NEW YORK STATE SUPERFUND CONTRACT

New Cassel Industrial Area
Offsite Groundwater
Town of North Hempstead, Nassau County

Remedial Investigation/ Feasibility Study (RI/FS) Report

Volume I • Remedial Investigation Report

Work Assignment No. D002676-42.1

September 2000

Prepared for:

New York State
Department of
Environmental Conservation

50 Wolf Road, Albany, New York 12233
John Cahill, *Commissioner*

Division of Environmental Remediation
Michael J. O'Toole, Jr., *Director*

By:
Lawler, Matusky & Skelly Engineers LLP

ENGINEERING AND OPERATIONS SERVICES
NEW YORK STATE SUPERFUND STANDBY CONTRACT

NEW CASSEL INDUSTRIAL AREA
OFF-SITE GROUNDWATER
TOWN OF NORTH HEMPSTEAD, NASSAU COUNTY

Work Assignment No. D002676-42.1

REMEDIAL INVESTIGATION REPORT

Prepared for:

New York State Department of Environmental Conservation
Division of Environmental Remediation

THOMAS E. PEASE
No. 057131-1

September 2000

EDWARD A. MAIKISH
No. 055116

LAWLER, MATUSKY & SKELLY ENGINEERS LLP
Environmental Science & Engineering Consultants
One Blue Hill Plaza
Pearl River, New York 10965

Project No. 650-428

NCIA OFF-SITE GROUNDWATER
REMEDIAL INVESTIGATION/FEASIBILITY STUDY REPORT

TABLE OF CONTENTS

Page No.

LIST OF FIGURES ix

LIST OF TABLES xiv

REMEDIAL INVESTIGATION REPORT: CHAPTERS 1 through 6

1 EXECUTIVE SUMMARY 1-1

2 INTRODUCTION AND BACKGROUND

- 2.0 Purpose and Objectives 2-1
- 2.1 Site Location and Description 2-1
- 2.2 Site Background 2-2
- 2.3 Report Organization 2-2

3 FIELD INVESTIGATION PROCEDURES

- 3.1 Introduction 3-1
- 3.2 Monitoring Well Installation 3-1
    - 3.2.1 General Monitoring Well Details 3-1
    - 3.2.2 Monitoring Well Soil Sampling 3-2
    - 3.2.3 Specific Monitoring Well Details 3-2
    - 3.2.4 In-situ Hydraulic Testing 3-3
- 3.3 Monitoring Well Sampling and Analysis 3-4
    - 3.3.1 Groundwater Sampling Protocol 3-4
- 3.4 Hydropunch Groundwater Sampling 3-5
    - 3.4.1 General Hydropunch Details 3-5
    - 3.4.2 Hydropunch Soil Sampling 3-5
    - 3.4.3 Specific Hydropunch Details 3-5
- 3.5 Related Field Investigation Procedures 3-6
    - 3.5.1 Decontamination 3-6
    - 3.5.2 Waste Handling and Disposal 3-7
    - 3.5.3 Soil Cuttings from Hydropunch Sampling 3-7
    - 3.5.4 Decontamination Water 3-7

NCIA OFF-SITE GROUNDWATER
REMEDIAL INVESTIGATION/FEASIBILITY STUDY REPORT

TABLE OF CONTENTS

Page No.

3.5.5 Disposable Personal Protective Equipment and General Trash 3-7
3.5.6 Site Restoration 3-7

4 PHYSICAL CHARACTERISTICS

4.1 Topography 4-1
4.2 Surface Water 4-1
4.3 Demography and Land Use 4-1
4.4 Ecology 4-2
4.5 Climatology 4-2
4.6 Soils 4-3
4.7 Geology 4-3

4.7.1 Regional Geology 4-3
4.7.2 Study Area Geology 4-4

4.8 Hydrogeology 4-6

4.8.1 Regional Hydrogeology 4-6
4.8.2 Study Area Hydrogeology 4-6

5 NATURE AND EXTENT OF CONTAMINATION

5.1 Previous Investigations 5-1

5.1.1 NCIA Investigation History and Previous Data 5-1

5.2 Remedial Investigation Analytical Results 5-2

5.2.1 Monitoring Well Sampling Results- April 1999 5-2
5.2.2 Monitoring Well Sampling Results- August 1999 5-2
5.2.3 Monitoring Well Sampling Results- January 2000 5-3
5.2.4 Hydropunch Sampling Results- January and February 2000 5-4

5.3 DATA ANALYSIS AND AREAS OF IMPACTED GROUNDWATER 5-5

5.3.1 Area of Historically Impacted Groundwater 5-5
5.3.2 Area of Impacted Groundwater 1998 to 2000 5-6
5.3.3 Temporal Variations in Groundwater Quality 5-6
5.3.4 Contaminant Distribution with Depth 5-7

TABLE OF CONTENTS

Page No.

6 SUMMARY AND CONCLUSIONS OF THE REMEDIAL INVESTIGATION

6.1 Field Investigation 6-1
6.2 Data Interpretation 6-2

6.2.1 Area of Historically Impacted Groundwater 6-2
6.2.2 Area of Impacted Groundwater 1998 to 2000 6-5
6.2.3 Area of Impacted Groundwater - Prior to 1993 to 2000 6-6
6.2.4 Temporal Variations in Groundwater Quality 6-6
6.2.5 Chemical Fate and Transport 6-8

6.3 Potential Exposure Pathways 6-10
6.4 Remedial Action Objectives 6-10

FEASIBILITY STUDY REPORT: CHAPTERS 7 through 12

7 APPLICABLE STANDARDS, CRITERIA, AND GUIDANCE

7.1 Introduction 7-1
7.2 Chemical Specific SCGs 7-2

7.2.1 New York State Groundwater Standards 7-2
7.2.2 New York State Groundwater Effluent Limitations 7-3
7.2.3 U.S. Environmental Protection Agency (USEPA) Drinking Water Standards 7-3
7.2.4 USEPA Drinking Water Health Advisories 7-4
7.2.5 Federal Ambient Water Quality Criteria 7-4
7.2.6 Sewage Discharge Pretreatment Standards 7-4
7.2.7 New York State Recommended Soil Cleanup Objectives 7-5
7.2.8 HEAST and IRIS Tables 7-5
7.2.9 Clean Air Act 7-5
7.2.10 New York State Air Guide One 7-5
7.2.11 Occupational Safety and Health Administration 7-6
7.2.12 National Institute for Occupational Safety and Health 7-6
7.2.13 American Conference of Government Industrial Hygienists 7-7

7.3 Location Specific SCGs 7-7

7.3.1 Well Usage Permit 7-7
7.3.2 New York State Protection of Sole Source Aquifer 7-7

TABLE OF CONTENTS

Page No.

7.3.3 Federal Protection of Sole Source Aquifer 7-7
7.3.4 Article IV of the Nassau County Public Health Ordinance 7-8

7.4 Action Specific SCGs 7-8

7.4.1 Comprehensive Environmental Response, Compensation, and Liability Act 7-8
7.4.2 Resource Conservation and Recovery Act (RCRA) and New York State Hazardous Waste Regulations 7-8
7.4.3 State Pollution Discharge Elimination System 7-10
7.4.4 Underground Injection Control 7-10
7.4.5 EPA Presumptive Remedies 7-10
7.4.6 EPA Guidance on Remedial Action for Contaminated Groundwater at Superfund Sites 7-11
7.4.7 EPA Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA 7-11
7.4.8 Risk Assessment Guidance for Superfund 7-12
7.4.9 NYSDEC Selection of Remedial Actions at Inactive Disposal Sites 7-12

8 HEALTH EXPOSURE PATHWAY ANALYSIS

8.1 Introduction 8-1
8.2 Data Collection and Evaluation 8-2

8.2.1 Collection of Relevant Site Data 8-2
8.2.2 Identification of Potential Contaminants of Concern 8-4
8.2.3 Concentration-Toxicity Screening 8-5

8.3 Exposure Assessment 8-6

8.3.1 Identification and Screening of Exposure Pathways 8-6

8.4 Toxicity Assessment 8-9

8.4.1 1,1-Dichloroethane (1,1-DCA) 8-9
8.4.2 1,1-Dichloroethylene (1,1-DCE) 8-10
8.4.3 1,2-Dichloroethylene (1,2-DCE) 8-10
8.4.4 1,2-Dichloroethane (1,2-DCA) 8-11
8.4.5 Tetrachloroethylene (PCE) 8-11
8.4.6 Trichloroethylene (TCE) 8-12

TABLE OF CONTENTS

Page No.

8.4.7 Vinyl Chloride 8-12

8.5 Uncertainty Analysis 8-13
8.6 Conclusions 8-13

9 OBJECTIVES OF THE FEASIBILITY STUDY

9.1 Introduction 9-1
9.2 Objectives of the Feasibility Study 9-2
9.3 Remedial Action Objectives 9-3

10 IDENTIFICATION AND SCREENING OF TECHNOLOGIES

10.1 Introduction 10-1
10.2 General Response Actions 10-1
10.3 Remedial Technology Screening Process 10-2

10.3.1 Groundwater Response 10-3
10.3.2 Air Emissions Controls 10-14

10.4 Evaluation of Technologies and Selection of Representative Technologies 10-17

10.4.1 Remaining Groundwater Response Technologies 10-17
10.4.2 Remaining Air Emissions Control Technologies 10-19

11 DEVELOPMENT AND SCREENING OF REMEDIAL ALTERNATIVES

11.1 Introduction 11-1

11.1.1 IMC Magnetics (Site No. 1-30-043A) 11-2
11.1.2 Atlas Graphics (Site No. 1-30-043B) 11-2
11.1.3 Arkwin Industries (Site No. 1-30-043D) 11-2
11.1.4 Tishcon Corporation at Brooklyn Ave (Site No. 1-30-043E) 11-3
11.1.5 Utility Manufacturing/Wonder King Site (Site No. 1-30-043H) 11-3
11.1.6 Former Laka Industries, Inc. (Site No. 1-30-043K) 11-3
11.1.7 Frost Street sites: (Site Nos. 1-30-043I, L, and M) 11-4
11.1.8 118-130 Swalm Street Site (Site No. 1-30-043P) 11-5
11.1.9 299 Main Street Site (Site No. 1-30-043S) 11-5
11.1.10 36 Sylvester Street Site (Site No. 1-30-043U) 11-5

TABLE OF CONTENTS

Page No.

11.1.11 Tischon Corporation Site at 29 New York Avenue (Site No. 1-30-043V) 11-6

11.2 Regulatory Requirements 11-6
11.3 Development of Remedial Alternatives 11-7

11.3.1 Alternative 1: No Further Action 11-8
11.3.2 Alternative 2: Monitored Natural Attenuation 11-9
11.3.3 Alternative 3: Monitoring, Assessment, and Contingent Remediation 11-18
11.3.4 Alternative 4A: Remediation of Upper Portion of Aquifer (to 125 ft bgs) with In-well Vapor Stripping/Localized Vapor Treatment 11-20
11.3.5 Alternative 4B: Remediation of Upper Portion of Aquifer (to 125 ft bgs) with Groundwater Extraction / Centralized Air Stripping and Vapor Treatment / Effluent Re-Injection 11-27
11.3.6 Alternative 5A: Remediation of Upper and Deep Portions of Aquifer (to 200 ft bgs) with In-Well Vapor Stripping / Localized Vapor Treatment 11-34
11.3.7 Alternative 5B: Remediation of Upper and Deep Portions of Aquifer (to 200 ft bgs) with Groundwater Extraction / Centralized Air Stripping and Vapor Treatment / Effluent Re-Injection 11-38
11.3.8 Alternative 6A: Full Plume Remediation of Upper Portion of Aquifer (to 125 ft bgs) with In-Well Vapor Stripping / Localized Vapor Treatment 11-41
11.3.9 Alternative 6B: Full Plume Remediation of Upper Portion of Aquifer (to 125 ft bgs) with Groundwater Extraction / Centralized Air Stripping and Vapor Treatment / Effluent Re-Injection 11-44
11.3.10 Alternative 7A: Full Plume Remediation of Upper and Deep Portions of Aquifer (to 200 ft bgs) with In-Well Vapor Stripping / Localized Vapor Treatment 11-47
11.3.11 Alternative 7B: Full Plume Remediation of Upper and Deep Portions of Aquifer (to 200 ft bgs) with Groundwater Extraction / Centralized Air Stripping and Vapor Treatment / Effluent Re-Injection 11-51

12 DETAILED EVALUATION OF GROUNDWATER RESPONSE ALTERNATIVES

12.1 Introduction 12-1

TABLE OF CONTENTS

Page No.

