the Valley plume remains the most likely source of contamination of Station No. 1.

COMMENT: One commenter suggests that contamination of Stations 1 and 2 was the result of a spill from a machine shop located adjacent to the Eastern boundary of the Site along School Street.

EPA RESPONSE: The machine shop referenced by the commenter was investigated as a potential source area by EPA, but no evidence of groundwater contamination was uncovered. That investigation was not an intensive sampling effort, but initial results showed that further sampling was not warranted. If elevated levels of TCE had been detected in the downgradient wells at the machine shop, then EPA would have investigated further. It should also be noted that the NUS-3/3A well cluster, located between the machine shop and Station No. 1, is not and historically has not been contaminated.

COMMENT: One commenter asked if contamination was currently reaching Station No. 1, and, if not, why the granular activated carbon ("GAC") treatment system still is in operation?

EPA RESPONSE: The Valley plume does not reach Station No. 1 at the present time. Contamination is not presently being detected at the Station No. 1 pumping well, and groundwater within the immediate area surrounding and upgradient of that pumping well has non-detectable to trace concentrations of contamination. Continued use of the granular activated carbon (GAC) system at Station No. 1 is prudent because it ensures a safe drinking water supply from this well.

COMMENT: One commenter stated that the original source of contamination of Station No. 1 has not been found. The commenter further stated that available evidence gathered to date proves that it is inconceivable for contamination in the Mill Pond area to have reached Station No. 1, even in a drought period. Finally, the commenter stated that the available data strongly suggest that Argilla Brook is the source of the contamination found at Station No. 1.

EPA RESPONSE: The emphasis in EPA's studies of the Site were to identify the nature and extent of contamination throughout the affected aquifer. EPA believes it has identified all major sources of contamination to the aquifer within the Site boundaries. The contaminant plume that extends from the Valley property (hereinafter referred to as the "Valley plume") does not reach Station No. 1 at the present time. Contamination is not presently being detected at the Station No. 1 pumping well, and groundwater within the immediate area surrounding and upgradient of that pumping well has non-detectable to trace concentrations of contamination.

EPA strongly disagrees with the statement that it is inconceivable for contamination in the Mill Pond area to have reached Station No. 1. EPA believes that it is probable that the daily pumping of Station No. 1 may have resulted in the interception of the Valley plume in the past. Given the lack of evidence that other areas within the Site are sources, and the Agency's determination that the pumping of Station No. 1 extends a cone of influence toward the Valley plume and Mill Pond, the Valley plume is the most likely source of past contamination at Station No. 1.

For contaminants to be captured by the Station No. 1 well, they do not have to travel all the way to the well during the drought (low recharge) period; they only need to migrate to within the well's normal capture zone limit. Once within this capture zone, contaminants will travel to the well within the well's groundwater migration pattern, even under conditions of normal precipitation and groundwater recharge. As a result, movement of the plume some fraction of the total distance to the pumping well may be all that is needed for contamination to eventually reach the well. EPA believes that contaminants from the Valley plume could have migrated to Station No. 1 in this manner in the past.

Modeling of drought conditions (low recharge) was performed as part of the no action evaluation, to estimate conditions during which Station No. 1 well may be impacted. Once established, the limiting condition was evaluated for its potential to occur. This is an appropriate method of evaluating a no action alternative. Contrary to the commenter's assertions, the limiting flow line to Station No. 1 in the referenced figures does intersect the Valley plume, albeit under apparently extreme (and infrequent) conditions, as the Supplemental MOM FS points out.

EPA does not believe that Argilla Brook is the source of the contamination found at Station No. 1. It is highly unlikely that contaminants would persist at levels exceeding 100 ug/l to the well intake considering the dilution of surface water recharge to the pumping well, the volatilization of contaminants within the stream prior to reaching Argilla Brook, and dilution/dispersion during subsurface migration from the source area to the stream. Contaminant levels exceeding 100 ug/l are extremely unlikely in a swiftly moving stream that flows over a shallow, gravelly stream bed, unless the contaminant source was in the immediate vicinity of the sampling point. That is not the case here.

<u>COMMENT</u>: One commenter states that the Supplemental MOM RI assumes

that the Valley plume extends continuously from the Valley property to the Merrimack River.

EPA RESPONSE: As discussed in the Supplemental MOM RI report, direct evidence of contaminant migration from the Valley property to Station No. 2 and beyond is provided by the comparison of TCE concentrations in wells downgradient of the Valley property. However, no assertion is made that the plume extends to the Merrimack River as there are no wells located close to it. The closest well to the Merrimack River sampled during the Supplemental MOM RI was ERT-21. This well is about 800 feet from the River; TCE levels recorded in the first MOM RI and the Supplemental MOM RI were 10 ug/L and 20 ug/L, respectively.

The furthest extent of the plume can only be assumed to be between ERT-21 and the River. Regardless of whether the plume does, in fact, currently reach the River, all areas within the Site not meeting ARARs or cleanup levels must be addressed by the remedial action and additional wells may be required to determine the extent of the groundwater that must be extracted.

COMMENT: One commenter contends that if the TCE in Station No. 2 is from the GZ-5 area, a high ratio of DCE to TCE should also be found there. It is not.

EPA RESPONSE: As discussed above, the differing mobility of DCE versus TCE could explain the relatively higher ratio of DCE/TCE in the GZ-5 area. Also, much of the data at this location is near the detection limit, significantly affecting the reliability of these ratios.

COMMENT: One commenter states that the fingerprint of the contamination, as determined by the DCE to TCE ratio at the Valley property and Station No. 2, demonstrates that the contamination at Station No. 2 is not derived from the Valley property.

EPA RESPONSE: "Fingerprinting" is often used to identify fuels and other materials in which the relative ratio of compounds do not change significantly with time. However, the use of the DCE/TCE ratio as a "fingerprint" to demonstrate that the plume near Station No. 2 is "different" than that at the Valley property is misleading. Various factors can account for this "difference", including the use of skewed data and differences in DCE and TCE mobility.

Review of the data used to compare the DCE/TCE ratio indicate that some data being used to draw these conclusions may not be representative of the area referenced. Relatively high concentrations in well No. 4 in the Valley area skew the data. Other wells in this area, such as NUS-5, have DCE/TCE ratios closer to 0.1 or less.

Higher DCE/TCE ratios near the Mill Pond extraction system may be explained by differing transport properties. DCE is about twice as mobile in the environment as TCE, as measured by the Organic Carbon Partition Coefficient. The higher mobility of DCE indicates that DCE would move through the aquifer more rapidly than TCE. DCE generated in the upgradient areas with much higher TCE concentrations would be expected to migrate to the extraction wells faster than would the TCE in this area. This would result in a higher DCE/TCE ratio at the extraction point.

COMMENT: One commenter states that the contaminant plume extending from its property is not spreading.

EPA RESPONSE: Contaminants are continuing to migrate (or spread) with the groundwater from the Valley property toward Station No. 2 and the Merrimack River. EPA has not yet determined whether the leading edge of the plume is currently advancing or stationary.

COMMENT: One commenter states that the source of contamination of Station No. 2 has not been found, that the Valley plume is not continuous, and that an alternative source of contamination in the gravel pit area east of the Valley plume is responsible for the contamination at Station No. 2. The commenter further state that the Valley plume discharges totally to Johnson Creek and Main Street.

EPA RESPONSE: EPA believes that the Valley plume is the primary source for the groundwater contamination in the Station No. 2 area. The Valley plume is continuous and traceable all the way from the Valley property to Station No. 2. In addition, similar contaminant types are detected throughout the area extending from the Valley property to Station No. 2, and overall contaminant concentrations decrease downgradient of the Valley property as expected.

The commenter further contends that the increase in TCE concentrations at Station No. 2 violates the second law of thermodynamics - the plume cannot become more concentrated. This would demonstrate that the plume is not continuous.

However, minor variations in contaminant concentration trends in the region between the Valley property and the Station No. 2 area are not uncommon within contaminant plumes and do not indicate the existence of a plume in the Station No. 2 area that is distinct from the Valley plume. Such minor variations can be readily explained through a variety of factors, including: normal sample analysis variations; heterogeneities in the subsurface that produce zones of preferential migration of groundwater/contaminants within the aquifer; induced infiltration of contaminated surface water due to the pumping of the Station No. 2 well; and/or separate "pulses" of contamination released from the source creating two areas of elevated contaminant concentrations.

EPA has found no evidence of a contaminant plume originating in the gravel pit area east of the Valley plume. This is based upon review of EPA sampling data. Groundwater flow patterns in the Johnson Creek area are similar for the stream segments from Mill Pond to Main Street and from Main Street to Station No. 2.

The commenter's contention that the Valley plume discharges totally to Johnson Creek near Main Street is not supported by the data since plume migration parallel to the stream as aquifer underflow has been documented. Data obtained during the Supplemental MOM RI/FS further indicate that contaminants have migrated parallel to the stream a significant distance downgradient of the Valley property. In addition, highest concentrations of contaminants found within the Valley plume are generally at the base of the overburden aquifer.

Surface water levels in Mill Pond and portions of Johnson Creek near the pond were observed to be above adjacent groundwater levels, indicating that surface waters recharge groundwater in some of the areas located above the plume. This surface water infiltration probably acts locally to inhibit contaminant migration towards the stream. Overall contaminant migration is controlled primarily by the general northerly groundwater flow direction within the valley. Local groundwater discharge to surface water bodies has not eliminated the continued movement of the contaminant plume at depth.

C. Mill Pond Extraction/Treatment System

COMMENT: One commenter states the downward vertical gradient exceeds the horizontal gradient by an order of magnitude in the Mill Pond area, suggesting a high degree of horizontal to vertical anisotropy in this area, a feature no analysis in the Supplemental MOM RI was capable of simulating.

EPA RESPONSE: The large downward gradient in the Mill Pond area is an expression of the infiltration of pond waters into groundwater in this area (which is described in the Supplemental MOM RI report and substantiated by field data), and of the localized effects of the pumping of partially penetrating wells, a category in which the current extraction wells belong. This partial penetration effect can be expected to dissipate rapidly away from the pumping wells, as occurred in the Station No. 1 pumping test, with the flow field reverting to a laminar form. The capture zone extent is unlikely to be affected by anisotropy/partial penetration effects unless the capture zone is so small as to be limited to the immediate vicinity of the extraction wells.

COMMENT: One commenter states that contaminant concentrations downstream of the Mill Pond interceptor system are more likely a result of movement of further portions of the plume back toward the interceptor system or possibly represent stagnation of contamination as a result of pumping at extraction wells G-1 and G-2.

EPA RESPONSE: The commenter's statement that contaminants located downgradient of the extraction system are likely a reflection of contaminants being drawn back to the Mill Pond extraction system does not agree with evidence that suggests the contamination is not being captured, but rather is continuing to migrate further downgradient away from the extraction system. Groundwater level contour maps developed from actual field data clearly show a flow gradient away from the extraction system almost immediately downgradient of the extraction system, indicating that flow reversals are not occurring at any substantial distance downgradient of the extraction wells. A downgradient capture zone limit calculation performed using field-measured data regarding flow gradients, aquifer thickness, a pumping rate of 40 gpm (ignoring stream recharge which is likely occurring), and the hydraulic conductivity of 22 feet per day as claimed in the comment, results in a downgradient capture zone limit of less than 60 feet. This is much less than the downgradient extent of the most concentrated portion of the plume, let alone the portions of the plume containing lower contaminant levels and located further downgradient. It should be noted that the assumptions made regarding pumping rate and hydraulic conductivity are conservative in that they will tend to overestimate the capture zone extent.

COMMENT: One commenter states that the Mill Pond System should not be abandoned and that the Supplemental MOM RI analysis did not consider the design data.

EPA RESPONSE: The Supplemental MOM FS clearly states that the remedial design provides for incorporating elements of the Mill Pond system based on further review. It should be noted that Discharge Monitoring Reports ("DMR") for the Mill Pond extraction and treatment system indicate that the system has at least on two occasions, exceeded its TCE effluent limitation due to "an accumulation of mineral solids which have precipitated in the groundwater treatment air stripper tower (see DMR transmittal letter dated April 26, 1989, from John L. Falcon to U.S. EPA). This iron sludge buildup has caused the shut down of the unit for clean out and maintenance on two occasions, in November 1988 and in April 1989. In addition, the problem has resulted in the reduction of loading (flow) to the unit. At startup in 1988, the extracted groundwater flow to the unit was approximately 75 gpm; currently flow to the unit is approximately 40 gpm.