12.2 Individual Analysis of Alternatives 12-2

12.2.1 Alternative 1: No Further Action 12-2
12.2.2 Alternative 2: Monitored Natural Attenuation 12-4
12.2.3 Alternative 3: Monitoring, Assessment, and Contingent Remediation 12-6
12.2.4 Alternatives 4A and 5A: Remediation to Designated Depths with In-Well Vapor Stripping / Vapor Treatment 12-8
12.2.5 Alternatives 4B and 5B: Remediation to Designated Depths with Groundwater Extraction / Air Stripping / Vapor Treatment / Reinjection 12-11
12.2.6 Alternatives 6A and 7A: Full Plume Remediation to Designated Depths with In-Well Vapor Stripping / Vapor Treatment 12-14
12.2.7 Alternatives 6B and 7B: Full Plume Remediation to Designated Depths with Groundwater Extraction / Air Stripping / Vapor Treatment / Reinjection 12-18

12.3 Comparative Analysis of Alternatives 12-21

12.3.1 Protection of Human Health and the Environment 12-21
12.3.2 Compliance With SCGs 12-22
12.3.3 Reduction of Toxicity, Mobility, and Volume Through Treatment 12-22
12.3.4 Short-Term Effectiveness 12-23
12.3.5 Long-Term Effectiveness and Permanence 12-24
12.3.6 Implementability 12-25
12.3.7 Cost 12-26

TABLE OF CONTENTS

Page No.

REFERENCES

APPENDICES

A Boring/Well Logs
B Well Development Logs
C In-Situ Hydraulic Testing
D Monitoring Well Sampling Logs
E Analytical Laboratory Data Summary Sheets
F Historical Groundwater Data Summary (Table 5-2)
G Areas of Impacted Groundwater for Various Years
H Concentration vs. Time Plots
I Quantities of Contaminated Groundwater
J BioChlor MNA Software and Model Run
K In-Well Vapor Stripping Sensitivity Analysis
L Evaluation of Local and Central Vapor Treatment Facilities for In-Well Vapor Stripping and Pump & Treat Groundwater Remediation Technologies

LIST OF FIGURES

Figure No.	Title	Following Page
1-1	NCIA Site Location	1-1
1-2	Site Plan	1-1
3-1	Monitoring Well Locations	3-1
3-2	Test Boring/Sampling Cross Section	3-1
3-3	Typical Overburden Monitoring Well Construction	3-1
3-4	Monitoring Wells Sampled April 1999 (Round 1)	3-4
3-5	Monitoring Wells Sampled August 1999 (Round 2)	3-4
3-6	Monitoring Wells Sampled January 2000 (Round 3)	3-4
3-7	Hydropunch Groundwater Sampling Locations: January & February 2000	3-5
4-1	Typical Cross Section in the SiteVicinity	4-3
5-1	April 1999 Well Sampling: Groundwater Data Summary	5-2
5-2	August 1999 Well Sampling: Groundwater Data Summary	5-3
5-3	January 2000 Well Sampling: Groundwater Data Summary	5-3
5-4	Hydropunch Groundwater Data Summary: January and February 2000	5-4
5-5	Area of Historically Impacted Groundwater 1977-Present, 0 to 64 feet.	5-5
5-6	Area of Historically Impacted Groundwater 1977-Present, 65 to 99 feet.	5-5

5-7	Area of Historically Impacted Groundwater 1977-Present, 100 to 124 feet.	5-5
5-8	Area of Historically Impacted Groundwater 1977-Present, 125 to 200 feet.	5-5
5-9	Area of Impacted Groundwater September 1998 to Present, 0 to 64 feet.	5-6
5-10	Area of Impacted Groundwater September 1998 to Present, 65 to 99 feet.	5-6
5-11	Area of Impacted Groundwater September 1998 to Present, 100 to 124 feet.	5-6
5-12	Area of Impacted Groundwater September 1998 to Present, 125 to 200 feet.	5-6
5-13	Area of Impacted Groundwater Prior to 1993, 0 to 64 feet.	5-6
5-14	Area of Impacted Groundwater Prior to 1993, 65 to 99 feet.	5-6
5-15	Area of Impacted Groundwater Prior to 1993, 100 to 124 feet.	5-6
5-16	Area of Impacted Groundwater Prior to 1993, 125 to 200 feet.	5-6
5-17	Area of Impacted Groundwater 1993-1996, 0 to 64 feet.	5-6
5-18	Area of Impacted Groundwater 1993-1996, 65 to 99 feet.	5-6
5-19	Area of Impacted Groundwater 1993-1996, 100 to 124 feet.	5-6
5-20	Area of Impacted Groundwater 1993-1996, 125 to 200 feet.	5-6
5-21	Area of Impacted Groundwater 1996-2000, 0 to 64 feet.	5-6
5-22	Area of Impacted Groundwater	5-6

	1996-2000, 65 to 99 feet.	
5-23	Area of Impacted Groundwater 1996-2000, 100 to 124 feet.	5-6
5-24	Area of Impacted Groundwater 1996-2000, 125 to 200 feet.	5-6
5-25	Changes in the Relative Percentage of Parent Compounds Over Time	5-7
5-26	Changes in the Relative Percentage of Breakdown Compounds Over Time	5-7
5-27	Cross Section A-A’	5-7
5-28	Cross Section B-B’	5-7
5-29	Cross Section C-C’	5-7
5-30	Cross Section D-D’	5-7
6-1	Groundwater Contours August 1999	6-9
9-1	Groundwater Contours – August 1999	9-1
9-2	Area of Impacted Groundwater Based on Data Collected Between 1996 – 2000 (0-64 ft bgs)	9-1
9-3	Area of Impacted Groundwater Based on Data Collected Between 1996 – 2000 (65-99 ft bgs)	9-1
9-4	Area of Impacted Groundwater Based on Data Collected Between 1996 – 2000 (100-124 ft bgs)	9-1
9-5	Area of Impacted Groundwater Based on Data Collected Between 1996 – 2000 (125-200 ft bgs)	9-1
11-1	Active and Selected Remediation within the NCIA	11-1
11-2	Off-Site Groundwater: Long-Term Monitoring and SamplingWells	11-16
11-3	In-Well Vapor Stripping Process	11-22

11-4 Alternative 4A In-Well Vapor Stripping Remediation of Upper Portion of Aquifer (to 125 ft BGS) 11-23

11-5 Alternative 4A In-Well Vapor Stripping Remediation of Upper Portion of Aquifer (to 125 ft BGS): 1996-2000 Plumes 11-23

11-6 Alternative 4A In-Well Vapor Stripping Remediation of Upper Portion of Aquifer (to 125 ft BGS): Treatment Well Placement and Contamination Contours For 1996 – 2000 Plumes 11-23

11-7 Well Influence on Groundwater 11-29

11-8 Alternative 4B Groundwater Extraction / Air Stripping: Remediation of Aquifer to 125 ft BGS 11-29

11-9 Schematic of Groundwater Treatment Operations 11-30

11-10 Alternative 5A In-Well Vapor Stripping Remediation of Upper and Deep Portion of Aquifer (to 200 ft BGS) 11-34

11-11 Alternative 5A In-Well Vapor Stripping Remediation of Upper and Deep Portions of Aquifer (to 200 ft BGS): Contamination Contours for 1996-2000 Plumes 11-34

11-12 Alternative 5A In-Well Vapor Stripping Remediation of Upper and Deep Portions of Aquifer (to 200 ft BGS): Treatment Well Placement and Contamination Contours for 1996-2000 Plumes 11-34

11-13 Alternative 5B Groundwater Extraction / Air Stripping: Remediation of Aquifer to 200 ft BGS 11-38

11-14 Alternative 6A In-Well Vapor Stripping Full Plume Remediation of Upper Portion of Aquifer (to 125 ft BGS) 11-41

11-15 Alternative 6A In-Well Vapor Stripping Full Plume Remediation of Upper Portion of Aquifer (to 125 ft BGS): Contamination Contours for 1996-2000 Plumes 11-41

11-16 Alternative 6A In-Well Vapor Stripping Full Plume Remediation of Upper Portion of Aquifer (to 125 ft BGS): Treatment Well Placement and Contamination Contours for 1996-2000 Plumes 11-41

11-17 Alternative 6B Groundwater Extraction / Air Stripping: Full Plume Remediation of Aquifer to 125 ft BGS 11-45

11-18 Alternative 7A In-Well Vapor Stripping Full Plume Remediation of Upper and Deep Portions of Aquifer (to 200 ft BGS) 11-47

11-19 Alternative 7A In-Well Vapor Stripping Full Plume Remediation of Upper and Deep Portions of Aquifer (to 200 ft BGS): Contamination Contours for 1996-2000 Plumes 11-48

11-20 Alternative 7A In-Well Vapor Stripping Full Plume Remediation of Upper and Deep Portions of Aquifer (to 200 ft BGS): Treatment Well Placement and Contamination Contours for 1996-2000 Plumes 11-48

11-21 Alternative 7B Groundwater Extraction / Air Stripping: Full Plume Remediation of Aquifer to 200 ft BGS 11-51

12-1 Natural Attenuation Screening Protocol 12-5

LIST OF TABLES

Table No.	Title	Following Page
3-1	Monitoring Well Summary: NCIA Off-Site Wells	3-2
3-2	Groundwater Elevations: NCIA Off-Site Wells	3-2
5-1	Groundwater Investigations Incorporated into the Database as of July 2000	5-1
5-2	New Cassel Industrial Area: Historical Groundwater Data Summary	Appendix E
5-3	Groundwater Data Summary (April 1999): NCIA Off-Site Groundwater RI	5-2
5-4	Groundwater Data Summary (August 1999): NCIA Off-Site Groundwater RI	5-3
5-5	Groundwater Data Summary (January 2000): NCIA Off-Site Groundwater RI	5-3
5-6	Groundwater Data Summary (Hydropunch Sampling January & February 2000): NCIA Off-Site Groundwater RI	5-4
7-1	Standards, Criteria, and Guidance Values	7-2
7-2	Maximum Toxicity Characteristic Concentrations	7-9
8-1	Potential Contaminants of Concern in Groundwater	8-5
8-2	Concentration-Toxicity Screening for Contaminants of Concern	8-6
8-3	Potential Contaminants of Concern for Inclusion in Health Exposure Assessment	8-6
8-4	Screening of Potential Exposure Pathways (Current Land Use Scenario)	8-7
8-5	Screening of Potential Exposure Pathways (Future Land Use Scenario)	8-7
9-1	Cleanup Objectives for Groundwater	9-4

10-1 Summary of Remedial Technologies for Groundwater Response 10-2

10-2 Summary of Remedial Technologies for Air Emissions Controls 10-2

10-3 Groundwater Response Technologies Retained 10-17

10-4 Air Emissions Controls Technologies Retained 10-17

11-1 Remedial Alternatives for Detailed Evaluation 11-7

11-2 Alternative 2, Monitored Natural Attenuation (Long-Term MNA Monitoring Program Summary): "Natural Attenuation Monitoring" 11-15

11-3 Alternative 2, Monitored Natural Attenuation (Long-Term MNA Monitoring Program Summary) "Contaminant Plume Monitoring" 11-16

11-4 Alternative 3, Monitoring, Assessment and Contingent Remediation: Monitoring Program Summary 11-18

11-5 In-Well Vapor Stripping Summary Table 11-23

11-6 Alternative 4A, In-Well Vapor Stripping: Monitoring Program Summary 11-27

11-7 Pump and Treat Summary Table 11-28

11-8 Effluent Limitations for COCs 11-33

11-9 Alternative 4B, Groundwater Extraction / Air Stripping: Monitoring Program Summary 11-33

11-10 Alternative 5A, In-Well Vapor Stripping: Monitoring Program Summary 11-37

11-11 Alternative 5B, Groundwater Extraction / Air Stripping: Monitoring Program Summary 11-40

11-12 Alternative 6A, In-Well Vapor Stripping: Monitoring Program Summary 11-44

11-13 Alternative 6B, Groundwater Extraction / Air Stripping: Monitoring Program Summary 11-47

11-14 Alternative 7A, In-Well Vapor Stripping: Monitoring Program Summary 11-50

11-15 Alternative 7B, Groundwater Extraction / Air Stripping : Monitoring Program Summary 11-53

12-1 Summary of Detailed Evaluation of Remedial Alternatives 12-2

12-2 Cost Estimate for Alternative 1: No Further Action 12-4

12-3 Cost Estimate for Alternative 2: MNA 12-6

12-4 Cost Estimate for Alternative 3: Monitoring, Assessment, and Contingent Remediation 12-7

12-5 Cost Estimate for Alternative 4A: In-well Vapor Stripping/ Vapor Treatment 12-11

12-6 Cost Estimate for Alternative 5A: In-well Vapor Stripping/Vapor Treatment 12-11

12-7 Cost Estimate for Alternative 4B: Groundwater Extraction / Air Stripping / Re-Injection 12-14

12-8 Cost Estimate for Alternative 5B: Groundwater Extraction/ Air Stripping/ Re-injection 12-14

12-9 Cost Estimate for Alternative 6A: In-Well Vapor Stripping / Vapor Treatment 12-17

12-10 Cost Estimate for Alternative 7A: In-Well Vapor Stripping / Vapor Treatment 12-17

12-11 Cost Estimate for Alternative 6B: Groundwater Extraction / Air Stripping / Re-Injection 12-21

12-12 Cost Estimate for Alternative 7B: Groundwater Extraction / Air Stripping / Re-injection 12-21

12-13 Summary of O&M Costs for Bowling Green Water District VOC Removal Processes 12-27

CHAPTER 1

EXECUTIVE SUMMARY

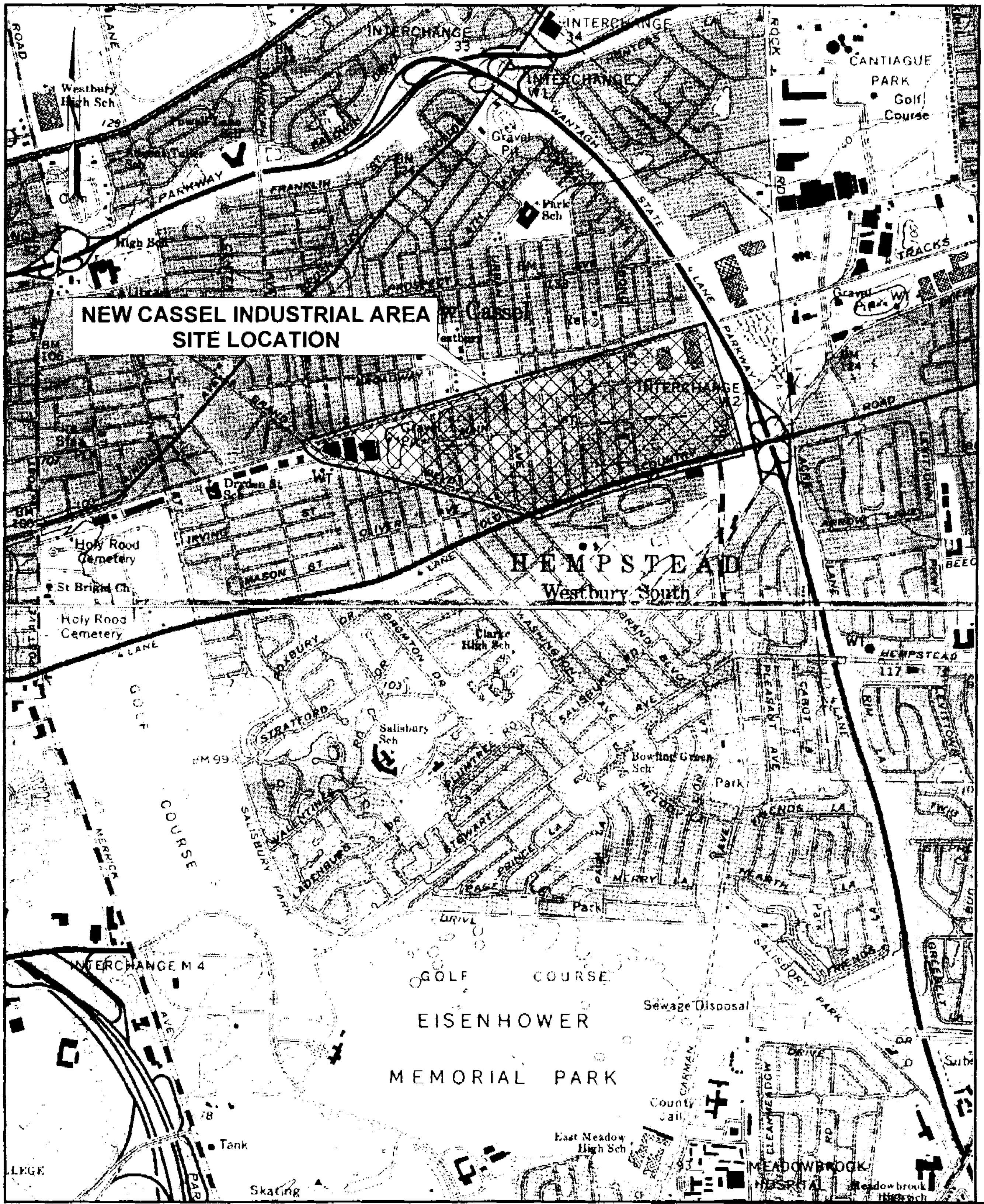
The New Cassel Industrial Area (NYSDEC Site No. 1-30-043) is located in the Town of North Hempstead, Nassau County (Figure 1-1). In 1986, extensive chlorinated solvent contamination (1,000 to 10,000 μg/l) was discovered in the upper glacial aquifer (UGA) and Magothy Aquifer, which underlie the NCIA. As a result of the Preliminary Site Assessments (PSAs) conducted by LMS (LMS 1996, LMS 1997), a total of 17 sites were listed as Class 2 hazardous waste sites on the New York State Registry of Hazardous Waste Sites. Since the completion of the PSA investigations, RI/FS's have been completed to address the on-site sources of contamination and to determine the nature and extent of the on-site groundwater contamination. The objectives of the Remedial Investigation/Feasibility Study (RI/FS) were to gather/summarize all of the groundwater data from sampling points within the on-site and off-site locations of the industrial area; collect/analyze new groundwater samples from locations primarily within the off-site locations to fill-in missing data on plume maps; and to evaluate remedial options for the off-site groundwater.

The NCIA is a heavily industrialized area of a variety of small to medium sized businesses covering about 25 blocks. The on-site NCIA is defined as the area bounded to the north by the Long Island Railroad, to the south by Old Country Road, to the east by the Wantagh Parkway and to the west by Grand Boulevard. The off-site locations are those areas downgradient (southwest) of the industrial area and that have groundwater impacted by contaminants migrating off of the on-site NCIA. In general terms, this area includes the commercial and residential areas south of Old Country Road and Grand Boulevard (Figure 1-2).

Remedial Investigation for the Off-Site Groundwater

The purpose of this RI was to complete additional groundwater sampling within the impacted area. These data were then summarized and compiled with all previous data to provide a comprehensive picture of the nature and extent of the groundwater contamination in the vicinity of the NCIA. The RI data also formed the basis for the development of the FS and the evaluation of possible remedial alternatives for the individual groundwater contaminant plumes.

The land surface in the vicinity of the NCIA site is essentially level with groundsurface elevations ranging from approximately 120 ft to 100 ft above mean sea level (msl). The



0 2000 ft

SCALE
1 in. = 2000 ft

Map source:
USGS 7.5-minute quadrangle series,
Freeport, NY, 1969, photorevised 1979,
Hicksville, NY, 1967, photorevised 1979.

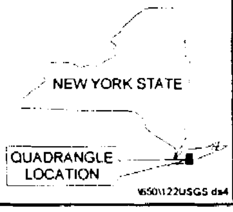


Figure 1-1

New Casssel Industrial Area
Site Location

OFFSITE GROUNDWATER
NEW CASSEL INDUSTRIAL AREA
NYSDEC I.D. No. 130043

LAWLER, MATUSKY & SKELLY ENGINEERS LLP
Pearl River, New York

\offsite\offsitesouth2.dsf

Figure 1-2

Site Plan

OFFSITE GROUNDWATER
NEW CASSEL INDUSTRIAL AREA
NYSDEC I.D. No. 130043

LAWLER, MATUSKY & SKELLY ENGINEERS LLP
Pearl River, New York

land in this area naturally has only a very gentle southward slope and the lack of relief has likely been enhanced in the area surrounding the site by grading done during construction of the large number of surrounding structures. The nearest sources of surface water are several small ponds in and around Eisenhower Memorial Park, approximately two miles southwest of the site. Based on an ecological communities classification system outlined by NYSDEC, the NCIA is entirely comprised of a terrestrial cultural community. The terrestrial cultural subsystem is defined by communities that are direct results of the influence of human activities. The climate of Long Island is moderated by its proximity to the ocean and land surfaces that are very close to sea level. Precipitation, distributed evenly through the year, averages about 44-in. per year.

Long Island regional geology consists of a significant thickness of unconsolidated sediments (Cretaceous and Pleistocene age) overlying Precambrian and Paleozoic basement bedrock consisting of gneiss, schist and granite at an average depth of approximately 1000-ft below sea level. The primary concern of this investigation is the two upper aquifers, the upper glacial aquifer and the Magothy Aquifer. The UGA is an unconfined aquifer consisting of poorly sorted sands and gravels. The Magothy is the sole source aquifer for the study area and consists of finer sand, silt and small amounts of clay. Following NYSDEC and USEPA regulations, both the UGA and Magothy are protected as sole source aquifers on Long Island. Depth to water is about 50 to 55 ft below the ground surface in the study area and the hydraulic gradient is approximately 0.0006 ft/ft to the southwest. In many area of the site the watertable is found below the top of the Magothy Aquifer and the UGA is unsaturated. The Bowling Green wellfield is located approximately 1200 feet downgradient of the NCIA. This wellfield consists of two high capacity public water supply wells that are completed in the lower Magothy Aquifer.

One of the initial tasks of the RI was to compile an Access database of all of the historical groundwater data for the NCIA. This data included the groundwater results from numerous investigations that have been conducted since the early 1980's in and around the NCIA.

The field investigation activities for the RI included the following field sampling activities:

- Three rounds of monitoring well sampling on existing wells in the area.
- Four rounds of sampling at the Bowling Green early warning wells.
- Completion of 4 new shallow monitoring wells in off-site locations.
- Completion of 4 hydropunch groundwater sampling locations.

LMS collected a total of 162 groundwater samples from the various sampling locations and submitted them to the NYSDEC contract laboratory for TCL VOC analysis. In addition to the VOC analysis, a subset of the samples collected during the third sampling round were analyzed for a number of parameters to evaluate the potential for monitored natural attenuation (MNA).

The groundwater analytical results showed concentrations of VOCs in excess of the Class GA groundwater standards in many of the samples that were collected. The groundwater samples that exhibited contamination had various halogenated volatile organic compounds (VOCs) including 1,1,1 trichlorethane (1,1,1-TCA), trichloroethylene (TCE), tetrachloroethylene (PCE), and the breakdown products of each compound.

Based on the results of the groundwater sampling and analysis past activities at the various sites within the NCIA has resulted in significant off-site groundwater contamination. The contamination has affected both the UGA and the upper zones of the Magothy Aquifer. The major conclusions drawn from the RI include:

- The source areas for the on-site groundwater and off-site groundwater contamination at the NCIA is clearly attributable to the individual facilities on the New York State Registry of Inactive Hazardous Waste Disposal Sites as Class 2 sites. Sampling conducted during this investigation and previous investigations has not identified any additional sources for this contamination, including any upgradient off-site sources.

- The area of historically impacted groundwater (Figures 5-5 to 5-8) indicates that three individual plume areas exist over the three depth intervals examined with the exception of the deepest sampled depth level (125 to 200 ft bgs) where only two apparent plume areas were found. The plume areas include one plume in the eastern portion of the NCIA, one plume in the central section of the NCIA and one plume in the western section of the NCIA. Each of the three plume areas are impacting the groundwater off-site.

- For each of the time periods which were examined, each of the plume areas at the shallow and intermediate depths appear to be generally of the same shape, size and magnitude of contamination. At the deepest depths, the data are limited and do not indicate an increasing plume size or increasing trend in contamination at depth.

- For those monitoring wells which have been sampled more than 6 times (40 of the 182 available wells), greater than 50% of the wells appear to have decreasing VOC concentrations. Thirty-seven percent of the wells continue to exhibit significant concentrations of VOCs, and of these approximately half show an apparent increase in VOC concentrations over the years. This suggests that although the concentrations of VOCs in the groundwater appear to be decreasing in a large percentage of the wells, a similar percentage of the wells have not show improvement or are increasing in concentration. Further analysis of the entire database indicates that naturally occurring breakdown of the parent compounds is not apparent, based on an evaluation of the relative percentages of the individual compounds to the total VOC concentration.

- The overall contaminant distribution is related to a number of factors at this site, which include:
  - The physical properties of the contaminants. The primary contaminants of concern are chlorinated solvents. As these compounds are present as non-aqueous phase liquids (NAPLs) on-site, a continuous source of contamination to off-site areas exists under present (2000) conditions. However, in the near future when proposed active remediation systems are installed at the on-site locations, these sources may no longer exist. These compounds are heavier than water in their pure form and will tend to sink into the aquifer. Overall these compounds do not appear to be rapidly breaking down in the aquifer.
  - Site geology and site hydrogeology including the influence of the Bowling Green production wells. The site geology and hydrogeology consists of a thick sequence of stratified unconsolidated sands, silts, and gravels. Only the deeper basal portion of the Magothy Formation is currently used as a source of raw public drinking water. Although the watertable is within the upper portions of the Magothy Aquifer, the fine-grained nature of the deeper portions of the aquifer appear to be limiting the downward migration of the contaminants. However, the presence of the Bowling Green supply wells produces a significant downward vertical gradient across these silts and clays in the deeper portion of the aquifer that tends to draw contaminants vertically downward. At this time, these silts and clays are the only factors that impede the migration of the contaminants to the supply wells.