Clearly, this system is not capable of operating at 75 gpm or even on a continuous basis at a lower flow without some form of pre-treatment to prevent solids buildup. The analysis of the design data would be of interest but is not a reflection of the actual operation of the system in 1990 when the Supplemental MOM RI was carried out.

COMMENT: One commenter feels that the Supplemental MOM FS indirectly attacked the lack of a vapor treatment system on the Mill Pond System.

EPA RESPONSE: The Supplemental MOM FS did not indicate that the vapor emissions from the Mill Pond System presented "unacceptable risks." Calculations presented in the Supplemental MOM FS Appendix indicate the full scale system would not present unacceptable risks due to untreated emissions, and therefore the much smaller system at Mill Pond would be expected to cause even less risks. The need for air pollution controls under Alternative 4 is based on an ARAR for new sources of vapor emissions.

COMMENT: One commenter disagrees with the statements in the Supplemental MOM FS that the "concentration of target compounds in the discharge to Johnson Creek from the air stripper effluent exceeds the preliminary discharge standards." The commenter also contends that average dilution factors from Johnson Creek should be considered when determining allowable discharge concentrations.

EPA RESPONSE: EPA disagrees with these comments. Acceptable concentrations of metals for surface water differ from (and are less than) those for groundwater. That some of these metals may be of natural origin is not relevant. The comments focus on arsenic. In addition to arsenic, there are nine other metals which may exceed preliminary discharge standards if not treated. The final standards for a pump and treat system discharge will be developed taking into account all ARARs associated with this portion of the remedy.

COMMENT: One commenter states that the Supplemental MOM FS fails to justify the proposed removal and replacement of the Mill Pond Interceptor

EPA RESPONSE: EPA agrees that the Mill Pond system has been effective in reducing the migration of contaminated groundwater near Mill Pond and has removed significant quantities of contaminants. However, this system was established as an interim measure and was not designed to effect a complete remediation of the contaminant volume. Specific components of this system will be retained if feasible for inclusion in a Site-wide remediation system. However, a system designed for 40 to 75 gpm may not be easily upgraded to handle a flow rate of about 365 gpm. Groundwater to be treated may also contain other analytes above potential receiving waters criteria. The existing system is not designed to ameliorate these concerns. It also employs an air stripper without vapor phase controls and, thus simply transfers contaminants from the groundwater to the air.

COMMENT: One commenter contends that the quantity of TCE in the aquifer, as calculated by NUS, is significantly overstated. To support this contention, the commenter compares the quantity of TCE removed by the existing Mill Pond extraction system with the estimated quantity of TCE remaining, the use of maximum versus average concentrations of contaminants at each location, the use of bedrock groundwater data, and the basis for estimating the partitioning coefficient.

EPA RESPONSE: The 6700 pound quantity of TCE is an estimate. The actual quantity of TCE present beneath the Valley property and within the Valley plume cannot be accurately estimated because the dense non-aqueous phase liquid ("DNAPL") mass (if it exists) is unknown. The direct comparison of NUS' estimated quantity of contaminants versus that removed by the system is not necessarily valid. The use of maximum concentrations at each point is valid. The use of average concentrations would incorrectly indicate that several areas are not contaminated. A remediation objective is to achieve compliance with the remediation goals at all areas, not just on the average. Also, the use of groundwater data in the bedrock is relevant since it is connected with the overburden. Additionally, as presented in Appendix A of the Supplemental MOM FS, the average concentration for a given zone is used. The average used is the geometric average for each area. The geometric average is less than the arithmetic average.

The partition coefficient used is appropriate for this aquifer. References in Appendix L of the commenter's statements do not provide sufficient basis to eliminate the values used. EPA agrees that the presence of iron would bias the total organic carbon ("TOC") results on the high side. However, the partition coefficients used are not unreasonably high. Also, if the partition coefficients are lower, remediation would be completed earlier than the estimated 30 years. This would result in similarly lower costs than those estimated.

COMMENT: One commenter questions the Supplemental MOM RI critique of the Mill Pond extraction system by claiming that the system is effective in remediating the contaminant plume and that no additional efforts are needed to adequately remediate the aquifer.

EPA RESPONSE: The two issues addressed by the commenter are the existing system's recovery of contaminants from the aquifer and the capture zone extent of the system. EPA agrees that the existing system is removing some contamination from the aquifer. However, EPA believes the existing system cannot meet the remediation goals of complete aquifer cleanup within an acceptable time frame and cannot control plume migration. Wells pumping at various rates will remove contamination from the aquifer, but lower-than-needed pumping rates or incorrect well placements will compromise the system's performance and effectiveness, despite the removal of contaminants.

The Supplemental MOM RI analysis of the capture zone of the Mill Pond extraction system was approximate in nature due to a lack of conclusive data. As a result, the results must be considered as rough approximations of the Mill Pond extraction system capture zone. The commenter cites a pumping test performed as part of the original design studies for the Mill Pond system as a source of the data used to support its analysis. A review of these data reveals that the pumping test analysis used evaluation methods that were inappropriate. The method used has a minimum time requirement that must be met before the analysis can be applied. The method requires a much longer testing time than the 270 minute pumping test that was performed. As such, the transmissivity and hydraulic conductivity values used in both the original design and reviewers analyses are based on improper analyses.

Additionally, the gradient calculated by the commenter as representative of the natural flow gradient is in error. The data points used by the commenter were within the projected zone of influence of the extraction system. As a result, water levels measured were not representative of background, unstressed water levels. The background flow gradient is required for the type of analysis performed, not the gradient used by the commenter. It is also not clear that the two wells used are directly downgradient of one another, and the use of only two wells to determine flow gradients is not a generally acceptable approach to gradient determinations. These factors resulted in a much lower calculated gradient than is appropriate for the analysis performed by the commenter and overestimated the extraction system's capture zone by a considerable amount.

Additional work, including additional well installations and aquifer testing, would be required to accurately determine the capture zone of the Mill Pond extraction system. However, several points can be made regarding the extraction system performance based on the data available. The overall groundwater flow pattern identified for the area of the plume clearly shows that downgradient portions of the plume, both south and north of Main Street, are outside of the capture zone of the Mill Pond extraction system. If additional extraction wells are not installed in this area, the contamination will persist in the groundwater indefinitely until natural flushing/degradation eventually cleans this portion of the aquifer. Given the current use of this water as a drinking water source, EPA finds this unacceptable. It is also apparent from the observed mounding of groundwater at Mill Pond and the locally observed discharge of surface water to groundwater, that a portion of the water pumped by the current extraction system is derived directly from Mill Pond and Johnson Creek. The effectiveness of contaminant removal is reduced by surface water infiltration, and the system's capture zone is also reduced.

<u>COMMENT</u>: One commenter questions the placement of the Mill Pond System under the No Action and Institutional Control Alternatives.

EPA RESPONSE: These are no longer part of the alternatives.

COMMENT: One commenter states that EPA should select the existing Mill Pond Extraction and Treatment system as its remedial technology.

EPA RESPONSE: The existing Mill Pond extraction system does not capture all of the contaminated groundwater in the Valley plume, will not achieve the remedial objectives set forth in the Supplemental MOM FS, and is not sufficiently protective of human health and the environment. As such, it will not cleanup the Site within a reasonable time frame considering the beneficial uses of groundwater at the Site.

COMMENT: One commenter states that the discharge of contaminated groundwater to Mill Pond and Johnson Creek was miscalculated in the Supplemental MOM RI.

EPA RESPONSE: The commenter overestimates the discharge of contaminated groundwater to Mill Pond and Johnson Creek. Data obtained during the Supplemental MOM RI/FS indicate contaminants have migrated parallel to the stream a significant distance downgradient from the Valley source area. Surface water levels in Mill Pond and portions of Johnson Creek near the pond were observed to be above adjacent groundwater levels, indicating that surface waters recharge groundwater over some of the area located above the plume. This surface water infiltration probably acts locally to inhibit contaminant migration towards the stream. Overall contaminant migration is controlled primarily by the general northerly groundwater flow direction within the valley. Local groundwater discharge to surface water bodies has not eliminated the continued movement of the contaminant plume at depth.

COMMENT: One commenter states that the contaminant transport model does not include the Mill Pond interceptor system and no check with hydrogeology was presented for the model.

EPA RESPONSE: The Mill Pond interceptor was not included because the model was used to develop an extraction well array that would capture the entire TCE plume. The model was calibrated to the observed contaminant distribution in the plume. During remedial design, locations of extraction wells, including those in the Mill Pond area, and pumping rates, will be determined.

D. Groundwater Modeling/Pump Test

COMMENT: One commenter states that the two-dimensional computer flow model used in the Supplemental MOM FS has not conclusively demonstrated that contamination from the Valley property could have reached Station No. 1 under pre-1979 pumping conditions.

EPA RESPONSE: This particular modeling exercise does not show

Valley to be the source under the conditions simulated. However, it cannot be concluded that the model shows that Valley is not the source of contamination of Station No. 1 before 1979, because the model may not represent past conditions. Past conditions cannot be replicated or verified because of changes in the physical setting. Although EPA believes it has demonstrated that contaminants in the plume did reach Station No. 1 in the past, it is not necessary for EPA to demonstrate that contaminants from a particular source were present at Station No. 1 for EPA to take response action.

COMMENT: One commenter contends that the zone of influence is not a proper measure of a well's capture zone.

EPA RESPONSE: The commenter is correct that the zone of influence is not a proper measure of a well's capture zone. The discussion of the zones of influence was intended to illustrate the extent of impacts on the aquifer due to pumping. Since Station No. 1 is not being pumped at 600 gpm as was the case in the past, and surface mining activities have altered recharge conditions upgradient of Station No. 1 (possibly increasing the recharge rate and decreasing the width of the capture zone), past conditions cannot be duplicated in the field.

COMMENT: One commenter states that the terms "capture zone" and "zone of influence" were confused in the Supplemental MOM RI/FS.

EPA RESPONSE: EPA recognizes that the terms refer to different concepts, and that they may not be used interchangeably. The Supplemental MOM RI/FS did not confuse "zone of influence" with "capture zone." The zone of influence, and not the capture zone, was emphasized in the Supplemental MOM FS because it is readily definable by the data, whereas the capture zone is more open to interpretation. The zone of influence (drawdown) can be projected with reasonable certainty for different lengths of pumping time, rates, and distance from the pumping well, whereas capture zone cannot be projected with equal certainty.

COMMENT: One commenter suggested that future water demand in the Town of Groveland could be accommodated by increasing the Station No. 1 pumping rate to 600 gallons per minute (gpm) during the cleanup process. On-site crews could sample groundwater to assure that the plume's path is not diverted to the well.

EPA RESPONSE: Based on simulations performed under conditions at Station No. 1 of non-pumping, pumping at 400 gpm, and pumping at 600 gpm, the preferred extraction system should prevent further migration of the plume toward Station No. 1.

Comment: One commenter contends that the pumping test conducted in the Supplemental MOM RI, which showed the influence of pumping to extend to Station No. 2 and to the Valley plume, was run at too high a rate to simulate the 1969-1979 conditions.

EPA RESPONSE: The commenter dismisses the importance of the fact that drawdowns from Station No. 1 can intersect the Valley plume in the glacial aquifer for two reasons: 1) the pumping test rate (400 gpm) exceeded the average rate for the 1969-1979 period; and, 2) the Supplemental MOM RI confused the zone of influence with the capture zone.

However, the pumping test rate of about 400 gpm closely approximates the average rate for the period between 1969 and 1979, which was estimated to be about 380 gpm. The 20 gpm difference is physically and analytically insignificant at the scale of this Site. Also, the actual pumping rate for Station No. 1 during the summers no doubt exceed the average annual rate (pre-1979) for extended periods of time.

The commenter also ignores the fact that drawdowns due to pumping in the bedrock, parallel to the reported strike of the bedrock, and in direct line with the Mill Pond area where the Valley plume occurs at some of the highest concentrations in bedrock. One of the wells effected by the pump test lies between Mill Pond and Station No. 1 and is presently contaminated.

COMMENT: One commenter states the surface water infiltration contribution to Station No. 1 is not accounted for in the pumping test analysis.