- Currently, the only potential pathway of exposure to the groundwater contamination is through the Bowling Green water supply wells. Institutional controls at the supply wells insure that the actual drinking water is treated such that any contamination in excess of relevant standards is removed. There are no on-site pathways of exposure to the groundwater within the industrial area since no private or municipal water supply wells exist and the groundwater is not used in any other capacity.

Feasibility Study for the Off-Site Groundwater

A health exposure pathway analysis was conducted for the Frost Street sites to evaluate the baseline exposures to human health from the NCIA off-site groundwater contamination. Results of this health exposure pathway analysis were used to determine the need for remedial action at the sites and to select site remedial action objectives. Prior to the pathway analysis, chemical-, location-, and action-specific standards, criteria, and guidance (SCGs) were identified. Contaminants of concern (COCs) for the off-site groundwater were selected by reviewing the analytical data obtained in the RI and determining the frequencies of detection and ranges of detected concentrations of contaminants. A concentration-toxicity screening was then performed to identify those contaminants most likely to contribute significantly to the human health risk at the sites. COCs identified included VOCs (including PCE, TCE, and common breakdown products). No current or future exposure routes of significance were identified for the off-site groundwater contamination. In the future land use scenario, any resulting exposure pathways are expected to be of limited duration to individuals conducting excavation work (i.e., performing utility work) and can be appropriately addressed by using personal protective equipment and/or engineering control. No exposure pathways associated with site development or remedial activities (e.g., operation of in-situ groundwater systems) were identified for workers, site occupants, or visitors in the future. There were no current or future direct exposure pathways identified for COCs through groundwater ingestion, inhalation, or dermal contact by site occupants or visitors because institutional treatment controls are implemented by the Bowling Green Water District.

An FS was then conducted to address contamination in the off-site groundwater at levels exceeding the remedial action objectives. The initial step in the FS process was the identification and screening of potential remedial technologies. Potential technologies that address contaminated groundwater and air emissions (for purposes of evaluating possible air emissions from groundwater treatment systems) were identified and evaluated based on their feasibility, effectiveness in addressing site contaminants, and relative costs.

The technologies that were retained as applicable to project conditions and groundwater contaminants were then combined into a range of site-wide remedial alternatives. The alternatives were then developed to allow for a detailed evaluation of key tradeoffs among alternatives. The remedial alternatives were evaluated with respect to the EPA- and NYSDEC-specified criteria, which include overall protection of human health and the environment; compliance with SCGs; long-term effectiveness and permanence; reduction of toxicity, mobility, or volume of contamination through treatment; short-term effectiveness; implementability; and cost. Public comment on the remedial alternatives will be considered prior to final selection of a remedial action plan and will be addressed in the Record of Decision (ROD) for the site. Capital and long-term operations and maintenance (O&M) costs were estimated for each alternative, and the present worth of each alternative was calculated based on a 30-yr life and a 5% discount rate.

Eleven groundwater response alternatives were selected for inclusion in the detailed evaluation of alternatives. All of the alternatives developed for this FS considered that active source removal and groundwater remediation is in-place or planned at 13 source sites within the NCIA. The alternatives developed are as follows:

1. **Alternative 1: No Further Action**

Minimal prevention of human contact with off-site groundwater contaminants through institutional controls only. Contaminants remain in the environment, and groundwater SCGs are not quickly or actively achieved. Most inexpensive of the eleven alternatives (estimated present worth cost of $1.5 million).

2. **Alternative 2: Monitored Natural Attenuation**

Minimal prevention of human contact with groundwater contamination through institutional controls. Contaminants anticipated to remain in the groundwater for several years, as natural attenuation is relied upon to achieve groundwater SCGs. Alternative 2 ranks third out of the eleven alternatives in terms of lowest cost ($2.4 million).

3. Alternative 3: Monitoring, Assessment, and Contingent Remediation

Minimal prevention of human contact with off-site groundwater contaminants through institutional controls. Contaminants remain in the environment, and groundwater SCGs are not quickly or actively achieved. However, technical evaluations of groundwater data and remedial options (to be conducted annually) may lead to the implementation of an active remedy. Second most inexpensive of the eleven alternatives (estimated present worth cost of $2.2 million).

4. Alternative 4A: Remediation of Upper Portion of Aquifer (to 125 ft bgs) with In-Well Vapor Stripping / Localized Vapor Treatment

Alternative 4A employs in-well vapor stripping, an active remedy, to address groundwater contamination in the upper portion of the aquifer (to 125 ft bgs). Only "hot spot" areas are targeted with the active treatment system, and natural attenuation is relied on to help achieve SCGs. Alternative 4A ranks fourth out of the eleven alternatives in terms of cost ($2.8 million).

5. Alternative 4B: Remediation of Upper Portion of Aquifer (to 125 ft bgs) with Groundwater Extraction / Centralized Air Stripping and Vapor Treatment / Effluent Re-Injection

Alternative 4B utilizes groundwater extraction/air stripping (pump and treat) to address groundwater contamination in the upper portion of the aquifer (to 125 ft bgs). Only "hot spot" areas are targeted with the active treatment system, and natural attenuation is relied on to help achieve SCGs. Alternative 4B ranks eighth out of the eleven alternatives in terms of cost ($5.0 million).

6. Alternative 5A: Remediation of Upper and Deep Portions of Aquifer (to 200 ft bgs) with In-Well Vapor Stripping / Localized Vapor Treatment

Alternative 5A employs in-well vapor stripping to address groundwater contamination in the upper and deep portions of the aquifer (to 200 ft bgs). Only "hot spot" areas are targeted with the active treatment system, and natural attenuation is relied on to help achieve SCGs. Alternative 5A is the fifth most inexpensive groundwater alternative in the FS (estimated present worth cost of $3.6 million).

7. Alternative 5B: Remediation of Upper and Deep Portions of Aquifer (to 200 ft bgs) with Groundwater Extraction / Centralized Air Stripping and Vapor Treatment / Effluent Re-Injection

Alternative 5B uses a pump and treat system to address groundwater contamination in the upper and deep portions of the aquifer (to 200 ft bgs). Only "hot spot" areas are targeted with the active treatment system, and natural attenuation is relied on to help achieve SCGs. Alternative 5B ranks ninth in terms of alternative cost ($5.3 million).

8. Alternative 6A: Full Plume Remediation of Upper Portion of Aquifer (to 125 ft bgs) with In-Well Vapor Stripping / Localized Vapor Treatment

Alternative 6A addresses groundwater contamination in the upper portion of the aquifer (to 125 ft bgs) with in-well vapor stripping. A larger aerial extent of the off-site groundwater contamination is actively remediated in Alternative 6A (as compared to Alternative 4A). Alternative 6A is the sixth most inexpensive groundwater alternative (estimated present worth cost of $3.7 million).

9. Alternative 6B: Full Plume Remediation of Upper Portion of Aquifer (to 125 ft bgs) with Groundwater Extraction / Centralized Air Stripping and Vapor Treatment / Effluent Re-Injection

Alternative 6B addresses groundwater contamination in the upper portion of the aquifer (to 125 ft bgs) with groundwater extraction/air stripping. A larger aerial extent of the off-site groundwater contamination is actively remediated in Alternative 6B (as compared to Alternative 4B). In terms of cost, Alternative 6B ranks tenth out of the eleven groundwater response alternatives, with an estimated present worth cost of $7.1 million.

10. Alternative 7A: Full Plume Remediation of Upper and Deep Portions of Aquifer (to 200 ft bgs) with In-Well Vapor Stripping / Localized Vapor Treatment

Alternative 7A employs an in-well vapor stripping system to remediate groundwater contamination in the upper and deep portions of the aquifer (to 200 ft bgs). A larger aerial extent of the off-site groundwater contamination is actively remediated in Alternative 7A (as compared to Alternative 5A). Alternative 7A is the seventh most inexpensive groundwater alternative (estimated cost of $4.9 million).

11. Alternative 7B: Full Plume Remediation of Upper and Deep Portions of Aquifer (to 200 ft bgs) with Groundwater Extraction / Centralized Air Stripping and Vapor Treatment / Effluent Re-Injection

Alternative 7B addresses groundwater contamination in the upper and deep portions of the aquifer (to 200 ft bgs) with a pump and treat system. A larger aerial extent of the off-site groundwater contamination is actively remediated in Alternative 7B (as compared to Alternative 5B). Alternative 7B is the most expensive alternative evaluated in this FS, with an estimated present worth cost of $8.2 million.

Each of the groundwater response alternatives addresses the off-site groundwater contaminant plumes located downgradient of the NCIA. The active remediation systems proposed (i.e., Alternatives 4A through 7B) focus on treating the groundwater from the water table (located approximately 55 ft bgs) to 125 ft bgs (Alternatives 4A, 4B, 6A, and 6B) and to 200 ft bgs (Alternatives 5A, 5B, 7A, and 7B) to reduce elevated VOC concentrations in the upper and deep portions of the aquifer and prevent the plumes from spreading to further downgradient locations at significant concentrations.

CHAPTER 2

INTRODUCTION AND BACKGROUND

2.0 PURPOSE AND OBJECTIVES

The purpose of this groundwater RI is to determine the nature and extent of the groundwater contamination associated with the NCIA as a result of past disposal practices that have impacted the groundwater both on-site and off-site. The purpose of FS is to specifically address the remedial options for the off-site groundwater since any groundwater that is contaminated on-site will be addresses as part of the on-site groundwater remedial program. The objective of this RI/FS is to provide a comprehensive picture of groundwater contamination associated with the NCIA and to form the basis for the selection of off-site groundwater remedial actions. This RI/FS did not include any investigation or propose remedies of the contaminant sources or soil contamination at the Registry sites within the NCIA. On-site groundwater remediation and soil remediation will be part of the on-site remedial programs.

2.1 SITE LOCATION AND DESCRIPTION

The New Cassel Industrial Area (NYSDEC Site No. 1-30-043) is located in the Town of North Hempstead, Nassau County (Figure 1-1). Overall this groundwater RI/FS encompasses all on-site and off-site locations at the industrial area where impacts to the groundwater related to past disposal practices have been found. During the RI special emphasis was been placed on determining the impact to groundwater in off-site locations at the NCIA. The off-site locations are those areas downgradient (southwest) of the industrial area. In general terms this area includes the commercial and residential areas south of Old Country Road and Grand Boulevard. The NCIA is a heavily developed industrial and commercial area. Development in this area dates back to the 1950's and many of the properties have housed various business over the years. The areas along Old Country Road are primarily commercial with residential neighborhoods off each of the side streets to the south. The areas south of Grand Boulevard and the areas north of the NCIA are also residential areas.

2.2 SITE BACKGROUND

The NCIA contains numerous Registry sites as a result of past disposal practices of the various industries and businesses in the area. During the Preliminary Site Assessment (PSA) conducted by LMS (LMS 1996, LMS 1997) an extensive area of chlorinated solvent groundwater contamination was discovered in several area of the industrial area. The purpose of this RI is to complete three additional rounds of groundwater sampling on 50 on-site and off-site monitoring wells in the impacted area. The first and second round of sampling included 49 and 50 monitoring wells respectively, while the final round included a subset of 24 of these wells. In addition to the monitoring well sampling 4 monitoring wells and 4 hydropunch sampling locations were completed at off-site locations. This data was then summarized and compiled with all previous data to provide a comprehensive picture of the nature and extent of the groundwater contamination in the vicinity of the NCIA. The RI data also forms the basis for the development of the FS and the evaluation of possible remedial alternatives for the individual groundwater contaminant plumes.

2.3 REPORT ORGANIZATION

The RI/FS report is divided into two volumes and 12 chapters. Chapters 2 to 6 describe and summarize the RI, and chapters 7 to 12 describe the FS. The supporting documentation including the RI/FS data and field logs are arranged in appendices at the end of the report.

Volume I:

Chapter 1	Executive Summary
Chapter 2	Introduction and Background
Chapter 3	Field Investigation Procedures
Chapter 4	Physical Characteristics
Chapter 5	Nature and Extent of Contamination
Chapter 6	Summary and Conclusions of the Remedial Investigation

Volume II:

Chapter 7	Applicable Standards, Criteria, and Guidance
Chapter 8	Health Exposure Pathway Analysis
Chapter 9	Objectives of the Feasibility Study
Chapter 10	Identification and Screening of Technologies
Chapter 11	Development and Screening of Alternatives
Chapter 12	Detailed Evaluation of Alternatives

CHAPTER 3

FIELD INVESTIGATION PROCEDURES

3.1 INTRODUCTION

The RI field investigation included the installation of four new shallow monitoring wells and four hydropunch locations downgradient of the site. The monitoring well sampling program included three rounds of sampling in April and August 1999, and January 2000. The first two sampling rounds for the RI included sampling 42 existing monitoring wells surrounding the site, the four newly installed monitoring wells, and the four Bowling Green early warning wells to determine the extent and magnitude of groundwater contamination resulting from past practices at the NCIA. The third sampling round included a smaller subset of monitoring wells and the analytic testing included a number of parameters to evaluate monitored natural attenuation (MNA).

3.2 MONITORING WELL INSTALLATION

3.2.1 General Monitoring Well Details

Four new shallow monitoring wells were installed downgradient of the NCIA site from 5 April 1999 to 13 April 1999. Each of the wells were placed in various downgradient positions of the NCIA to supplement the existing monitoring well network (Figure 3-1). The monitoring wells were set in or just below the UGA at depths of approximately 70-ft bgs.

All of the newly installed wells were drilled using a 4.25-in. I.D. hollow-stem augers, as shown in Figure 3-2, and constructed from ten foot sections of threaded, flush-joint 2-in. Schedule 40 PVC (Figure 3-3). Each of the new wells was fitted with 10 feet of 10-slot sized Schedule 40 PVC screen. The sand filter pack surrounding the screened interval of each well consisted of No. 1 grade Morie sand installed to a minimum of 2 ft above the top of the screen a bentonite well seal was then installed above the sand pack. Since the well seal was above the water table a layer of bentonite pellets at least 2-ft thick was added to the annulus of the well and hydrated with water. After installing the sand pack and bentonite

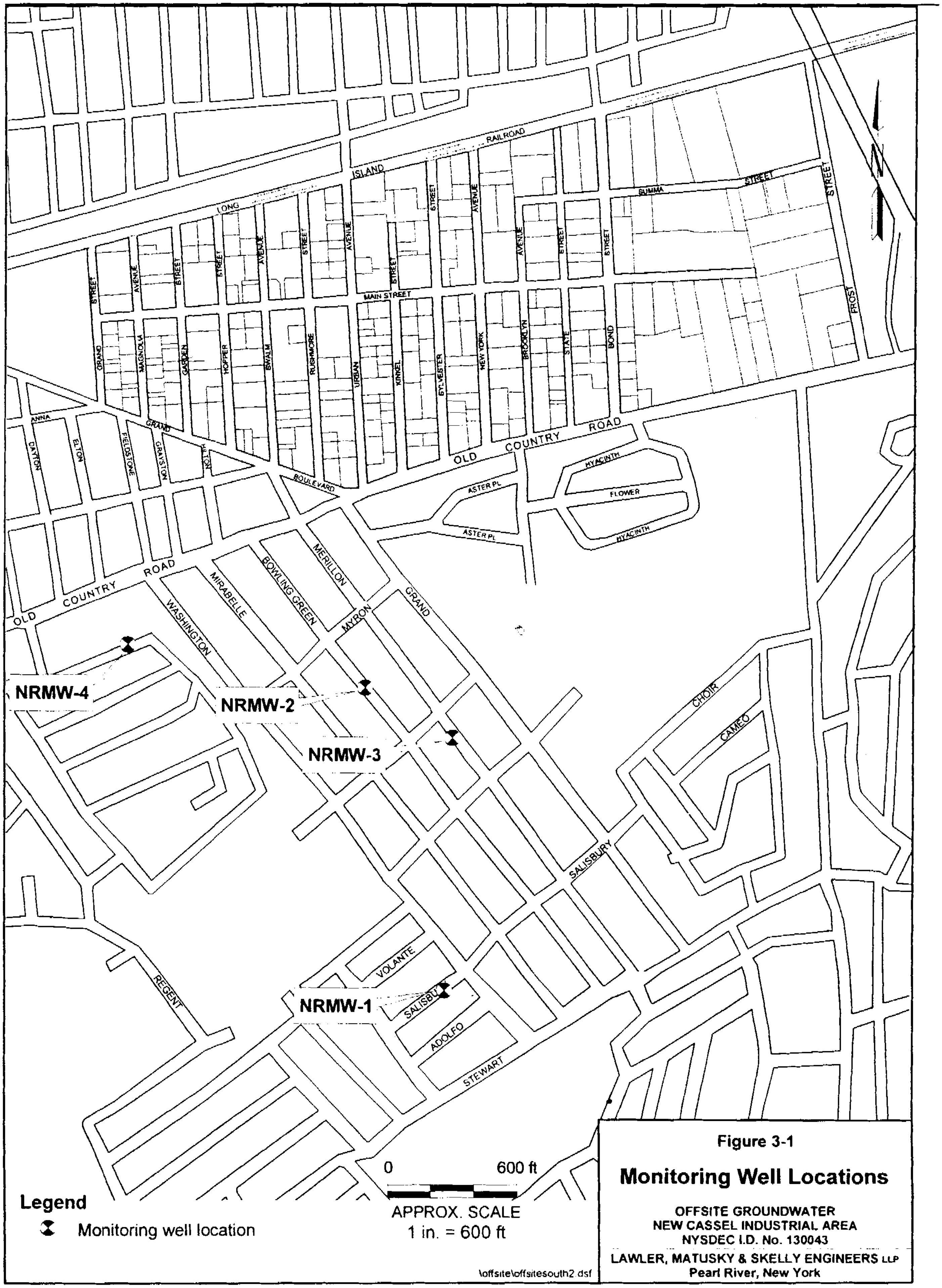
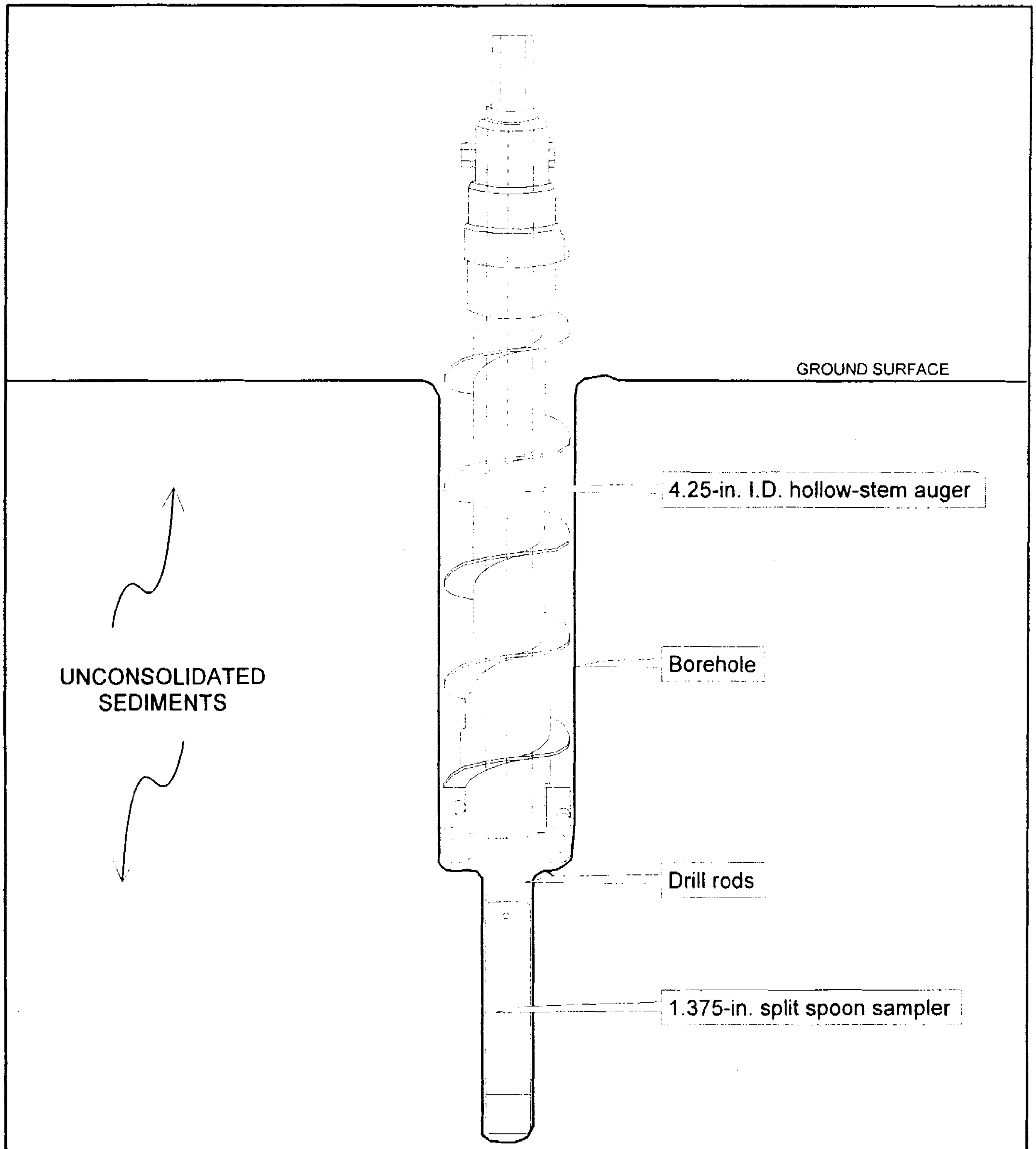


Figure 3-1

Monitoring Well Locations

OFFSITE GROUNDWATER
NEW CASSEL INDUSTRIAL AREA
NYSDEC I.D. No. 130043

LAWLER, MATUSKY & SKELLY ENGINEERS LLP
Pearl River, New York



NOT TO SCALE

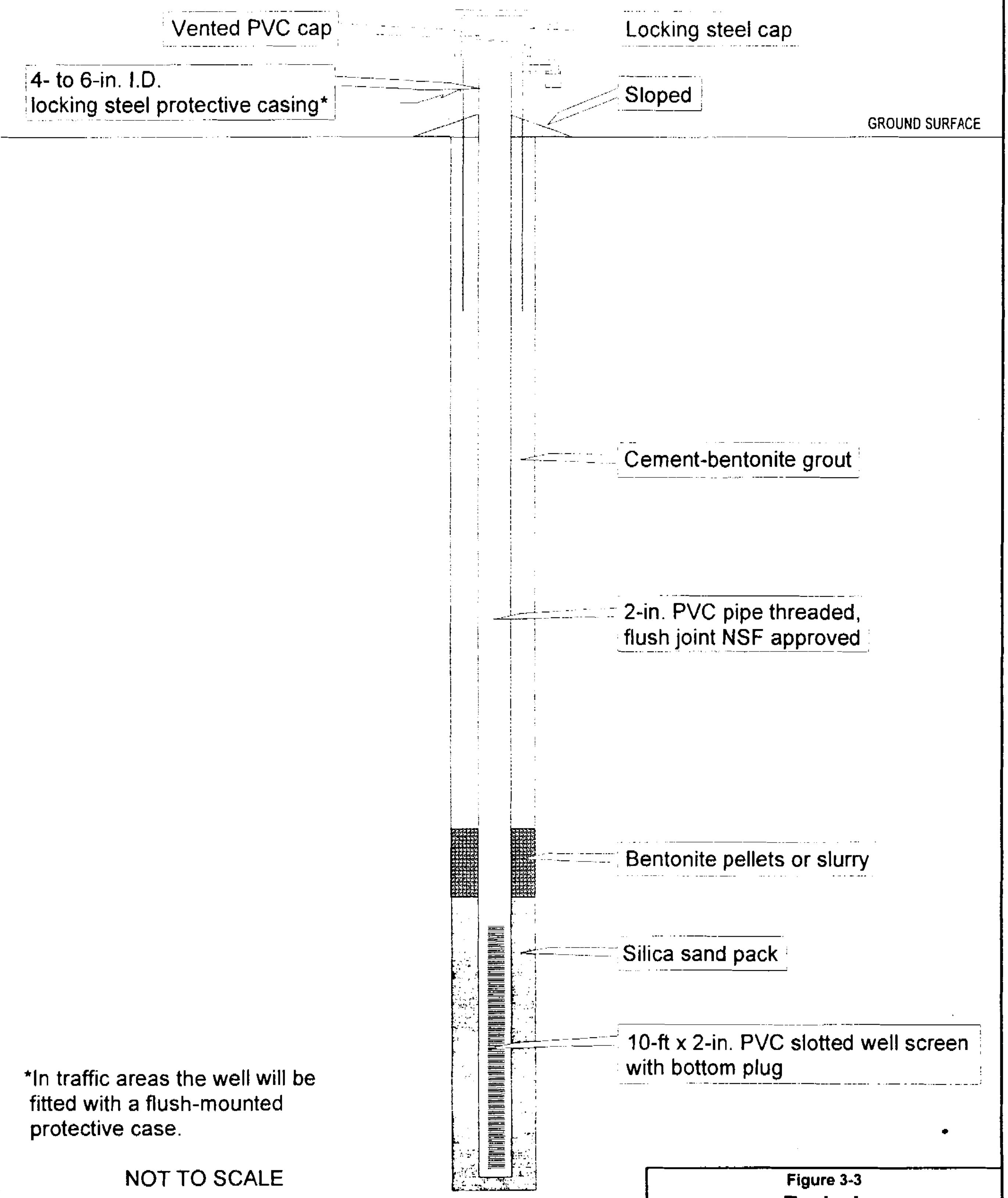
\offsite\boring xsection and well const.dsf

Figure 3-2

Test Boring/Sampling Cross Section

OFFSITE GROUNDWATER
NEW CASSEL INDUSTRIAL AREA
NYSDEC I.D. No. 130043

LAWLER, MATUSKY & SKELLY ENGINEERS LLP
Pearl River, New York



*In traffic areas the well will be fitted with a flush-mounted protective case.