EPA RESPONSE: The Supplemental MOM RI acknowledged that some stream infiltration occurs in the vicinity of Station No. 1. However, the increase in surface water discharge in the downstream direction may be small due to the short distance between measuring points, and whether or not there was a thaw. The commenter's estimate of 200 gpm from surface water infiltration is probably high. A more reasonable estimate would be 10-20% of the total flow or 40-80 gpm. However, factoring in gains from surface water infiltration will not decrease the capture zone of the well, as the pumping rate used in the pumping test analysis would have to be adjusted downward an amount corresponding to the surface water infiltration rate. This will ultimately reduce the test-derived value for hydraulic conductivity and result in an increase of the required capture zone beyond what would be calculated using the higher value of hydraulic conductivity, obtained without factoring in stream recharge. In essence, the increase in recharge from the stream would offset the resulting decrease in the aquifer's pumping test-calculated hydraulic conductivity as they relate to the well's capture zone. A final consideration is that the observed drawdown pattern within the aquifer includes the effects of stream infiltration, whatever rate it may have been for the test.

COMMENT: One commenter has concluded that the area of aquifer contamination that EPA used to establish cleanup limits is separated from Station No. 1 by a permanent groundwater flow divide.

EPA RESPONSE: There appears to be no evidence of a fixed and permanent groundwater flow divide between Station No. 1 and Johnson Creek. Under non-pumping conditions, groundwater flows generally northward, some discharging locally to Johnson Creek and Argilla Brook; the remainder discharges to the Merrimack River. Depending on the climatic conditions and the magnitude of groundwater pumping, the effect of that pumping can be expected to extend further away from the extraction well(s), capturing water that would have moved to the Creek, Brook or River. Therefore, the likelihood of contaminants reaching Station No. 1 depends on how much water is pumped and how dry the season or year. Currently it appears unlikely that contaminants from the Valley plume will migrate to Station No. 1. The contaminated portion of the aquifer has, however, been used as a potable water supply source (Station No. 2) and could potentially be used again.

COMMENT: One commenter states that the model simulates the Mill Pond interceptor system as one well pumping at 40 gpm. Representing the two wells individually at 20 gpm would have resulted in a larger calculated capture zone.

EPA RESPONSE: Given the size of the model and the intended purpose, the approach to use one well was technically valid. The capture zone is dictated by the pumping rate rather than the number of wells. The location and pumping rate of extraction well(s) will be determined in remedial design.

COMMENT: One commenter states that the pumping rate proposed for the proposed extraction system is 365 gpm.

EPA RESPONSE: The results of the modeling were used to simulate capture zones to assure that the extraction system would capture the entire plume. To provide for uncertainties in this analysis, the treatment system capacity was increased to 400 gpm.
The pumping rate for the extraction system will be determined during remedial design.

COMMENT: One commenter states the contaminant transport model does not permit discharge to Johnson Creek.

EPA RESPONSE: Contaminant discharge to Johnson Creek cannot be simulated by the analytical transport model used in the Supplemental MOM FS, however, this is by no means a fatal flaw in the model. The simulated concentrations match well with the average observed concentrations as shown in the commenter's Figure 2. In fact, both the model result and actual field data show similar trends. Without hard data to back up the commenter's average observed concentrations data, it is not even clear that the apparent minor difference is valid.

COMMENT: One commenter states there has not been enough time to travel from Valley to Station No. 2 using velocities cited in the

Supplemental MOM RI and retardation factors impled by the model.

EPA RESPONSE: Using the reasonable retardation factor of 2.0 proposed by the commenter, the initial estimate of travel time in the model is reduced to less than eight years. Whether a travel time of 25, 18, or 8 years is used, it is clear that the scenario of contaminant migration from Valley to Station No. 2 is very viable and likely under the range of scenarios mentioned by the commenter and in the Supplemental MOM FS. The travel times calculated that result in migration of the contaminant plume in Station No. 2 are well within the range of error in any modeling effort of this type.

COMMENT: One commenter reconstructed the contaminant modeling in the Supplemental MOM FS to incorporate their own modifications.

EPA RESPONSE: EPA has reviewed the contaminant transport model reconstructed by the commenter and in general does not agree with the modifications because the model appears to provide results that no longer replicate the observed trends, as shown in the commenter's own Figure 8.

COMMENT: One commenter states that there is a much more rapid reduction in contaminant concentrations than predicted by the contaminant transport model.

EPA RESPONSE: The data presented in the comment do indicate that in several areas TCE concentration, are decreasing more rapidly than predicted by the model. However, these data also indicate that in several areas the contaminant concentrations are remaining the same or are increasing. The model was not intended to predict the concentration at discreet locations. The model estimates the time required to clean up all locations in a given area and, as a result, it is generally on the conservative side. During the remediation, it is likely that groundwater at some locations will reach the remediation goals sooner than other areas. Based on the data presented in Table 2 of the commenter's statements, the length of time required to clean up specific locations can be estimated. These estimates are based on the consideration that the percent reduction in concentration as a function of time is typically a constant. Note that this approach is not always accurate because of factors such as non-ideal flow conditions, upgradient sources, and non-equilibrium conditions. However, this approach often provides insights into cleanup times and several examples are provided below.

For well 71-21, there is a 90% reduction in 6 years. Six years later, another 90% reduction would be expected to occur. At that time, the estimated concentration at this location would be about 6 ug/l, or very close to the remediation goal. For Well 71-24, about an 80% reduction would occur every 6 years, indicating that about 8 to 10 years would be required for the groundwater concentration to equal the remediation goal. Using the average reduction of 82% every six years, and the most contaminated well location (TW-25), about 32 years would be required to achieve the remediation goals at this location. For well ERT-5, if a 32% reduction occurs every 6 years the data indicate that this location would remain contaminated for an additional 42 years. As can be seen, various points can be expected to be cleaned up at various rates. The conclusion that "80%" of the contamination has been removed and "20%" remains is very misleading.

<u>COMMENT</u>: One commenter comments that the contaminant transport model cannot be used to evaluate the effectiveness of different pumping scenarios.

<u>EPA RESPONSE:</u> The contaminant transport model estimates the number of aquifer pore volumes that must be removed to achieve cleanup goals. The estimate can be used along with information regarding pumping rates, well location, and contaminated volume of the aquifer to estimate cleanup times of effectiveness of different pumping scenarios.

<u>COMMENT</u>: One commenter questions the hydraulic conductivity values used in the modeling effort, stating that those used in the Johnson Creek area were too high.

<u>EPA RESPONSE</u>: The values were based on an initial input of pumping test-derived values of hydraulic conductivities, and is an appropriate use of these field data. These values were adjusted during the modeling process to create a satisfactory match between the modeled groundwater levels (lead) and corresponding field data results, as is standard modeling procedure. The use of limited slug test data by the commenters to the exclusion of long-term pumping test data is contrary to generally accepted practices. Pumping test data reflects hydraulic conditions within a volume of aquifer orders-of-magnitude greater than the extremely localized slug tests effects and are thus more appropriate for establishing general aquifer characteristics. In addition, slug test results are much more susceptible to the smearing effects of drilling activities (skin effects) on the well boring walls which generally causes an underestimation (lower-than-actual) of hydraulic conductivity. Pumping test data are relatively insensitive to localized effects. The trend discussed by the commenter appears to be more a function of variances between testing methods.

Boring log descriptions support this alternate view, as the overall makeup of the aquifer materials was relatively consistent throughout the Station No. 1/Johnson Creek areas. If the hydraulic conductivity trends were accurately portrayed by the commenter, this would be one factor facilitating the movement of contaminated groundwater from areas of lower hydraulic conductivity (Johnson Creek) to areas of higher hydraulic conductivity (Station No. 1 vicinity) and increased dispersion.

COMMENT: One commenter states that "for some inexplicable reason" modeling was included in the Supplemental MOM FS.

EPA RESPONSE: Modeling was used in the Supplemental MOM FS as a tool to evaluate potential future scenarios regarding the continued use of the Station No. 1 well as it relates to the existing groundwater contaminant plume.

This was done to determine the potential long-term effects of the Valley plume on Station No. 1 and is consistent with good engineering practices. The model was also used to develop a conceptual design for a groundwater extraction system for the Valley plume. Again, this is a valid reason for modeling and the model used was designed explicitly for this purpose.

COMMENT: One commenter requests that EPA develop a three-dimensional, anisotropic model that more accurately reflects conditions at the Groveland Wells Nos. 1 and 2 Site.

EPA RESPONSE: A three-dimensional model will provide a more exact simulation of groundwater flow conditions than a two-dimensional model, if the additional field data needed to adequately characterize the modeled area are obtained. The need for additional modeling to assist in remedial design and track progress during the remedial action will be evaluated. However, it is uncertain that the additional modeling could be used to establish an incontrovertible tie between the Valley plume and Station No. 1.

COMMENT: One commenter states the groundwater model developed during the first remedial investigation at the Site could have been used to test hypotheses regarding suspected contamination events.

EPA RESPONSE: The intent of the Supplemental MOM RI was to define the current extent of contamination and to determine the impacts of pumping on the groundwater conditions in the study area. Therefore use of the groundwater model developed during the first MOM RI to test hypotheses regarding suspected contamination events was not warranted.

Since Station No. 1 is no longer contaminated, and has not been since the well was returned to service, the Valley plume is no longer within the well's capture zone, or the hydrologic conditions in the study area have changed such that the Station No. 1 well is no longer affected by ongoing (and/or persisting residuals from) releases from a known source. If another unidentified source of the contamination to Station No. 1 existed, it was not found in previous studies and apparently is no longer present.

COMMENT: One commenter expressed various concerns about the groundwater modeling performed as part of the Supplemental MOM FS as follows:

- Criteria identified for acceptance of a calibration are inconsistent with established criteria as presented in "Stochastic Subsurface Hydrology - From Theory to Applications" by Lynn W. Gelhar, published in Water Research Vol. 22 No. 9 (August 1986).

- The calibration of the Supplemental MOM RI two-dimensional model is significantly poorer than that achieved by the model used in the first remedial investigation completed at the Site.

- The two-dimension model does not accurately reflect aquifer behavior.

EPA RESPONSE: Among the three "established criteria" identified by the commenter, two of them (the average difference and systematic bias) were not mentioned, developed, or defined in the cited publication. The only acceptance criteria, head variance, described in the cited publication, addressed the influence of unmodeled heterogeneity on the quality of predictions from such models in which only averaged parameters were used to describe the simulated aquifers. According to the author, "this head variance can be viewed as a measure of the error in the model as the result of unmodeled aquifer heterogeneity," and "this head standard deviation is an appropriate calibration target provided that other sources of error are also considered."

The calculation of a specific head variance value involves estimating the aquifer material-based parameters, site-specific dimensional consideration based-parameters, and site-specific mean hydraulic gradient. Gelhar did not attempt or suggest generalizing the calculated head variance for a specific case study as a criteria that should be applied anywhere other than the studied Site. Also, in the field application discussed in the publication, the head variance was used as a "target" and not an upper limit of the sample variance. The final sample standard deviation (0.16 m) judged to be acceptable in the example was higher than the estimated head standard deviation (0.14 m). It is clearly pointed out that this criteria should be used an order of magnitude type of criteria.

As mentioned earlier, Gelhar also pointed out that, in addition to the aquifer heterogeneity, there will be other sources of modeling error and acceptable values of all these possible errors which will need to be independently estimated. The final model criteria should be the summation of all these errors. These possible errors may include measurement errors, discretization errors associated with the numerical scheme, and, in most simplified long-term steady flow approaches, the unavoidable seasonal water level fluctuations in the measurement.

The commenter's specific values of 0.1 ft and 0.6 ft for "average difference" and "standard deviation" apparently were taken from Table 2 in the cited publication. The values (from a number of studies) summarized in this table were actually standard deviations and correlation scales for log hydraulic conductivity or log transmissivity, not head variance as the commenter states, that can be utilized as references for two of the parameters required in the calculation for the head variance.

In this Table, for silty clay loam soil (alluvial) and outwash sand, values of 0.6 and 0.1, respectively, are labeled in meters, rather than feet as the commenter states. By quoting these two values using wrong units the commenter gave them totally "new" meanings. Clearly, they cannot replace the criteria identified in the Supplemental MOM FS.

With respect to the commenter's concern about the systematic bias in the simulated flow direction, it is interesting to note that in Fig. 10 of the field application example in the cited publication, in many locations the differences between the observed and simulated flow directions are more than 30 degrees.

The ERT three-dimensional model used in the first remedial investigation achieved a 1.525 foot standard deviation between 25 field measurements and simulated results in a smaller model area as shown in Figure M5-1 of the remedial investigation report. The NUS two-dimensional model used in the Supplemental MOM FS, with the simplified aquifer structure covering a larger area, achieved 2.06 and 1.88 overall standard deviations using 72 and 49 field measurements, respectively. As described in the Supplemental MOM FS, these two standard deviations are well within the seasonal fluctuations of the local water table. Considering the greater number of comparison points, the larger area covered by the model and model simplification, the NUS model is calibrated and validated as well as, if not better than, the ERT model, and is a representative model of overall aquifer behavior within the area of concern.