NOT TO SCALE

Figure 3-3

Typical Overburden Monitoring Well Construction

OFFSITE GROUNDWATER
NEW CASSEL INDUSTRIAL AREA
NYSDEC I.D. No. 130043

LAWLER, MATUSKY & SKELLY ENGINEERS LLP
Pearl River, New York

\offsite\boring xsection and well const.dsf seal the remaining volume of the borehole was filled to just below the surface with a bentonite and cement grout. The remainder of the borehole was filled with clean sand to provide adequate drainage around the protective case. Finally, a flush mounted well cover was installed with a surrounding cement pad. All cuttings from the drilling of the wells were containerized for later disposal in a 15 cubic yard covered roll-off located at the Bowling Green wellhead. Installation details for each well can be found in the monitoring well completion logs in Appendix A. Once the monitoring wells were installed a New York State licensed land surveyor established the location and elevation of each of the wells.

3.2.2 **Monitoring Well Soil Sampling**

During installation of each of the wells soil samples were collected using a 1.375-in I.D. split spoon sampler (Figure 3-2). The sampler was driven with either a 140-lb or 175-lb hammer in accordance with the standard penetration test method ASTM-D 1586. Samples were collected in 2-ft runs at 5-ft intervals from the ground surface to the bottom of the well boring. Upon recovery of the split spoon sample the soil was immediately scanned for VOCs using an FID or PID and the reading (relative to background), sample interval, soil description, blow counts, moisture content, color and evidence of contamination entered on a test boring log. Field boring logs and monitoring well completion logs are contained in Appendix A. Portions of each sample were bagged and labeled for field reference and comparison purposes while drilling the other wells but no split spoon samples were sent off-site for chemical analysis

3.2.3 **Specific Monitoring Well Details**

Specific monitoring well details are listed in Table 3-1 and water level data can be found in Table 3-2. All four of the newly installed wells were developed after installation. The new wells were allowed to set at least 24-hrs before development. All development was done using a 2-in. submersible pump. The development water was pumped into a 55-gal holding tank before being discharged under permit into a Nassau County sewer line. The monitoring well development was completed on 13 April 1999. Groundwater parameters such as pH, specific conductivity, temperature and turbidity were measured and logged during development. Development of the four new monitoring wells was done until the well had been pumped for three hours or the turbidity measured less than 50.0 NTUs. All four

TABLE 3-1

MONITORING WELL SUMMARY

NCIA OFF-SITE WELLS

Well I.D.	Total Depth (ft)	Screened Interval (ft)	Riser material	Riser length (ft)	DTW (ft)	Filter pack	Seal	Protective case
NRMW-1	70	60-70	PVC (2")	60	40.6	#1 sand	bentonite	flush mount cap
NRMW-2	70	60-70	PVC (2")	60	44.45	#1 sand	bentonite	flush mount cap
NRMW-3	70	60-70	PVC (2")	60	40.2	#1 sand	bentonite	flush mount cap
NRMW-4	70	60-70	PVC (2")	60	42.25	#1 sand	bentonite	flush mount cap

TABLE 3-2

GROUNDWATER ELEVATIONS

NCIA OFF-SITE WELLS

Well I.D.	Groundwater elevation (ft MSL) (4/15/1999)	Groundwater elevation (ft MSL) (4/20/1999)	Groundwater elevation (ft MSL) (8/10/1999)	Groundwater elevation (ft MSL) (1/11/2000)
NRMW-1	66.41	66.36	63.33	63.48
NRMW-2	68.25	68.27	65.26	63.70
NRMW-3	68.04	68.13	64.95	65.56
NRMW-4	67.78	67.81	65.03	65.24

new monitoring wells were developed at a rate of approximately 4-gal/min and turbidity levels stabilized to less than 50 NTUs in approximately 1 hour. The monitoring well development logs are found in Appendix B.

3.2.4 **In-situ Hydraulic Testing**

Slug tests were performed on each of the new monitoring wells to characterize the hydraulic conductivity of the aquifer in which they were screened. The slug test relates the response of the aquifer to an artificial change in water level at the monitoring well over time. A pressure transducer was first lowered into the water column in the monitoring well to a level well below that of the static water level and carefully fixed at that level to prohibit any movement. The transducer and water level were allowed to equilibrate and a stainless steel slug was lowered into the well to a point just above the top of the water column. At that point the static water level was set to be the reference level for the transducer. From this point any fluctuation in water level was displayed as a positive or negative displacement relative to the reference water level. The slug was then lowered instantaneously into the water, displacing an equal volume of water and raising the water level. At the moment the slug was lowered the Hermit data logger was activated to record the change in water level detected by the pressure transducer through time. The Hermit logger coupled with the transducer made it possible to record a large number of water level measurements in a short period of time. This was especially important in the wells tested since the UGA is highly permeable and exhibit very rapid recovery after being stressed. The Hermit logger was set to collect data on a logarithmic time scale such that many measurements were taken early in the test and the frequency of measurement would decrease with time. Once it was apparent that the water level had fully recovered (approximately 10 minutes) the data logger was stopped and programmed for the next phase of the test that involved the removal of the slug from the water column. The data logger was started and the slug was quickly pulled out of the water and the recovery response was again logged for about 10 minutes.

Data from the slug tests were downloaded from the Hermit logger to a PC and used in AQTESOLV, a hydraulic testing analysis program. AQTESOLV utilized the Bouwer-Rice method and a graphical solver to calculate the hydraulic conductivity of the aquifer based on the data collected in the field. Appendix C contains the graphical presentation of the in-situ hydraulic testing data and results from analysis of these data.

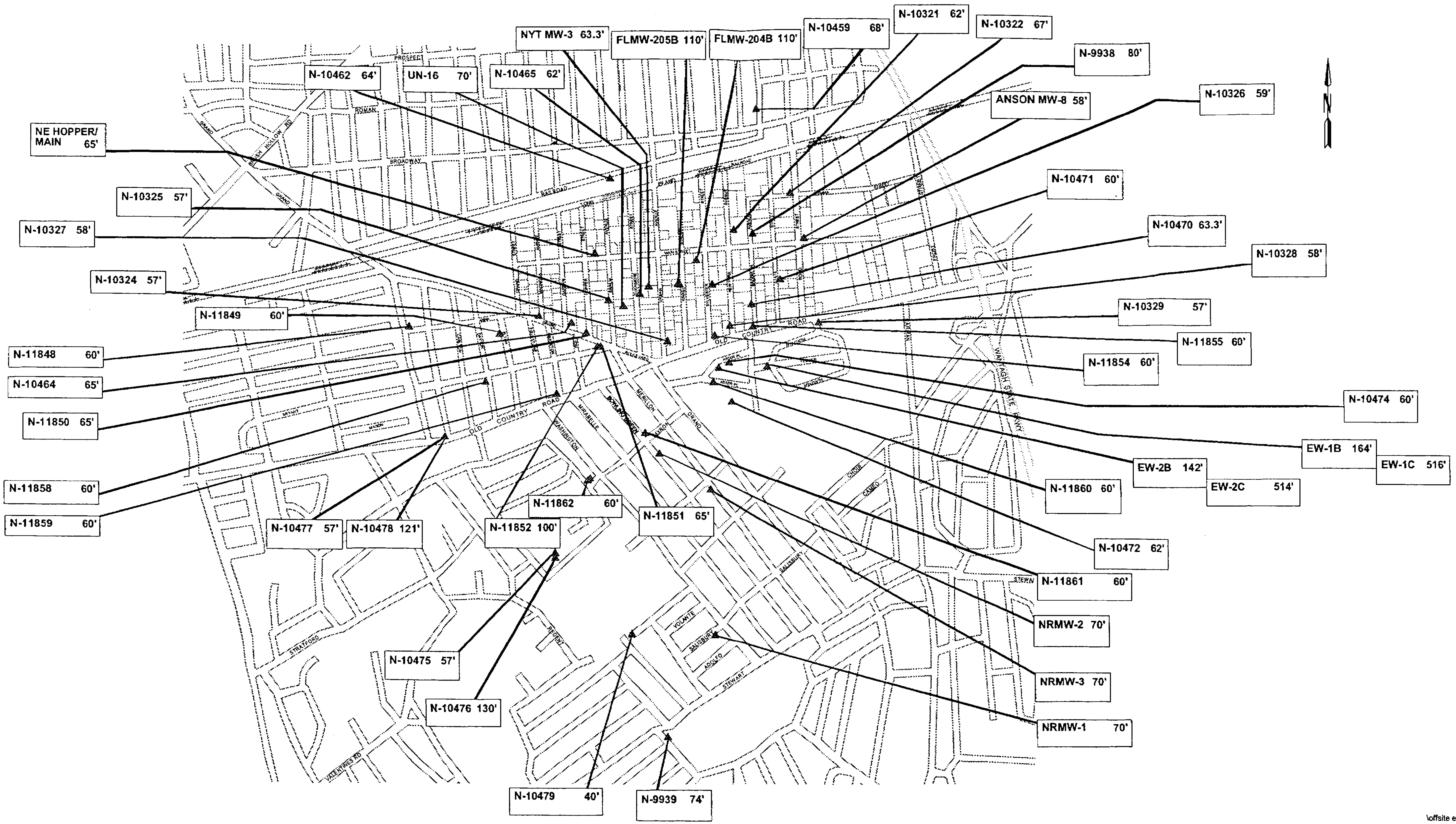
3.3 MONITORING WELL SAMPLING AND ANALYSIS

3.3.1 Groundwater Sampling Protocol

Groundwater sampling was conducted at series of 50 wells surrounding the NCIA site during three separate sampling rounds (Figure 3-4 to Figure 3-6). The existing wells included wells installed by Nassau County, the USGS, NYSDEC, and several individual property owners. Specific details on the well locations, construction information, and sampling information are found in Appendix D. In addition to the 41 existing wells in the area, the 4 newly installed wells and the 4 Bowling Green early warning wells were also sampled during the April 1999 RI Field activities. A second sampling round of the same subset of wells and sampling protocol as the first round was conducted in August 1999 (Figure 3-5). During the second round one additional monitoring well was added so that a total of 50 groundwater samples were collected. The final round of monitoring well sampling was conducted January 2000 (Figure 3-6) and included a reduced subset (24 monitoring wells) of the monitoring well network.

Prior to sampling, each monitoring well was purged to remove the standing water inside the well. A minimum of three well volumes was removed to insure that water being sampled was representative of that contained in the aquifer. Purging of shallow wells with water column heights less than ten feet was done by hand bailing due to the small amount of purging necessary. The intermediate and deep wells often had larger water columns requiring prohibitive lengths of time to hand bail the required amounts of water. These wells were purged using a 2" Grundfos submersible pump or other similar submersible pump. During purging of the wells, pH, conductivity, temperature and turbidity were monitored at intervals determined by the amount of water necessary for adequate purging. In January, alkalinity, chloride, dissolved oxygen, oxidation-reduction potential (ORP), hardness, and Fe^{2+} were also monitored during purging. All purge water was containerized in a large plastic holding tank for transport to a pre-determined Nassau County sanitary sewer manhole.