COMMENT: One commenter states the Supplemental MOM FS modeling shows that contaminant discharge to Johnson Creek is occurring and implies that contaminant migration does not reach Station No. 2.

EPA RESPONSE: The flow model classified reaches of Johnson Creek between Mill Pond and Station No. 2 as either a gaining or a losing stream, as shown in Figure B-1a. The model shows Mill Pond between Staff Gauge No. 5 and a smaller pond by Station No. 2 are recharging groundwater while the rest of the reach of Johnson Creek between Staff Gauge No. 5 and the downstream pond is gaining groundwater. The surface water elevation of Staff Gauge No. 5 (19 mean sea level [msl]) was used directly in the model at the location of the gauge. A msl of 23 was used for the reach of Creek between Mill Pond and Staff Gauge No. 5 and is an interpolated value between Mill Pond's elevation of 27 msl and Staff Gauge No. 5's measurement.

The statement in the Supplemental MOM RI regarding flow direction between Johnson Creek and the aquifer was based on field measurements around the Mill Pond area and Staff Gauge No. 5 where the surface water elevation is clearly higher than the groundwater table. At the time this statement was made, the result of the flow model was not yet available.

Although the groundwater discharges into Johnson Creek between Staff Gauge No. 5 and the downgradient Pond, the particle tracking simulations have shown that contaminants from the Valley property can still reach Station No. 2 especially when Station No. 1 was pumping, as shown in Figures B-16, B-7, and B-19. The zone of groundwater discharge is not very wide and is some distance away from the Valley property. After the contaminants have migrated to the east of the Creek in the Mill Pond area, most of the contaminant plume can reach Station No. 2 before it can discharge into Johnson Creek. This pattern would be clearer if the lateral dispersion was simulated. The particle tracking simulation used can only simulate the longitudinal migration of contaminants.

COMMENT: One commenter states that no pervious (permeable) zones were found in bedrock.

EPA RESPONSE: Numerous fractures were found in bedrock cores, and slug tests in bedrock wells indicated a moderate permeability. These wells yielded water consistently during development, purging, and sampling operations. Additionally, significant drawdowns were noted in bedrock wells during the overburden pumping test, in most cases nearly as much as adjacent overburden wells.

COMMENT: One commenter states that the area of excavation to the south of Station No. 1 existed in 1965 and has undergone very little lateral expansion since 1971. Therefore, the change in the groundwater pattern occurring as specified in the Supplemental MOM RI did not occur.

EPA RESPONSE: The aerial photographs of the Site do not include a view of the area in 1979 when the contamination in Station No. 1 was detected or in 1990 when the Supplemental MOM RI was conducted. This is the appropriate time period over which the comparison of soil and vegetative cover loss should be made. In addition, in the photographs supplied with the comment, is it not possible to determine if vertical expansion has occurred. What has been observed in the field, however, is that substantial areas surrounding well casings have been excavated subsequent to wells having been drilled (and after Station No. 1 was contaminated), which indicates that excavation has occurred since that time.

COMMENT: One commenter states that the Supplemental MOM FS states the covering of the sand and gravel excavation areas south of Station No. 1 would have little impact on the Station No. 1 capture area.

EPA RESPONSE: EPA does not agree with this interpretation of the statements made in the Supplemental MOM FS.

E. A. W. Chesterton

COMMENT: One commenter states that the results of the computer flow model used in the Supplemental MOM FS show that the A.W. Chesterton property is a potential source of the original contamination of Station No. 1, while demonstrating that the Valley property is not.

EPA RESPONSE: The flow model shows that the A.W. Chesterton property is a potential source area for the contamination of Station No. 1. It is unlikely that this is the case as evidence of a significant source at Chesterton does not exist. Although the flow model results indicate that the Valley property is not a potential source area for the contamination of Station No. 1 under present conditions, it cannot be concluded that Valley was not the historical source of contamination at Station No. 1. Again, the purpose of EPA's investigations was to identify contaminant releases within the aquifer beneath the Site in order to fashion a protective remedy. EPA's investigations were sufficient for that purpose.

COMMENT: One commenter contends that EPA failed to name earlier owners/operators of the A.W. Chesterton facility as PRPs.

EPA RESPONSE: This comment concerns enforcement actions against PRPs that may be undertaken in connection with remediation activities at the Site, and does not relate to the Proposed Plan or the remedy selection process.

COMMENT: One commenter, representing A.W. Chesterton Company, expressed dismay that EPA had characterized the company as a "likely" source, and as "one of several" sources, of the contamination of Station Nos. 1 and 2 Superfund Site. The commenter further states that, since the contaminants on the Chesterton property are different from those found at Station Nos. 1 and 2, the Supplemental MOM RI indicates that the contamination on the Chesterton property is confined to its own boundaries, and EPA is addressing remediation at the Chesterton property under a separate law, these characterizations are creating unwarranted, adverse publicity for an innocent company.

EPA RESPONSE: The Chesterton property is one of three potential sources of groundwater contamination within the Site boundary identified in both remedial investigations completed at the Site. Groundwater sampling at Chesterton first was undertaken in a remedial investigation completed earlier in 1985. As part of the Supplemental MOM RI, additional groundwater sampling was undertaken at the Chesterton property to update the characterization of contamination. Groundwater sampling data indicate that Chesterton is not a likely source of groundwater contamination for the Valley plume. However, groundwater contamination exists within the Chesterton property boundaries. Included among the contaminants in that groundwater are low levels of TCE as well as other contaminants. Although EPA is addressing this problem under separate legal authority, this property is still considered part of the Site and will be further evaluated to ensure that all CERCLA requirements are met at this property.

COMMENT: Several commenters state that instead of proceeding with the proposed contaminant plume-wide pump and treat operation, EPA should focus its efforts on the most highly contaminated portion of the Valley plume, with the result that fewer extraction wells would be needed, the flow of contaminated water needing treatment would be decreased, and the cost of remediating the groundwater would be reduced.

EPA RESPONSE: EPA believes that the extraction system included in the selected remedy focuses on the highly contaminated portions of the Valley plume. EPA's preferred extraction well locations, which may be revised during remedial design, will essentially capture the Valley plume where TCE levels exceed 5 ug/L. Estimated extraction well locations and pumping rates are based on capturing the Valley plume based on model simulations as discussed in Appendix B of the Supplemental MOM FS report.

Two extraction wells with pumping rates of 100 gpm and 125 gpm are situated between Mill Pond and Main Street to intercept the concentrated portion of the plume as close as possible to the source area. One well with a pumping rate of 100 gpm is positioned near Station No. 2. The other three wells extract less contaminated groundwater at lower rates (10 to 20 gpm) in the downgradient portion of the plume.

COMMENT: Several commenters feel that by concentrating the extraction system in the area between Mill Pond and Main Street, the flow rate could be reduced to probably less than 200 gpm. The commenters suggests that this targeting could reduce the size of the treatment plant to one-tenth. The commenters believe that this approach would result in a significant capital and operations and maintenance cost savings.

EPA RESPONSE: EPA agrees that limiting the extraction system to those areas would likely decrease capital and operating costs, although treating 200 gpm (or less) would not be expected to reduce costs by a factor of 10 from the preliminary extraction rate of 365 gpm. However, a significant portion of the contaminated plume would not be addressed under this scenario and, thus, the remedy would not be protective of human health and the environment, nor would it meet ARARs, necessary components for selection of remedies under CERCLA.

F. Selected Remedy

COMMENT: One commenter states that the cost estimate for the UV/Oxidation system in the Supplemental MOM FS is too low as it was based on information provided by a single vendor.

EPA RESPONSE: FS Guidance for cost evaluations recommends that estimates be in a -30% to +50% range to avoid significant underestimates of remedial costs. A conservative posture was adopted in the Supplemental MOM FS for costing purposes. The vendor providing the cost information has supplied the process to approximately 30 commercial facilities over the last five years. The vendor's cost information is considered to be within the appropriate range.

COMMENT: One commenter states that EPA has failed to perform a treatability study which it concedes will be necessary to determine whether the UV/Oxidation process will be effective. EPA guidance makes it clear that EPA cannot select a process where it lacks treatability studies to demonstrate effectiveness. In addition, circumstance under which testing can be postponed until remedial design do not exist here.

EPA RESPONSE: The Superfund Remedial Design and Remedial Action Guidance Manual (OSWER) Directive No. 9355.0-4A) indicates in Section 2.3.2 that remedial actions involving on-site treatment or disposal of contaminated wastes may require additional studies to supplement the technical data available from the RI/FS so that the optimum treatment or disposal methods may be determined. Additional studies could include bench- and pilot-scale studies. Since treatability studies were not conducted during the Supplemental MOM RI/FS, these additional studies on UV/Oxidation will be conducted as part of the remedial design/remedial action.

The Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA (OSWER Directive No. 9355.3-01) indicates in Chapter 5 that the decision to conduct treatability must be made by weighing the cost and time required to complete the investigation against the potential value of the information in resolving uncertainties associated with selection of a remedial action. In some situations, treatability investigations may be postponed until the remedial design phase. The decision process for treatability investigations includes 1) determining data needs, and 2) reviewing existing data on the Site and available literature on technologies to determine if existing data are sufficient to evaluate alternatives. The Guidance further states that pilot-scale studies should be limited to situations in which bench-scale testing or field sampling of physical or chemical parameters provide insufficient information from which to evaluate an alternative. Because of the time required to design, fabricate, and install pilot-scale equipment and to perform tests from a reasonable number of operating conditions, conducting a pilot study can add significant time and cost to the RI/FS.

For the Groveland Wells Site, EPA believes that the existing information, in particular the technology evaluation report SITE Program Demonstration of Ultrox International Ultraviolet Radiation/Oxidation Technology (EPA/540/5-89/012, January 1990) provides adequate test data on the effectiveness of the UV/Oxidation process from treatability studies performed on contaminated groundwater. EPA believes that for this Site, an evaluation of test data from treatability studies on UV/Oxidation performed on groundwater similar to groundwater found at the Site and existing Site characterization data provides sufficient information from which to evaluate alternatives without the need to perform a pilot study during the Supplemental MOM RI/FS. Therefore, conducting a pilot study on UV/Oxidation during the Supplemental MOM RI/FS would have added an unreasonable time delay. A pilot study will be performed as part of the remedial design of the remedy. In general, data necessary for remedy selection is distinct from that required for remedial design. Performing treatability studies at every Superfund site during the RI/FS for a significant number of remedial alternatives would be extremely time-consuming and expensive.

<u>COMMENT</u>: One commenter raises the concern of exposure of Groveland residents to ultraviolet radiation.

<u>EPA RESPONSE</u>: There should be no exposure of UV radiation. The lamps are contained in a vessel which does not allow their release. The system is designed not to over-expose a worker at the system. Regular glass effectively blocks UV light. Additionally, the system will be inside a building further blocking any escape of the UV light. Therefore, residents, who will be not nearly as close to the system and should not be in the building, should not have any exposure to the UV radiation.

<u>COMMENT</u>: One commenter is concerned about the greater length of design time that innovative technology like UV will take. The pre-design studies for UV/Oxidation are more extensive than those which would be required by selection of air stripping, a proven technology. The skilled technicians to conduct such studies may not be readily available nor may be the one vendor of the UV oxidation process identified in the Supplemental MOM FS.

<u>EPA RESPONSE</u>: EPA believes that the benefits derived from using the UV/Oxidation system outweigh the effects of delaying the remediation. Also, as previously stated, there is more than one vendor available to conduct this work. The vendor presented in the Supplemental MOM FS was an example.

COMMENT: One commenter questions the reliability and sturdiness of UV/oxidation, particularly given the estimated 30-year operational requirement. It cites the case of a plant in Nashua, New Hampshire, where the UV reactor vessel, less than five years old, has become perforated, the electrical system has required annual overhauls and the "technical response to difficulties has been problematic."

EPA RESPONSE: The plant referenced in this comment treats phenol-contaminated groundwater at a rate of 50 gpm for discharge to a local publicly owned treatment works using a UV system with ozone as the oxidant. EPA contacted both the owner and the vendor who supplied the treatment unit to discuss this comment. According to the owner's representative, the plant has treated about 92 million gallons since start up and has met the treatment requirements with no extended shut downs. This installation was among the first of the commercial units employing this technology and has been in operation for 5 years. The owner's representative reports that pitting of the reactor vessel floor and walls has occurred to the point that the serviceable life of the unit is in question. According to the vendor, the reactor vessel design was changed about 3-1/2 years ago to specify a more resistant stainless steel. No pitting in units fabricated with the new design have been reported. Concerning the electrical system overhaul, this problem could not be verified except that some site-specific wiring problems have been experienced. The owner reports that the ozone generators are rebuilt on a 12 to 18 month schedule by the generator supplier. The comment about technical response is vague and could not be verified.

COMMENT: One commenter expressed concern about the cost of the quarterly monitoring, which he estimates at $32,000. He suggested that if EPA contracted the monitoring effort out to a private company, these costs could be reduced by one-fourth to one-half.

EPA RESPONSE: EPA's estimates of the cost of performing quarterly monitoring are based on substantial experience. The cost of the sampling program was determined by taking into consideration the number of analytes, the required sensitivity of the analysis, the regulatory requirements, and the data quality objectives.

When remedial design is completed, and implementation of the remedy is about to begin, a determination will be made concerning who will perform the monitoring.

COMMENT: One commenter questions the number, location, and pumping rate of the extraction wells.

EPA RESPONSE: The extraction well system presented in the Supplemental MOM FS was based on the capture of the entire contaminant plume. This includes groundwater north of Main Street. The exact locations and number of wells will be determined during remedial design. A preliminary extraction system was developed to allow costing of alternatives. The pumping rate used was estimated to capture all of the contaminated groundwater, not just the most contaminated. The extraction system design will be revised during remedial design to optimize the capture of contaminants.

COMMENT: One commenter states that nearly all of the new wells installed in preparing the Supplemental MOM RI were at the location of existing wells.

EPA RESPONSE: Approximately one-third of the wells installed were in areas where no wells existed, and another third were installed at key locations where previously installed wells were destroyed or unusable. The remaining wells were installed adjacent to existing wells to provide a three-dimensional profile of contaminant distribution and groundwater flow.

G. Analysis Of Alternatives

COMMENT: Several commenters cite the different sensitivities to metals between the two treatment systems. It states that an air stripping unit could tolerate a higher level of metals in the groundwater than could a UV/Oxidation unit. The UV system lamp surfaces are sensitive to metals coating and can be readily rendered ineffective due to scaling.

EPA RESPONSE: The commenters' statements are correct. However, the system designed for metals removal is intended to effectively reduce the problems associated with metals ccating the UV lamps.

COMMENT: Several commenters recommend that an air stripping system (Alternative 4 in the Supplemental MOM FS) be selected as the appropriate remedy because that system would be safer and more implementable, reliable, efficient, and cost-effective than EPA's preferred UV/Oxidation system (Alternative 6 in the Supplemental MOM FS).

EPA RESPONSE: EPA agrees that air stripping is a reliable, efficient, cost effective, and readily implementable technology. The UV/Oxidation process, has been known for at least 10 years and has been evaluated under the EPA Superfund Innovative Technology Evaluation (SITE) program. The process is still considered an innovative technology, mostly because of the small size and number of the existing full-scale treatment units.

The SITE project evaluation of the UV/Oxidation process revealed that at "preferred" operating conditions, the process achieved removal efficiencies as high as 90 percent for the total VOCs present in the groundwater. The major contaminant at that Site, TCE, had removal efficiencies greater than 99 percent. Treatability testing would be required to confirm feasibility of the UV/Oxidation process and to derive design parameters at the

Groveland Wells Site. Subject to this verification, the process reliability of this technology is expected to be good, based on experience with normal ozonation. There are several vendors who are capable of providing UV/Oxidation treatment systems.

EPA selected UV/Oxidation over air stripping because UV/Oxidation provides for on-site destruction of organic contaminants in groundwater and the use of that treatment technology for organic contaminants produces virtually no waste residuals.

COMMENT: One commenter suggests that EPA adequately did not explore alternatives between the no action and the highly technical, costly alternatives discussed in the Supplemental MOM FS and the Proposed Plan.

EPA RESPONSE: EPA's primary responsibility at the Site is to undertake remedial action that is protective of human health and the environment. In addition, under Section 121 of CERCLA, EPA's remedial action, when complete, must comply with all federal and more stringent state environmental standards, requirements, criteria or limitations, unless a waiver is invoked, be cost-effective and utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable, and prefer remedies in which treatment permanently and significantly reduces the volume, toxicity, or mobility of the hazardous substances.

The Supplemental MOM FS considers the universe of potentially applicable technologies given the nature and extent of contamination at the Site and focuses specifically on a limited number of alternatives which address groundwater contamination at the Site. (See Section 4 of the Supplemental MOM FS for a discussion of the alternatives that were screened). Those which were not technically implementable were eliminated from further consideration; the remaining technologies include alternatives that potentially are capable of achieving the statutory requirements outlined above. The Proposed Plan includes this group of alternatives, which is a subset of the feasibility studies' many considerations.

Given the scope of the statutory requirements, and the nature and extent of contamination at the Site, EPA believes that it considered an appropriate range of alternatives in the Supplemental MOM FS and the Proposed Plan. See later response re: range of alternatives.

COMMENT: One commenter recommends that EPA reinject the treated water into the downgradient portion of the Valley plume or dilute the less contaminated areas of the plume by injecting water from the Merrimack River into the plume through the Station No. 2 well, in order to accelerate the cleanup process.

EPA RESPONSE: Reinjection of treated water into the aquifer was considered in the Supplemental MOM FS. Its use was rejected because it appeared to be less cost effective than the proposed discharge to Johnson Creek. In addition, there was concern that it would exacerbate the current contamination distribution, and may conflict with proposed remediation. Injection of Merrimack River water into the aquifer was rejected also because it dilutes rather than remediates the problem.

COMMENT: One commenter states that the Supplemental MOM FS failed to conform to the National Contingency Plan (NCP) by not evaluating different cleanup times.

EPA RESPONSE: The Supplemental MOM FS did evaluate alternative pumping rates (and therefore different cleanup times). During the evaluation of technologies, the Supplemental MOM FS evaluated injection as a means of accelerating remediation through higher pumping rates. However, these technologies were not found to be technically implementable. As a result, only one pumping rate was developed, namely that required to capture the entire contaminated plume. Pumping at a lower rate would result in contaminants bypassing the extraction system. Pumping at a higher rate would result in excessive drawdown in the area.

COMMENT: One commenter states that since there presently is no contamination at Station No. 1, and no likelihood that the plume will be drawn to Station No. 1, efforts to clean-up the Valley plume to protect people from drinking contaminated groundwater are unjustified.

EPA RESPONSE: EPA disagrees with the commenter because taking no action to remediate the Valley plume would not provide overall protection of human health and the environment. For example, humans could be exposed to excessive levels of organic contaminants if new private wells were located in the aquifer.

The aquifer at the Site is a valuable resource both under EPA's Guidelines for Groundwater Classification and under the State classification for groundwater. The goal of EPA and the Commonwealth of Massachusetts is to restore usable groundwater on the Site to its beneficial uses. This aquifer is classified as Class I by the Commonwealth of Massachusetts and Class II by EPA. Restoration of this aquifer is consistent with these classifications. See 55 Fed. Reg. 8732.

COMMENT: Several commenters feel that the relative total costs between Alternatives 4 and 6 are uncertain. Capital costs are usually more expensive, while energy consumption is substantially higher for UV systems than those for air strippers. The commenters question whether the Supplemental MOM FS evaluated other air emission control systems such as thermal oxidation and if air controls were included in the cost for Alternative 6.

EPA RESPONSE: The relative accuracy of costs in an Supplemental MOM FS are typically -30%/+50%. EPA believes that the cost estimates provided are within this range of accuracy.

The use of other air pollution control devices was considered in the Supplemental MOM FS. However, for the relatively low level of contaminants expected to be in the groundwater treated, the operation of an incinerator-type (thermal oxidation) air treatment system is typically higher in both capital and operating costs. Also, as contaminant concentrations decrease with time, the operating costs for activated carbon also decrease; for thermal oxidation, they remain the same.

H. Institutional Controls

COMMENT: One commenter states that No Action and Institutional Controls will meet groundwater quality ARARs.

EPA RESPONSE: The EPA disagrees with this comment. The point of time referenced for compliance with ARARs is at the completion of the remedial activities. At this time, contaminated groundwater would remain in the aquifer and therefore groundwater quality ARARs would not be met.

COMMENT: One commenter states that the existing Institutional Controls are sufficient to prevent ingestion of contaminated groundwater.

EPA RESPONSE: Institutional Controls, on a practical basis, have a spotty record of effectiveness in preventing the use of contaminated groundwater. In addition, Section 121 of CERCLA states Congress' preference for treatment and permanent remedies as opposed to simple prevention of exposure thru legal controls. Although institutional controls are used by EPA in appropriate circumstances, they should not substitute for more active response measures that actually reduce, minimize, or eliminate contamination unless such measures are not practicable.

COMMENT: One commenter states that Institutional Controls will be needed indefinitely because of natural contamination of the groundwater.

EPA RESPONSE: At the present time, EPA does not believe that natural inorganics concentrations exceed MCLs. During remedial design, however, background levels of inorganics will be determined. If cleanup levels set forth in the Management of Migration ROD are achieved, institutional controls should not be necessary. EPA does not dispute the need for institutional controls while remediation of the Valley plume is ongoing.

COMMENT: One commenter states that the imposition of institutional controls is an effective strategy and can achieve the objective of preventing people from drinking contaminated groundwater from the aquifer.

EPA RESPONSE: Institutional controls have a spotty record of effectiveness in preventing the use of contaminated groundwater. However, effective institutional controls, although difficult to implement and enforce, may prevent people from drinking contaminated groundwater from the aquifer. However, such controls would need to be maintained for a much longer period of time than the approximately 30 years that would be required for complete implementation of the selected remedy. In addition, additional remedial actions will be required regardless of what institutional controls are employed. See earlier response re: preference in CERCLA.

The NCP, at § 300.430 (a)(iii)(D) states that "the use of institutional controls shall not substitute for active response measures (e.g., restoration of ground waters to their beneficial uses) as the sole remedy unless such active measures are determined not to be practicable, based on the balancing of tradeoffs among alternatives."

I. Risk Assessment

COMMENT: One commenter asked whether the groundwater contamination was related to the high rate of cancer in the vicinity of Harvard and Yale Streets.

EPA RESPONSE: EPA lacks sufficient data to respond to this comment. However, the commenters concerns will be referred to the Agency for Toxic Substances and Disease Registry.

COMMENT: One commenter states that the risk assessment "grossly" exaggerates the real risk due to volatile organics because an EPA guidance document entitled "Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual, Supplemental Guidance, 'Standard Default Exposure Factors,'" OSWER Directive 9285.6-03 (Interim Final March 1991) was not correctly followed.

EPA RESPONSE: The risk assessment performed for the Supplemental MOM RI, completed in February 1991, followed the guidance in effect for Region I at that time. Consistent with this guidance, it is acknowledged that the resulting risk estimates are designed to overstate the actual (real) risk estimates. This approach is adopted by EPA to account for uncertainty inherent in the risk assessment process and the fact that the actual (real) risk can never be known. While it is true that the risk estimates would be modified slightly were the OSWER Directive 9285.6-03 followed, the Directive was not issued (March 25,1991) until after the Risk Assessment had been finalized (February, 1991). EPA determined that a new risk assessment was not warranted after consideration of these two documents.

COMMENT: One commenter states that the Supplemental MOM RI risk assessment does not consider that natural attenuation, biodegradation or dilution is occurring. Use of this approach would decrease the risk by a factor of 13 to 21, over an order of magnitude. Similar results would be obtained for all aspects of the risk analysis in Section 6 of the Supplemental MOM RI. The commenter further states that the Supplemental Risk Assessment Guidance notes that the exposure duration should be 30 years for carcinogens, while in the Supplemental MOM RI, a duration of 70 years is used, and that the Guidance cites an exposure frequency of 350 days as opposed to the frequency of 365 days used in the Supplemental MOM RI. The commenter states that the combined reduction in risk, after conforming the analysis to guidance, will be by a factor of 31 to 51 times, the higher values being based on observed behavior.

EPA RESPONSE: It is not EPA's intention to ignore natural attenuation, biodegradation, or dilution in groundwater. However, given that the baseline risk assessment is to characterize both present and future potential exposure and resulting risk, and that the groundwater under the Groveland Site has been classified by the Commonwealth of Massachusetts as Class I (suitable for drinking), it is consistent to assume that someone could consume groundwater from the contaminated area. Thus natural attenuation, biodegradation, or dilution does not preclude someone from consuming groundwater from within the contaminated plume at some point in the future.