Groundwater samples were collected after purging using dedicated Teflon bailers. At each well 40-ml pre-cleaned glass vials were filled for VOC analysis. Sampling parameters (pH, conductivity, temperature and turbidity) were measured and recorded on a sampling log at the beginning and end of sampling at each well. The deep Bowling Green early warning wells were sampled using the same sample procedures with the



\offsite extended data.dsf

LEGEND:

Well ID	Depth
N-10479	40'

Well Location ▲

0 1200 ft

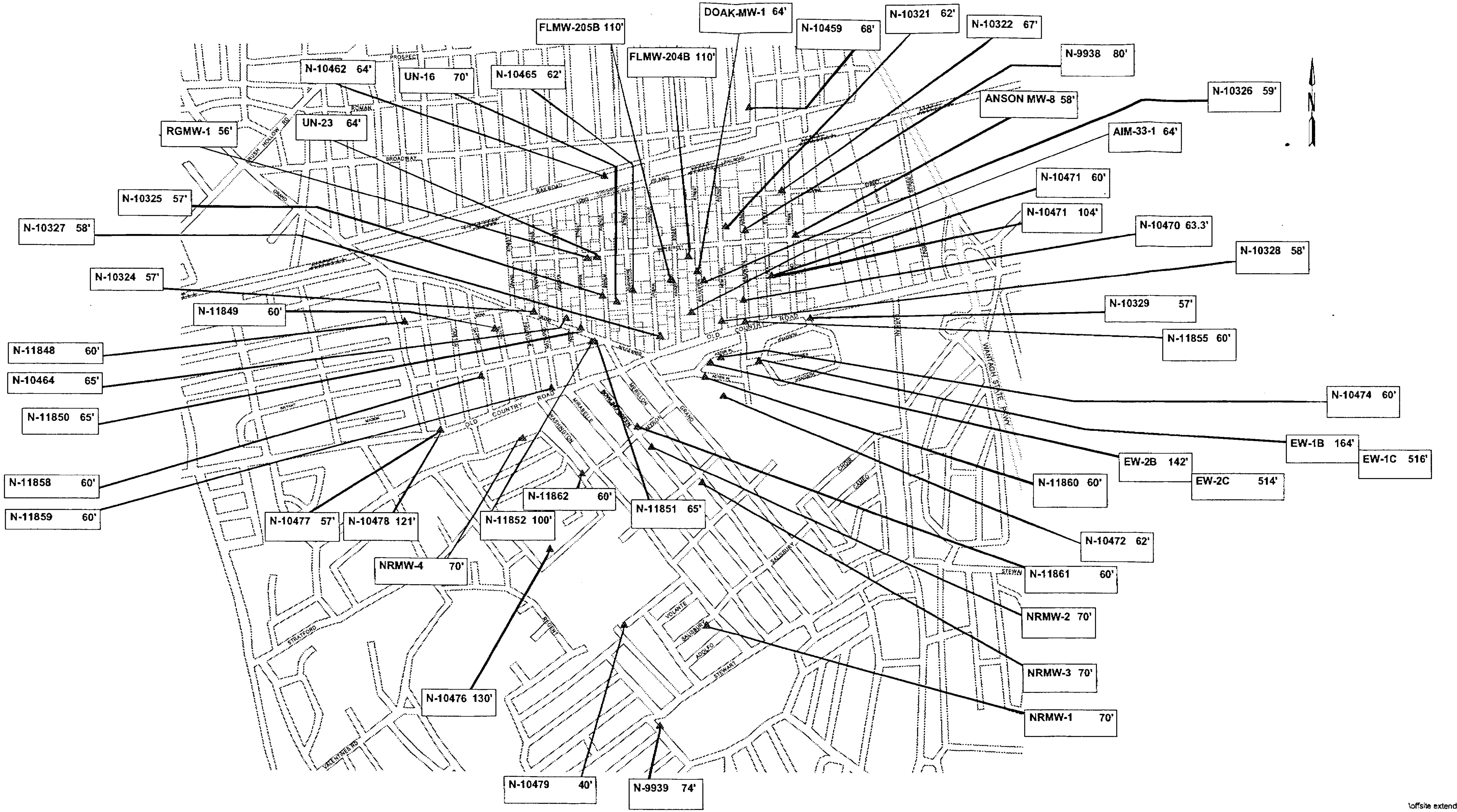
Approximate Scale
1 in. = 1200 ft

Figure 3-4

Monitoring Wells Sampled April 1999 (Round 1)

OFFSITE INVESTIGATION
NEW CASSEL INDUSTRIAL AREA
NYSDEC I.D. No. 130043

LAWLER, MATUSKY & SKELLY ENGINEERS LLP
Pearl River, New York



\offsite extended data.dsf

LEGEND:

Well ID	Depth
N-10479	40'

Well Location ▲

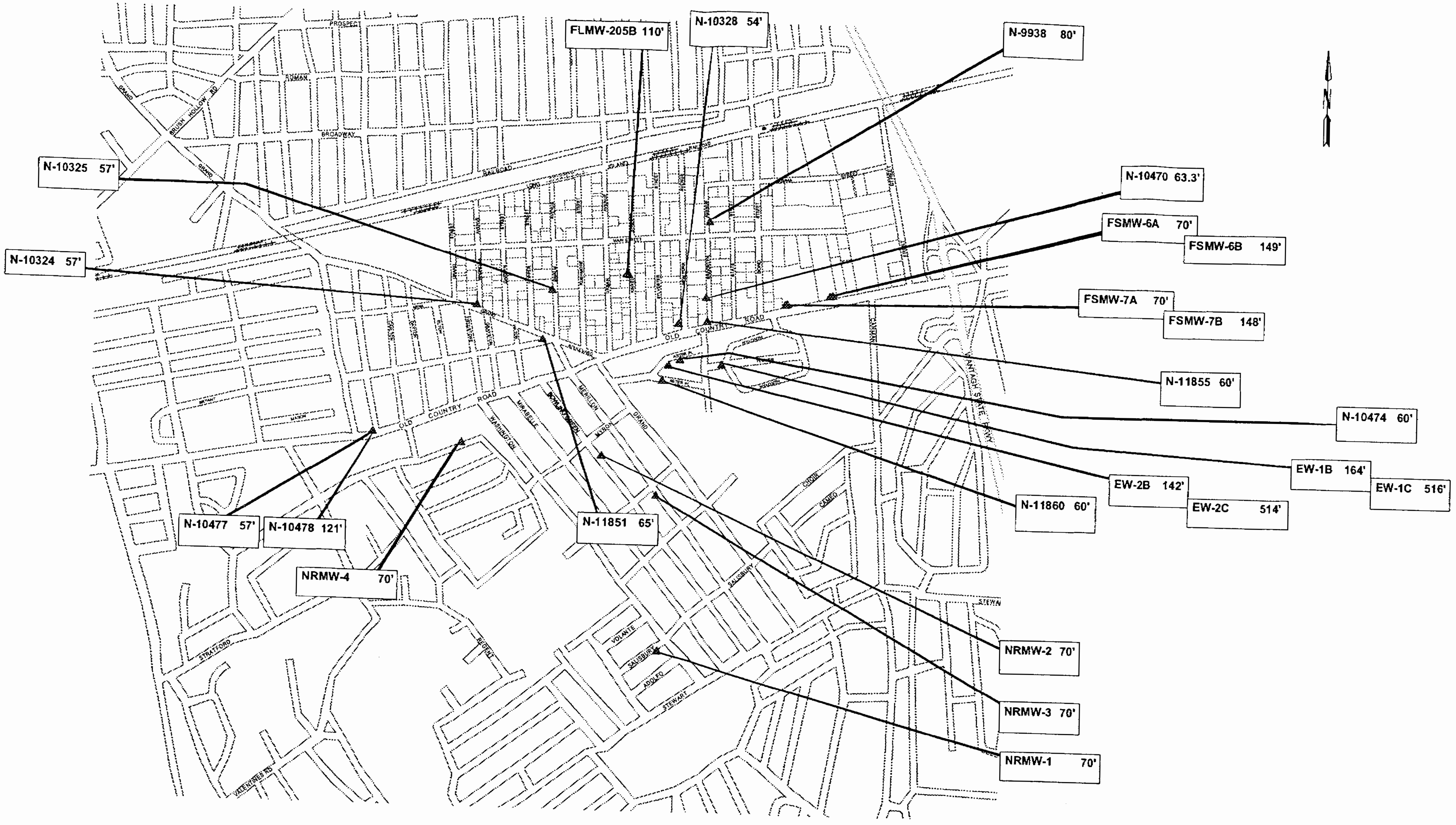
0 1200 ft
Approximate Scale
1 in. = 1200 ft

Figure 3- 5

Monitoring Wells Sampled August 1999 (Round 2)

OFFSITE INVESTIGATION
NEW CASSEL INDUSTRIAL AREA
NYSDEC I.D. No. 130043

LAWLER, MATUSKY & SKELLY ENGINEERS LLP
Pearl River, New York



LEGEND:

Well ID	Depth
N-10479	40'

Well Location ▲

0 1200 ft

Approximate Scale
1 in. = 1200 ft

\offsite extended data.dsf

Figure 3- 6

Monitoring Wells Sampled January 2000 (Round 3)

OFFSITE INVESTIGATION
NEW CASSEL INDUSTRIAL AREA
NYSDEC I.D. No. 130043

LAWLER, MATUSKY & SKELLY ENGINEERS LLP
Pearl River, New York

exception that the samples were collected directly from the dedicated pump after the appropriate purging period. QA/QC samples, including field blanks, matrix spike and matrix spike duplicate, and a blind duplicate, were also collected. Upon collection of samples they were immediately packaged in protective wrap and placed in a secure, ice-filled cooler for storage in the field. At the end of each day all samples were logged on an appropriate chain of custody record and carefully packaged on ice. All groundwater samples were hand delivered to H2M Laboratories for TCL VOC analysis under direct contract to the NYSDEC. Groundwater samples collected in January 2000 were also submitted for methane, ethane, ethene, arsenic, total iron, manganese, sulfate, nitrate, and total organic carbon (TOC) analyses.

3.4 HYDROPUNCH GROUNDWATER SAMPLING

3.4.1 General Hydropunch Details

Four hydropunches were installed downgradient of the NCIA site from 17 January to 11 February 2000. Each of the hydropunches were placed in various downgradient positions of the NCIA including one hydropunch immediately downgradient of the Bowling Green production wells (Figure 3-7). The hydropunches were sampled from the groundwater table (approximately 60 ft) in ten-ft increments down to 150 ft bgs.

All of the hydropunches were drilled using 4.25-in. I.D. hollow-stem augers, as shown in Figure 3-2. After the hydropunch was completed, the augers were removed and the borehole was filled to the surface with a cement/bentonite grout. All cuttings from the drilling of the hydropunches were containerized for later disposal in a lined, covered, low-profile roll-off located at the Bowling Green wellhead. Boring logs for each hydropunch can be found in Appendix A.

3.4.2 Hydropunch Soil Sampling

Soil samples were collected using standard ASTM-D 1586 methods as described in Section 3.2.2. Boring logs completed during the installation of the hydropunches are contained in Appendix A. None of the soil samples collected from the split spoons were sent off-site for chemical analysis.

3.4.3 Specific Hydropunch Details

Groundwater samples were collected at the water table (approximately 60 ft), in ten-ft

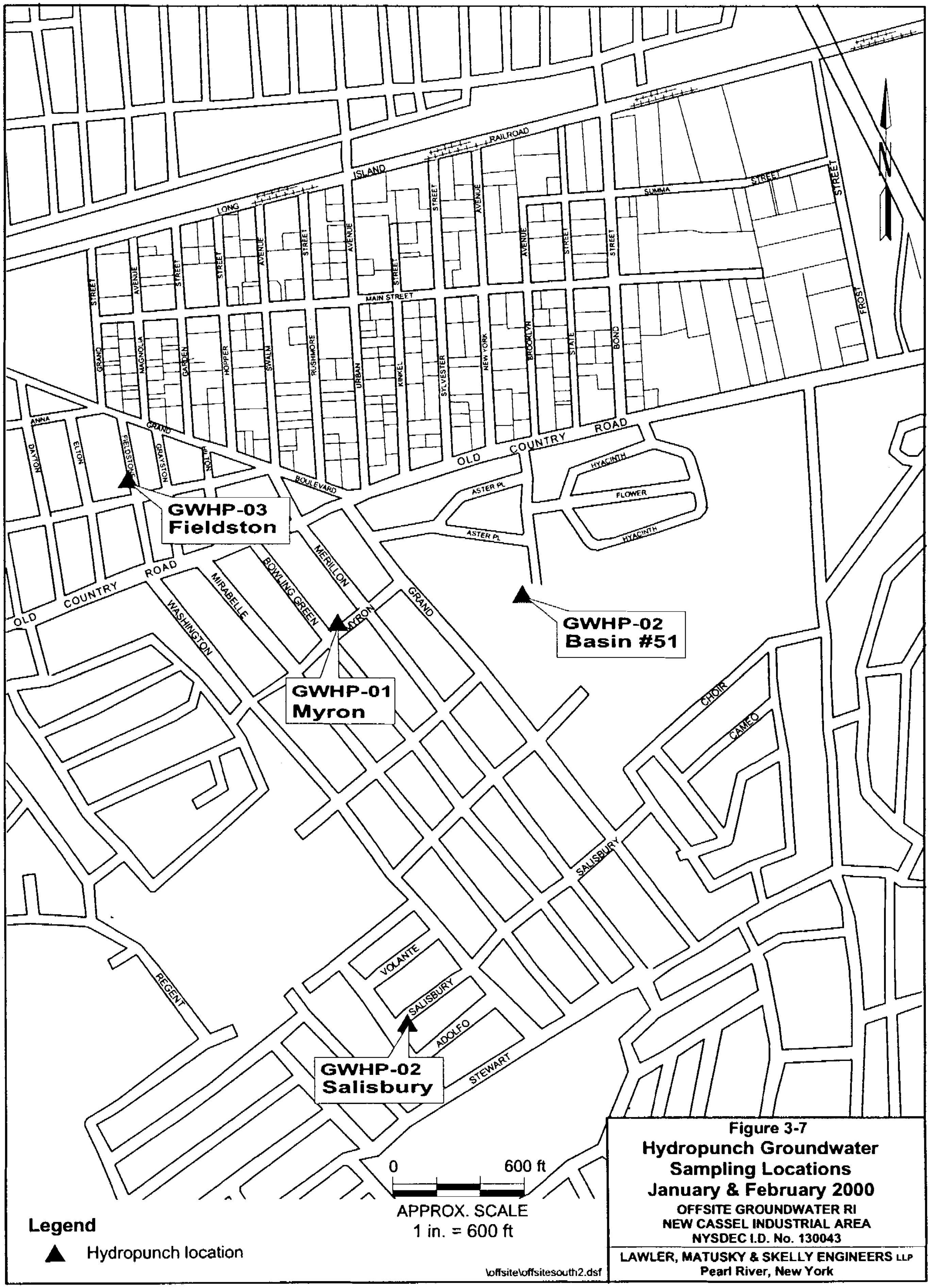


Figure 3-7

Hydropunch Groundwater Sampling Locations January & February 2000

OFFSITE GROUNDWATER RI
NEW CASSEL INDUSTRIAL AREA
NYSDEC I.D. No. 130043

LAWLER, MATUSKY & SKELLY ENGINEERS LLP
Pearl River, New York

increments down to 150 ft bgs using a hydropunch sampling system. A total of 39 groundwater samples were collected during the hydropunch sampling, only one of the sampling attempts failed to recover enough groundwater for sampling purposes.