With respect to the potential concentrations of contaminants that could be expected to arise in the groundwater in the future, it is EPA's belief that given the high degree of uncertainty in any predictions (due to an unknown mass of contamination and complex chemical and physical properties of the chemicals and the environment), it is reasonable to assume for the purpose of risk evaluation, that those concentrations remain constant over time. Consequently, natural attenuation were not factored into the risk assessment, but were recognized in the discussion of uncertainty.

EPA believes the appropriate place to evaluate natural attenuation, biodegradation, or dilution at the Groveland Site is not in the risk assessment, but rather in the evaluation of remedial alternatives in the Feasibility Study. From EPA's view of the no action alternative, it was concluded that it would take approximately 50 years to reach the interim groundwater cleanup goals listed in this ROD which EPA deemed to be unacceptable.

With respect to the comment regarding exposure assumptions contained in the "Human Health Evaluation Manual, Supplemental Risk Assessment Guidance: Standard Default Exposure Factors" of March 25, 1991, and the relevance of that guidance to the Supplemental MOM RI finalized before this date (February, 1991), please refer to the comments and responses above.

COMMENT: One commenter states that regarding the baseline risk assessment, data from 1984 to 1990 indicate that natural attenuation is occurring at an even faster rate and that based on observed data, the decay rate is 0.30/year for a cleanup time of 21 years.

EPA RESPONSE: These comments imply that the potential decay of TCE over time should have been factored into the baseline risk assessment. However, it is standard procedure in most baseline risk assessments to calculate risks based on current contaminant levels assuming no significant remediation at a Site. It should be noted that the potential change in contaminant concentrations over time and the affect of such a change on the risk assessment was briefly discussed in the uncertainty section of the baseline risk assessment. More importantly, the TCE contamination in the groundwater of certain areas downgradient of the Groveland Site is grossly in excess of the current Safe Drinking Water Act ("SDWA") MCL for TCE. The TCE concentration in the groundwater will remain at concentrations in excess of the MCL or the 1×10^{-6} cancer risk level for many years, even using the optimistic decay rates suggested in the commenter's statements. The consideration of the natural decay of TCE over time does not alter the primary conclusion of the Supplemental MOM RI.

COMMENT: One commenter states that the failure of the Supplemental MOM FS to use time-averaged contaminant concentrations in intake calculations has resulted in gross overstatement of excess cancer risks associated with volatile organic contamination in the management of migration study area.

EPA RESPONSE: One commenter implies that the guidance requires the use of a time-averaged contaminant concentration in risk calculations for the baseline risk assessment. This is incorrect. In fact, page 1 of the Supplemental Guidance states that:

> Separate guidance on calculating contaminant concentrations is currently being developed in response to a number of inquiries from both inside and outside the Agency. The best method for calculating the reasonable maximum exposure (RME) concentration for different media has been subject to a variety of interpretations and is considered an important area where further guidance is needed.

Page 29 of the EPA Region I guidance document states that "Average and maximum chemical concentrations (exposure point concentrations) should be developed for each exposure pathway based on Site sampling data or on modeling results." The baseline risk assessment presents risks based on average and maximum chemical concentrations, as required by the Region I guidance document.

J. Miscellaneous

COMMENT: One commenter suggested that the cleanup activity be undertaken using EPA's removal authority because this approach would allow an immediate response to the spreading plume, as opposed to waiting for EPA to identify and negotiate with PRPs or obtain authority to use money from the Superfund Trust Fund.

EPA RESPONSE: EPA's removal authority is used when a determination is made that it is necessary to minimize or mitigate a release in the short term. In this case, EPA has determined that it is more appropriate to address the contaminated groundwater plume extending from the Valley property on a permanent, long-term basis, consistent with the definition of a remedial action.

COMMENT: One commenter states that well cluster DEQE-1 should have been sampled instead of only DEQE 1-1.

EPA RESPONSE: Sampling of this cluster requires a special sampling apparatus which was not readily available. EPA feels that there were enough other wells available for sampling in the area for the purpose of the investigation, and sampling this well was not warranted.

COMMENTS RECEIVED PRIOR TO THE COMMENT PERIOD.

Other issues concerning the Groveland Wells Nos. 1 and 2 Superfund Site that were raised prior to the public comment period are summarized as follows:

A. Status of Cleanup at Other Contamination Sources

COMMENT 1: A citizen wanted to know what is happening to make A. W. Chesterton and the Haverhill Landfill address the contamination within their property boundaries.

EPA RESPONSE: Contamination at Chesterton appears to be confined to its own property. It will be required to cleanup under another law, the Resource Conservation and Recovery Act ("RCRA"), through a corrective action permit. At the Haverhill Landfill, EPA will address this site as a separate Superfund action.

COMMENT 2: A citizen wanted to know what Valley Manufactured Products Company is doing to cleanup its site and how long will it take.

EPA RESPONSE: Valley was issued an Administrative Order in December 1990, effective February 4, 1991, to remediate the unsaturated soil using a vapor extraction system. In the saturated zone, Valley will extract groundwater, remove solvents with an air stripper, then recirculate the treated water into the ground to assist in flushing remaining contaminants. They will also install a granular activated carbon system downgradient of their property. The Order requires that most of the contamination be removed within 5 years and the groundwater must meet drinking water standards in 10 years.

Valley agreed to comply with this Order, so it is expected that on-site remediation should begin in the near future.

COMMENT 3: A resident wanted to know if the use of granular activated carbon will simply transfer pollution from one medium to another.

EPA RESPONSE: The carbon unit will adsorb the contaminants. After the carbon is fully exhausted, it typically will be disposed of off site at a special facility.

COMMENT 4: Is the Haverhill Landfill impacting the northern end of the plume?

EPA RESPONSE: Only 3 or 4 wells were sampled in the area of the Haverhill Landfill. Some metals and semi-volatiles were found but information gathered to date does not appear to indicate that the Landfill is a major TCE contaminant source.

COMMENT 5: If the Haverhill Landfill isn't cleaned up, is it likely that the area around Station No. 2 will be cleaned up?

EPA RESPONSE: Most of the contamination around Station No. 2 is different from the type of contamination found at the Landfill.

B. Concerns about the Preferred Alternative

COMMENT 1: Will the extraction wells create a new hydrogeological influence such that they will draw contaminated groundwater from the Haverhill Landfill toward the existing plume?

EPA RESPONSE: That is an interesting question. You may want to make it part of the official record through either oral or written comment during the public comment period.

COMMENT 2: How will the locations of the extraction wells be determined? Will EPA take anyone's land by eminent domain?

EPA RESPONSE: The groundwater flow model used in the Supplemental MOM FS determined preliminarily that six wells would be needed based on capture zone definitions. It also defined conceptual locations for the wells. Permission to drill these wells will be obtained from land owners through access agreements similar to the procedure used to drill wells during the Remedial Investigation.

COMMENT 3: Did EPA evaluate focusing its extraction well efforts in the plume where the contamination is highest, down near Mill Pond?

EPA RESPONSE: The groundwater flow model suggested that one of the extraction wells would be located near the Mill Pond area and that it would have the highest pumping rate of the extraction wells. Since the plume is moving, EPA also has to address its outlying sections.

COMMENT 4: About how large an area would the proposed treatment plant take up? How will EPA deal with aesthetics, noise, security, property values and ownership issues?

EPA RESPONSE: EPA anticipates that the physical plant may require about an acre. Underground piping would bring the extracted water to the plant. EPA doesn't have specifics yet but a likely location for the plant is just east of Station No. 2, land that is owned by the Town. A similar plant at a site in Maine was about the size of a barn, is surrounded by a cyclone fence and no odor or noise issues have been raised. The Commonwealth of Massachusetts has found that cleaning up groundwater has increased property values.

COMMENT 5: Will EPA build a backup treatment system in case something goes wrong?

EPA RESPONSE: No. Operation and maintenance costs are built into the cost estimates. If something serious should go wrong, however, the system would be shut down for repair.

C. Drinking Water Quality - the Public Supply

COMMENT 1: Several residents expressed concern about the safety of the Town's drinking water supply and asked what is a 'safe' level for TCE.

EPA RESPONSE: Groveland's water supply is safe. The water is tested quarterly. Station No. 3 is in another aquifer and Station No. 1, which has a backup water treatment system, is not showing any contamination. The Safe Drinking Water Act maximum contaminant level for TCE is 5 parts per billion ("ppb").

COMMENT 2: One commenter stated that instead of spending all this money, why not just dig another water supply well.

EPA RESPONSE: The commenter has stated that other potential well locations had been studied throughout the Town but none have proven suitable. There is, however, currently a safe, adequate supply of potable water.

COMMENT 3: If EPA chooses Alternative 6, is it their intention to let Station No. 2 come back in service at the end of 30 years?

EPA RESPONSE: The purpose of the remediation is not to restore Station No. 2 to service. Its goal is to cleanup the contaminated groundwater. The Town itself, however, may chose to bring Station No. 2 back into service in the future.

COMMENT 4: Shouldn't Groveland have as its highest priority protecting Station No. 1?

EPA RESPONSE: The Well Committee decided to decrease the pumping rate at Station No. 1 to assure the plume would not be drawn to it.

D. Drinking Water Quality - Private Wells

COMMENT 1: Several residents who have property located over the plume asked what EPA would do to help them.

EPA RESPONSE: Questionnaires were sent to 19 property owners whose land overlies the contaminated plume to determine present and past private well usage. If wells exist beyond those 19 properties, EPA wants to know about them. Only one respondent indicated the existence of a private well and that the water from the well was not being consumed. EPA subsequently sampled the well and determined that the TCE level was below drinking water standards.

E. Long-Term Public Health Implications

COMMENT 1: A resident expressed concern about the long-term effects of having consumed public water prior to 1979, when the two wells were closed because of contamination. He stated that children born in 1979 (including one of his own) had an unusually high incidence of learning disabilities.

EPA RESPONSE: There is no known relationship between ingestion of TCE-contaminated water and learning disabilities.

COMMENT 2: This same resident related several cases of cancer and cancer-related deaths for people living at both ends of Center Street. He implied a cause/effect relationship between drinking contaminated water over the years and their deaths.

EPA RESPONSE: Monitoring wells near Chesterton were sampled; no excessive levels were found. Based on existing field data, the plume's source is downgradient of Center Street.

F. Surface Water Contamination

COMMENT 1: One citizen wanted to know whether it was safe to wade in the brooks and Creek.

EPA RESPONSE: There should be no adverse impact expected from this activity.

COMMENT 2: A resident asked if EPA could determine how long it would take for the TCE plume to dissipate by measuring how quickly it volatilizes through contact with surface water at Johnson Creek.

EPA RESPONSE: The only surface water location found to have high volatile organic compound levels was at the Mill Pond treatment system discharge point. In addition, a large portion of the plume is well below the level of Johnson Creek. The natural dissipation rate of the plume (or the time needed for contaminant concentrations to fall below MCLs throughout the plume) is not just a function of the rate that contaminants volatilize upon entering Johnson Creek. Insufficient data exist to succeed in that type of a study.

G. Liability

COMMENT 1: Several citizens wanted to know who is going to pay for the cleanup.

EPA RESPONSE: EPA has completed its search for responsible parties. They may be sent a 'special notice' inviting them to undertake the cleanup activities and reimburse the government for past cleanup costs.

COMMENT 2: The $8.3 million cost EPA is proposing is high, particularly when the Town of Groveland has a potable water supply. Why not let the groundwater clean itself up? Who is going to pay for this remedy? The Town of Groveland and its residents cannot afford to foot the bill. Has EPA looked at a more economical and practical alternative that features a low-maintenance option with institutional controls?

EPA RESPONSE: Once the ROD is signed, EPA will begin negotiations with those responsible for the contamination. If that fails, EPA has two choices: it can institute a suit against those responsible or it can use money from the trust fund to pay for the cleanup. EPA must also include in its selection process protection of the environment (not just the public) which is why natural attenuation is not a viable option. Natural attenuation would take over 50 years.

COMMENT 3: The problems at this site have been known for over 10 years. Can't Groveland be placed at the front of the line for Fund money?

EPA RESPONSE: EPA will look to negotiations and enforcement before seeking money from the Trust Fund since Region I must compete with sites across the country to make a site a 'Fund-lead' site.

H. Timing of the Cleanup Schedule

COMMENT 1: Once the ROD is signed, when does actual work begin?

EPA RESPONSE: EPA expects to complete negotiations with the PRPs and begin design work in fiscal year 1992. So the earliest design could start is 1 1/2 years from today and actual work could start 1 1/2 years after that.

I. The Plume

COMMENT 1: Where will the plume be by the time the actual cleanup work begins?

EPA RESPONSE: Natural groundwater flow is about one foot per day.

COMMENT 2: Is the Mill Pond system not currently capturing the entire plume?

EPA RESPONSE: No, it is not.

COMMENT 3: Won't the concentrated area of the plume spread out as it travels closer to the Merrimack River?

EPA RESPONSE: The concentrated area is expected to move downgradient and lengthen and spread out as it moves.

COMMENT 4: Could water from the Merrimack River be used to dilute the plume such that its concentrations fall below 5 ppm?

EPA RESPONSE: Reinjection could force the plume to move toward Station No. 1.

COMMENT 5: What happened to the pollution at Station No. 1?

EPA RESPONSE: The pump test showed that the most likely source of contamination was the plume coming from the Mill Pond area. Since 1979, among other things, hydraulic conditions have changed, thereby altering the plume's configuration.

COMMENT 6: Is 75 acres the area of the plume itself?

EPA RESPONSE: Yes, and 850 acres is the area of the entire NPL Site.

ATTACHMENT A

COMMUNITY RELATIONS ACTIVITIES CONDUCTED AT THE GROVELAND WELLS NOS. 1 AND 2 SUPERFUND SITE IN GROVELAND, MASSACHUSETTS

ATTACHMENT A

COMMUNITY RELATIONS ACTIVITIES AT THE GROVELAND WELLS NOS. 1 AND 2 SUPERFUND SITE

1982	Groveland Wells Nos. 1 and 2 Site listed on the National Priorities List.
1983	EPA issued a Community Relations Plan.
January 1983	EPA held a public meeting to discuss EPA's plans under Superfund.
July 10, 1985	EPA issued a press release announcing an initial remedial measure ("IRM") that would relieve the water emergency.
September 30, 1988	EPA announced that the source control Record of Decision was available to the public.
November 22, 1989	EPA issued a press release that the supplemental (RI/FS) would commence. Its focus was on groundwater contamination on the Mill Pond Area.
March 1991	EPA issued a Fact Sheet on the RI results and the Risk Assessment.
March 22, 1991	EPA issued a press release announcing a press release on April 3 to discuss the results of the Supplemental MOM RI and the Risk Assessment.
April 3, 1991	EPA conducted a town meeting at the Groveland Town Hall to discuss the results of the RI.
July 1991	EPA issued the Proposed Plan.
July 1, 1991	EPA published a notice announcing the public meeting and public hearing on the FS and the Proposed Plan and the availability of the Administrative Record.
July 2, 1991	EPA issued a press release announcing the release of the Proposed Plan.
July 9, 1991	EPA held a Public Meeting At the Groveland Town Hall to explain the FS and the Proposed Plan and to answer questions.

ATTACHMENT B

TRANSCRIPT OF THE JULY 31, 1991 INFORMAL PUBLIC HEARING

ENVIRONMENTAL PROTECTION AGENCY

SUPERFUND PROGRAM

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IN RE:

GROVELAND WELLS NOS. 1 AND 2
GROVELAND, MASSACHUSETTS

****

BEFORE: JAY NAPARSTEK, Chairman,
Mass Department of Environmental
Protection, Branch Chief for Bureau
of Waste Site Management;
CHARLES TUTTLE, Geologist
Mass Department of Environmental
Protection;
ROBERT J. LEGER, Remedial Project
Manager, U.S. Environmental
Protection Agency

Groveland Town Hall
183 Main Street
Groveland, Massachusetts
Wednesday, July 31, 1991
7:33 p.m.

Marybeth Coldwell, RPR

PROCEEDINGS

MR. NAPARSTEK: Okay. I think we will get started now if that is okay. Thank you all for coming tonight. My name is Jay Naparstek. I'm a Branch Chief with the Bureau of Waste Site Cleanup for the Mass. Department of Environmental Protection and I'll be serving as a hearing officer for tonight's hearing on the proposed plan for groundwater contamination at the Groveland Wells Site.

Let me introduce the other members of the panel here tonight and explain the agenda and the format for tonight's hearing. On my right here is Robert Leger and he is the Remedial Project Manager with E.P.A. On my left is Charles Tuttle and he is the Project Manager for the Mass. Department of Environmental Protection. Also here tonight are Diane Ready, Public Relations Coordinator, and Lisa West also working with Diane in the Public Relations Office.

Now, for those of you who are not familiar with the Groveland Wells Site or with E.P.A.'s approach to the cleanup, you should know that we have divided the remediation into two phases which are also known as Operable Units 1 and 2.

The first phase addresses the contaminated soils and groundwater that are on or adjacent to the Valley Manufactured Products on Washington Street. The remedy for this phase is presently being designed by the consultant for Valley under the terms of an Administrative Order with the E.P.A.

The second phase of the project addresses the contaminated groundwater in the aquifer north of the Valley Property which is the subject of tonight's hearing.

Now, back on July 9th the

E.P.A. held a public meeting here to present the results of the Feasibility Study which examined alternative ways for the cleaning up of the groundwater and then we presented E.P.A.'s preferred approach, followed by a question and answer period.

Now, after I conclude these introductory remarks, Bob Leger from the E.P.A. will just briefly recap the proposed plan and then we will begin the actual hearing.

The purpose of tonight's hearing is to allow the public to comment on the E.P.A.'s proposed plan for cleaning up the groundwater under the second operable unit. We will be transcribing the meeting and later provide a printed transcript which will become part the administrative record which is used by E.P.A. to make a final remedy decision.

In order to ensure accuracy in the record, I ask that anyone who wishes to make a statement, first fill out one of the index cards that are provided at the entrance with your name, your address and your affiliation, if you have any. I'll then call on you in the order in which the cards are submitted. I must reserve the right to limit the time available to any one speaker to ten minutes to ensure that everybody who wishes to make a statement gets a chance.

You should understand that E.P.A. will not be responding to any questions tonight. However, you may ask questions as part of your statement and a response will be included in the Responsiveness Summary that E.P.A. will prepare after the public comment period closes.

The Responsiveness Summary will then will be included in the Record of Decision which the E.P.A. plans to issue later this fall. In addition to tonight's hearing, you may also submit written comments for E.P.A.'s consideration.

E.P.A. recently received two requests to extend the public comment period and we will, therefore, be extending the comment period to September 9, 1991. The written comments should be written to the E.P.A. contact in the proposed plan which you could pick up at the front desk and must be postmarked no later than September 9, 1991. Copies of the proposed plan are available at the registration desk just as you came in.

And finally, let me remind you that copies of the administrative record are located at the Langley-Adams Library here in Groveland as well as the E.P.A. offices at 90 Canal Street in Boston and you may review any documents contained in the administrative record at these locations during the normal business hours.

Before I begin the actual hearing, are there any questions either on the hearing format or on the public participation process that you would like clarified?

Yes, Karl.

MR. LeMUTH: Just one question. I assume that you've gotten the well pollution committee request for an extension.

MR. NAPARSTEK: I believe that we have.

MR. LeMUTH: Could I ask who the other person was that asked for the extension?

MR. NAPARSTEK: I think that is part of the public record. That was Martin Pentz from Nutter, McClennan & Fish. Okay.

Anybody else?

Okay. Bob Leger then is just going to give a brief recap of the proposed plan for the remediation of groundwater under Operable Unit 2.

MR. LEGER: Thanks, Jay. My name is Bob Leger, the Remedial Project Manager. I'm with the Environmental Protection Agency in Boston and I'll be going over very briefly tonight some of the material that we went over in the beginning of July when we presented the proposed plan to you for your consideration.

My comments will be very brief to give you people an opportunity to present your opinion and your thoughts and your considerations on our proposed plan to clean up the pollution in the groundwater in Groveland.

Very quickly, Groveland Wells No. 1 and 2 Superfund Site consists of approximately 850 acres located mostly in the town of Groveland, bounded by School Street, Salem Street, Washington Street, Main Street and the Haverhill landfill. Get your bearings. Station No. 1 (indicating), Station No. 2

(indicating), Valley Manufacturing Company and A.W. Chesterton Company (indicating).

Based on investigations that were conducted over several years here at the Site, we've identified three sources of pollution.

Let me back up. Back in 1979, the town's wells became -- were discovered to be polluted with a solvent called Trichloroethene. At the time Station 1 and Station 2 provided entire drinking water supply of the town. And when the contamination in the town wells were discovered, both wells were shut down and the town went into emergency water rationing and subsequently drilled another well right up here (indicating) Station No. 3 which provided drinking water for the town. Subsequently, Station 1 was rehabilitated as a result of E.P.A. funding so now the town has a safe drinking water supply from the water being supplied from Station 3 and Station 1. Station 2 has remained closed since 1979.

The E.P.A. through funding came and started investigating into the contamination of the property and subsequently identified three major sources of pollution on this Site; the Chesterton Company, the Valley Manufactured Products Company and the Haverhill Landfill.

The contamination of the Chesterton property we discovered is primarily confined to the property boundary. The contamination of the Chesterton property does not appear to be related in any way to the contamination that was discovered in the Stations 1 and 2.

Haverhill landfill contamination --

Let me back up a bit. The Chesterton contamination is being dealt with under the Resource Conservation and Recovery Act (RCRA). That contamination in the Chesterton property is being handled under another law.

Contamination of the Haverhill Landfill is being handled under a superfund law so basically what we are talking about tonight, we are not talking about the contamination of the Chesterton or the Haverhill. We are talking about the contamination emanating from the Valley Manufactured Products.

Contamination from the Valley Manufactured Products Company primarily consists of Trichloroethene contamination, what we call a Volatile Organic Compound, solvent that was used by Valley Manufactured Products Company. As a result of spills and contamination leaks, it got into the groundwater and resulted in groundwater contamination.

Basically the groundwater flows

from south to the north. And again here (indicating) is the Center Street and Merrimack is up here (indicating). We discovered a groundwater contamination, what we call contaminant plume. What you see here is concentrations of Trichloroethene of above drinking-water standards, above five parts per billion and this is what the groundwater within this area here (indicating) outlined in the black is contaminated with Trichloroethene above safe-drinking water standards for that contamination.

Basically it is about, the contamination is primarily 75 acres surface area, about six billions gallons of water, about 6,000 pounds of trichloroethene that needs to be cleaned up to drinking water standards.

When we were here in the beginning of July, we basically put forth to you what our objectives were. Basically to clean up the groundwater so that it can be -- it could be used for drinking in the future time. As I said right now there is no present threat to groundwater because the ground -- the groundwater you are getting right now is from Stations 1 and 2 and that is perfectly safe.

The E.P.A.'s task is to clean up the contamination to the groundwater so that possible future use if someone wanted to drill a well in that area that they could in the future. So, basically our objective is to clean up the groundwater so that it can be safely drank.

MR. FALCONE: Stations are Sources 1 and 3.

MR. LEGER: I'm sorry.

MR. FALCONE: You said Stations 1 and 2. They are stations 1 and 3.

MR. NAPARSTEK: That's 1 and 3 are the stations, water drinking stations.

MR. LEGER: Yes, that's

correct. We looked at several alternatives to clean up the contaminant plume that I showed you earlier and I'll put that picture back up again so that you could take a look at it. We looked at several alternatives on how to clean that up.

When we look at the alternative, we have to -- the law says that we have to evaluate each alternative according to the nine criteria. And we look at all -- any alternative that we look at, we balance against these nine criteria.

The No. 1 and 2 obviously the overall protection of human health and the environment in compliance with ARARs. The compliance with the environmental laws and regulations and that's what ARARs are. So, if any alternative passes muster for the first two, then we look at how it passes muster for the last remaining seven criteria.

We discussed this criteria early in July so I'm not going to go over them again. We looked at basically -- we looked at a lot of different things to clean up the groundwater, a lot of technology, a lot of differential techniques to best clean up the water here at Groveland.

It came down to basically six major alternatives we considered to cleaning up groundwater. The first is an alternative which we are mandated by law to consider and that is to not do anything. No action. All the other criteria are based against that.

So, the first criteria is not to do anything. What would happen? Well, obviously the groundwater would never get cleaned up. Wouldn't be safey to drink for a long long time. But, that is -- there is no action alternative is one that we are required to look at by law. We are required to balance each alternative and compare it against no action.

The second alternative is basically what we call institutional controls. Prevent people through deed restrictions to prevent them from putting a well in the contaminated groundwater area. Now, that wouldn't clean up the groundwater but it would provide some protection to the public. They wouldn't be able to drill a well there.

And the remaining four alternatives basically consider taking the groundwater out and treating it by some way and putting the water back in. Taking the water out and treating it to drinking water standards. Once you take it out, you put it through some sort of treatment so that when you put it back in it is now safe to drink. We looked at four different alternatives to pump the water out.

No. 1 was to pump it out and to send it to the Haverhill publicly owned treatment plant. When we take it out, we have to do some sort of metals removal because we have to meet the standard for metals in water before we gave it to the Haverhill -- to the Haverhill treatment plant. The fourth alternative was to take it out.

The fourth, fifth and sixth alternative was to take it out and treat it onsite. Take it out and treat it using air stripping. If you are familiar with the air stripper up at Mill Pond, basically air is forced through the water and contaminants go from the water to the air.

The fifth alternative was to take the groundwater out and put it through a filter called the Granular Activated Carbon similar to what is used now at Station 1. The water that you have been drinking now has been filtered through what is called a Granular Activated Carbon. It filters out all the contaminants.

And the sixth alternative that we looked at was to take the water out and to take care of the inorganics and then destroy the contaminants by a process known as Ultraviolet Light/ Oxidation. I'm not going to go into the actual details of ultraviolet light and oxidation. It is an innovative process but it involves actual destruction of the contaminants onsite. Any volatile organic compound that comes out of the groundwater would be destroyed onsite as opposed to taking the water out and the water -- the contaminant would be transferred to another media, if you like, the air stripping. The contaminant would be transfered from the water to the air and then you have to treat the air or the carbon. You would have to treat the carbon. That treatmeant would occur off site. But, the ultraviolet light/(UV) oxidation process contaminants are being actually destroyed onsite.

So, we opted for that primarily because the new Superfund law requires that we look at the permanent treatment and so we thought that would be in line with the idea and the intent of the new Superfund laws. The cost was also a consideration. The particular costs were one of the cheaper ones.

We looked at air stripping. Air stripping and ultraviolet/oxidation were the two cheaper. I'm not going to say cheap because they were over a million dollars. It isn't cheap but they were two of the cheaper alternatives that we looked at.

The alternative that the E.P.A. is proposing will cost approximately nine million dollars to clean up the groundwater. It basically consists of installing a network of groundwater extraction wells to take the groundwater out, to construct the treatment facililties for special inorganic and for organics, to extract the water from the installation of the wells, extract the water and finally to discharge the treated water back to Johnson Creek.

The schematic basically looks like this. The extraction wells will take the water out and flow is approximately 400 gallons per minute. There is some inorganics like metals that needs to be removed to protect the equipment, to help the process, the treatment process operate more effectively and need to take the metals out. So, the metals are taken out. They are eventually put into what we call a dry, a dry sludge. They are transported out off site to a landfill. The filtered water that now has most of the inorganics removed from it is subject to what we call the ozone, ultraviolet light, hydrogen peroxide treatment and then basically the groundwater -- once it is treated, it is discharged back to Johnson Creek.

The approximate location of the wells so to give you an idea of where the wells would be located (indicating). This is very preliminary, very preliminary. These little circles over here represent (indicating) the extraction wells. Six of them. Most of the contamination from the Valley is around this area right here (indicating) so we want to put a well over here. The wells have been designed to extract all of the contamination, all of the contamination. Basically we figure around six wells would be needed to be installed. Exact location of the wells or the exact location of the treatment facilities, we are leaving that for a later decision in what we call during remedial design. We will be looking at where is the best place to locate these wells, where is the best place to locate the treatment facility. Right now we are very proximal to the location of the treatment station.

Now, Station 2 that doesn't say where it is going to be put. For now that is a possible location. The wells, as I said, is not absolute. The location isn't set in concrete. These are preliminary locations of the wells. The wells are to be installed and to capture the entire contaminant.

Basically our best statement right now for a time of clean up is approximately 30 years it will take to clean up the groundwater to drinking water standards. Right now that's our best estimate.

That's all I really have to say about E.P.A.'s proposed alternatives. We welcome questions. I won't be responding to your questions. The format is to ask questions and your questions will be responded to in what we call a Responsiveness Summary which will be issued by the E.P.A. at a later time.

With that, Mr. Chairman, that's all I have.

MR. NAPARSTEK: Thanks, Bob.

Okay. I just want to emphasize one more time the purpose of the hearing tonight is as Bob said it is, although, I'm sure that you all have some questions that you would like to ask, we are not here to answer your questions tonight. We are here to take your comments and your questions and then consider those in the final decision for the remedial action. All your comments will go into the record and will be responded to as part of the responsiveness summary.

I think with that, I would like to begin the hearing. I only have two speakers that have filled out cards. I'm sure that there are probably a couple that would want to but I'm going to go in order that I have them. I would ask that you come up and give us your name and any affiliation that you have. The first speaker that I have is Linda Loreth.

MS. LORETH: Hi.

MR. NAPARSTEK: Hi.

MS. LORETH: Did you want me over there?

MR. NAPARSTEK: Anywhere that you would like.

MS. LORETH: Okay. I'm the Environmental Health and Safety Manager with A.W. Chesterton Company and my name is Linda Loreth. I'd like to read a written comment that we have.

"This is in regards to your Feasibility Study regarding the E.P.A. region Superfund for Groveland Wells, No. 1 and 2, in Groveland, Massachusetts of July of '91. This is submitted within your 30-day comment period" which has been extended.

MR. NAPARSTEK: Which has been extended.

MS. LORETH: "You are aware

that Chesterton went to great lengths and expense prior to the involvement of the E.P.A. to assure the town and itself that Chesterton was not the source of the contamination of the Groveland wells Nos. 1 and 2. Despite that effort Chesterton continues to receive adverse and inaccurate publicity. Your proposed plan dated July 1991 describes Chesterton Site as (1) "likely" rather than "possible" source of the contamination, (2) as one of "several sources of contamination" of the Groveland wells, and (3) not "currently" contaminating the wells. There is no evidence that we have ever contaminated the wells. In fact, the contaminants on Chesterton property are distinctly different from the contaminants associated with the Groveland wells No. 1 and 2.

"Please comment on why the E.P.A. as recently as July 2nd, '91 in the E.P.A. Environmental News Press

Release refers to the A.W. Chesterton Company as a "likely source of contamination" in relation to the closing of the Groveland wells No. 1 and 2; when (1) Chesterton has never used or stored the well contaminant; (2) the E.P.A. remedial investigation determined that the contamination was confined to Chesterton property boundary; (3) the E.P.A. considered Chesterton property as a separate remedial unit; and (4) the E.P.A.'s remediation is to treat Chesterton separately under RCRA.

"If you need clarification to this request, please contact me at (617) 438-7000 extension 2309." I thank you for the opportunity to speak and I would like to offer you written copies.

MR. NAPARSTEK: Thank you, Linda.

The second speaker that I have submitted on a card is David Argyros.

MR. ARGYROS: My name is Dave

Argyros. I'm an environmental engineer by background. I've also been a Chesterton employee for the past 11 years and familiar with the Groveland Well problem, a member of the town and member of the aquifer protection committee for several years.

My comments are in regards to the proposal from the point of view of a U.S. citizen and taxpayer and someone who has been a taxpayer and may have to ultimately foot the bill for the project. My comments are in regards to two areas.

The first are the treating plant. Given that the town Well, No. 1, the primary town well is currently supplying safe drinking water and that the area surrounding well No. 1 is no longer contaminated due to the natural flushing and the controlled pumping and also that the natural flow of the contaminant plume is not directly towards well No. 1, it should be concluded that groundwater monitoring, control pumping and limited well-head treatment such as the current carbon polishing and institutional controls would be effective in assuring continued safe drinking water supply for the town.

Also, the fact that the contaminant source has been discharging into the Valley area for approximately 15 years and that it currently continues to discharge into that area and that the natural migration of that plume is along the brook and towards the river and also given that there is a high rate of transitivity in the sandy soils, I would also like to point out that the majority of the contaminants within that entire contaminated 75 acre plume, more than 80 percent of that entire contamination, is confined to a relatively small area near the Valley site, that area is roughly 1/20th or five percent of the total volume of the plume contains 80 percent of the contamination where those concentrations near the Valley site are approximately one thousand times higher than the majority of the plume.

Considering now several facts; one that the cost of treatment, cost of the treatment plant are proportional to the volume of water that you are going to capture and treat; also that the disruption to the town's people and the town itself from extraction wells, piping systms, pumps, tanks, etc., that is also proportional to the volume of water that you are going to be pumping and treating. However, the contaminant reduction and removal and destruction of contaminants is not proportional to the volume of water as nearly as much as it is proportional to the concentrations of the contaminated water that you are pumping out and that is if you pump out at a small quantity of groundwater contaminated at a thousand parts per billion, you will get much more treatment than a greater quantity of water at five parts per billion.

For these reasons, it should be concluded that for maximum efficiency, cost effectiveness, and a minimum disruption to the town treatment efforts themselves should be focused at eliminating the source area where 80 percent of the contamination is concentrated and that is five percent of the area and volume.

If you were to do this, if you were to focus your efforts not on the entire size of the plume but on that five percent area where it is concentrated, you could roughly reduce your treatment plant in the vicinity of 1/10th the proposed size and also reduce your costs from eight million dollars down to a much smaller and reasonable level. You won't be treating the entire 360 million gallons contaminated water. You would be treating roughly 18 million gallons, 12 million gallons of highly contaminated water.

Also, because of the smaller size of the system needed to treat that higher contaminated but smaller volume, it may be more practical to use a different type treatment method such as air stripping alone with the carbon capture. It might be even possible to use the air stripper that was once at No. 1 when the levels were higher there.

In summary, to summarize my comments to E.P.A.'s proposal, it is that in your proposed cleanup plan, you evaluated several widely different alternatives from do nothing alternative to alternatives which involved complete plume extraction. There was no evaluation of an alternative that was in between which would seem to be the most practical. And that alternative which should be evaluated in detail involves basically the capture and the treatment of the highly contaminated head portion of the plume which is continuing to migrate off the Valley site. That treatment of the smaller highly contaminated area at a much lower cost combined with the institutional and monitoring controls at the well head and throughout the rest of the plume should be able to treat the contamination, stop the source. And during that time that the head of the plume or the highly contaminated portion is being treated, the remaining 95 percent of the plume with the 20 percent of the contamination will naturally dissipate on its own. The high transivity of the soils there, I think the water flow is that of about a foot per day combined with the fact that it is basically discharging towards the Merrimack and

Valley would dissipate the less concentrated but larger size of that plume probably well within the time that it would take you to treat the highly concentrated portion. In that majority, that large size plume, the 95 percent that is less contaminated, there may only be 120 gallons of the solvent or in the order of 800 pounds of material that would actually not be captured and would be left to naturally decrease.

That summarizes my comment in relation to the town's system itself or the proposed treatment itself. It is to evaluate a practical alternative somewhere in between do nothing and clean up the entire 360 million gallon plume.

My second comment, again, as a taxpayer, who may some day foot part of the bill for this project involves just briefly looking through the costs of the sample program outlined in the report and the numbers were sort of shocking, surprising to me. For example, in alternative No. 2, it indicates eight groundwater samples for the sampling. For the cost of sampling itself, the eight samples four times a year, the cost was $8,000 based upon 24 man hours per sampling, plus travel, living and the shipping expenses. The analysis of those, there would be 40 samples a year would be $20,000 and the reporting, 20 man hours to produce a report, plus other direct costs was approximately 4,000 a year roughly looking at $32,000 a year to pull eight groundwater samples four times a day and produce a report. It may be more cost effective rather than E.P.A. sending somebody out and putting them in the hotel to take the samples to contract with a private agency, private testing lab with the E.P.A., a certified E.P.A. lab and simply putting them on a rotating scheduling to pull samples and produce a report. The cost should be approximately half or to a quarter the costs contained in the report.

So that summarizes my second comment. Again, cost associated one. Simply look at the cost of private contracting pulling the samples. Should be significantly less. Thank you very much.

MR. NAPARSTEK: Thank you, Mr. Argyros. Okay.

Those are the only two people that have submitted cards. Are there any other speakers that would like to submit a comment at this time?

Okay. Well, if there are no others that would like to make a statement, I'll close the hearing. Let me just remind you again that the deadline to submit written comments is September 9th. All comments must be postmarked or hand-delivered to the E.P.A. at that time. I thank you for coming and for your participation tonight. Thank you.

(Whereupon, the hearing concluded at 8:05 p.m.)