The drilling rods were removed from the boring at each of the specified sampling depths and a steam-cleaned hydropunch tool attached to the rods. The rods were then lowered back into the boring and the hydropunch driven to the targeted sampling depth. Once the hydropunch tool was driven to the desired depth, it was retracted several inches to expose the sample port. The hydropunch tool was then allowed to fill with the groundwater sample. Once the hydropunch tool was filled, it was returned to the surface and the groundwater sample was transferred to laboratory-cleaned glass VOC vials, labeled with the appropriate sample location, interval, date, time, sampler, and required analyses. Each of the groundwater samples were hand delivered to H2M Laboratories for analysis under direct contract to the NYSDEC.

Upon completion of the hydropunch sampling, the boreholes were grouted with Type 1 Portland cement and betonite mixture. The ground surface above the borehole was then repaired with asphalt patch.

3.5 RELATED FIELD INVESTIGATION PROCEDURES

3.5.1 Decontamination

All equipment that came into direct contact with potentially contaminated soils, sediments, and groundwater was decontaminated before being removed from the site. In addition, equipment used for the installation of soil borings was decontaminated between each boring location to prevent cross-contamination. Downhole equipment used during the construction of the monitoring wells and hydropunches was steam cleaned.

Equipment decontamination procedures used at each site consisted of the following steps:

- Physically removed packed dirt, grit, mud, and debris with a wire or soft bristle brush.
- Scrubbed all potentially contaminated surface areas with a water/detergent solution.
- Rinsed off scrub solution with a potable water rinse.
- Allowed to drip and air dry on-site.
- Scanned equipment with a PID or FID to assure the absence of contamination

prior to removal from the site.

3.5.2 Waste Handling and Disposal

Investigation derived wastes (IDW) included disposable personal protective equipment (PPE), soil cuttings, decontamination rinse water, well development water, and general trash. These wastes were handled as described below.

3.5.3 Soil Cuttings from Hydropunch Sampling

The drilling cuttings were containerized for off-site disposal since these areas are developed and suitable locations to disperse soil cuttings were not available. A lined, covered, low-profile roll-off was staged in the Bowling Green wellhead area to store these materials until LMS completes analytical testing on the materials. After analytical testing determines the classification of the cuttings (hazardous, contaminated, or clean) the cuttings will be disposed of properly. Disposal options include:

- Disposal as clean fill.
- Disposal at an industrial waste landfill if soils are non-hazardous, but exceed cleanup criteria.
- Disposal at an approved treatment, storage, and disposal (TSD) facility if soils exceed hazardous criteria.

3.5.4 Decontamination Water

Water generated from the decontamination of equipment and personnel was discharged to the ground surface.

3.5.5 Disposable Personal Protective Equipment (PPE) and General Trash

Used PPE and other trash was stored in appropriate trash bags on site. Upon completion of the field activities, the trash generated was transported back to an LMS facility for proper disposal.

3.5.6 Site Restoration

LMS and its subcontractors restored any damaged grass or landscaped areas. All boreholes were patched using cold patch or concrete. No further site restoration was required by the NYSDEC.

CHAPTER 4

PHYSICAL CHARACTERISTICS

4.1 TOPOGRAPHY

The land surface in the vicinity of the NCIA site is essentially level with groundsurface elevations ranging from approximately 120 ft to 100 ft above mean sea level. The land in this area naturally has only a very gentle southward slope and the lack of relief has likely been enhanced in the area surrounding the site by grading done during construction of the large number of surrounding structures.

4.2 SURFACE WATER

The nearest sources of surface water are several small ponds in and around Eisenhower Memorial Park, approximately two miles southwest of the site. Typically, this area of Long Island does not have many surface water bodies due to the highly permeable subsurface material and depth to groundwater, precipitation quickly infiltrates into the subsurface.

4.3 DEMOGRAPHY AND LAND USE

The NCIA site is located in the town of North Hempstead (Nassau County, New York). Based on the 1990 census the population of the county is 1.3 million and of North Hempstead about 200,000 (U.S. Department of Commerce, 1990). The NCIA is a heavily industrialized area with a variety of small to medium sized businesses covering about 25 blocks. The NCIA is bounded to the north by the Long Island Railroad, to the south by Old Country Road, to the east by the Wantagh Parkway and to the west by Grand Boulevard. For miles east and west of the NCIA, along Old Country Road, commercial property dominates while land use north and south of the area consists primarily of residential property.

4.4 ECOLOGY

Based on an ecological communities classification system outlined by NYSDEC the NCIA is entirely comprised of a terrestrial cultural community. The terrestrial cultural subsystem is defined by communities that are direct results of the influence of human activities or are modified to such an extent as to be significantly changed from the community as it was before alteration by humans (NYSDEC, 1990).

From the classification system utilized by the NYSDEC, five ecological communities dominate the NCIA. The first community (NYSDEC terrestrial cultural community #16) accounts for approximately 20% of the NCIA and is characterized by roads and paths paved with asphalt, concrete, brick and stone with only sparse vegetation present in cracks in the surface. Junkyards (NYSDEC terrestrial cultural community #30) that have been utilized for storage of refuse are another component of the NCIA ecology and account for approximately 10% of the NCIA. Urban vacant lots (NYSDEC terrestrial cultural community # 31) comprise about 10% of the NCIA. These lots are characterized by debris laden, sparsely vegetated open sites within a developed area where construction is pending or demolition has occurred. Urban structure exteriors (community #32) and interiors of non-agricultural buildings (community #35) compose the majority of the NCIA. Approximately 35% of the area is made up of the interior of non-agricultural buildings, including those used for commercial or industrial purposes. Urban structure exteriors make up approximately 25% of the area of the NCIA and include exteriors of commercial buildings or any inorganic structural surface. Typically, only sparse vegetation is present but birds and insects are common. (NYSDEC, 1990)

4.5 CLIMATOLOGY

The climate of Long Island is moderated by its proximity to the ocean and land surfaces that are very close to sea level. Precipitation, distributed evenly through the year, averages about 44-in. per year with a range between approximately 32 and 58-in. per year. Rainfall amounts reach a maximum in August with 3 to 4.5 inches recorded in a typical year. Temperatures range from an average low of 32°F in January to an average high of about 75°F in July. The average annual temperature on Long Island over an 85 year period is 52.7°F (USGS, 1963).

4.6 SOILS

The soils in the area around the NCIA are medium - coarse grained, well drained soils of the Haven Variant association. This association is typically a deep soil formed on the nearly level land (0-3%) of the southern outwash plain. At depths between 20 to 36 inches the loamy, upper soils are underlain by stratified sands and gravel. The upper soil material is moderately permeable while the deeper sand and gravel has a very high permeability (USSCS, 1976).

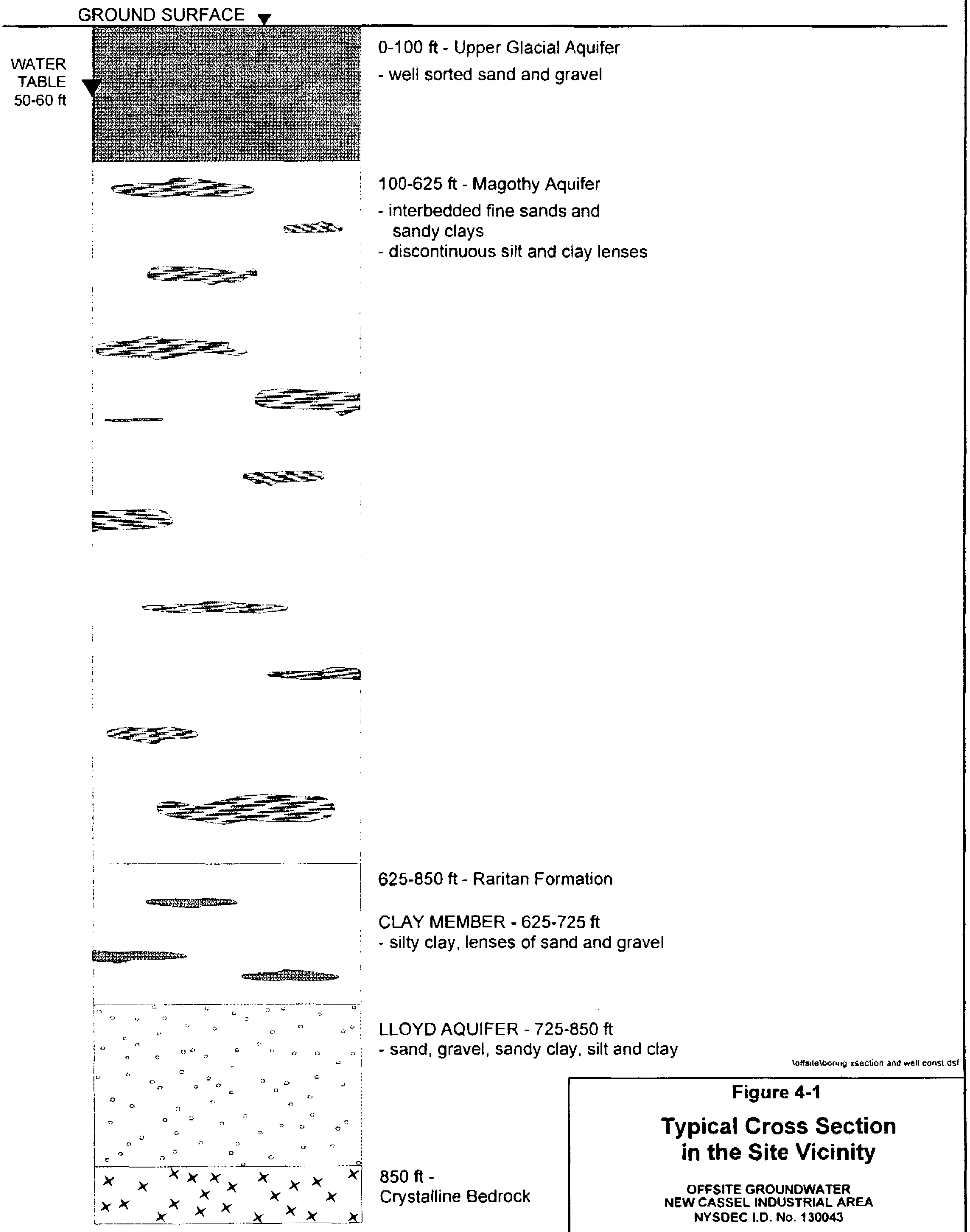
4.7 GEOLOGY

4.7.1 Regional Geology

Long Island regional geology consists of a significant thickness of unconsolidated sediments (Cretaceous and Pleistocene age) overlying Precambrian and Paleozoic basement bedrock consisting of gneiss, schist and granite that forms the base of Long Island (Figure 4-1). The bedrock surface is found at an average depth of approximately 1000-ft below sea level and dips southward to the south shore of the island (USGS, 1989).

Directly above the bedrock lies the Raritan Formation, composed of the lower Lloyd Sand Member and an upper confining layer of clay. The Lloyd Sand Member is one of three important aquifers in the study area and consists of poorly sorted quartzose sands and gravel. The top of the Raritan Formation is encountered at an average depth of approximately 400-ft below sea level with a maximum thickness of about 700-ft (USGS, 1989).

Unconformably overlying the Raritan Formation is the Magothy Formation, consisting of interbedded lenses and layers of fine to medium sand, clayey sand and solid clay with a basal gravel zone. The Magothy is the major aquifer for public supply to nearly all of Long Island. The depth of the upper surface of the Magothy is found at about 100-ft below sea level and the formation thickens to the south, reaching a maximum thickness of 1100-ft in some locations.



\offsite\boring xsection and well const.dsf

Figure 4-1

Typical Cross Section in the Site Vicinity

OFFSITE GROUNDWATER
NEW CASSEL INDUSTRIAL AREA
NYSDEC I.D. No. 130043

LAWLER, MATUSKY & SKELLY ENGINEERS LLP
Pearl River, New York

What lies above the Magothy Formation is a function of the geographical location on the island. In eastern Nassau County and Suffolk County the Monmouth greensand, a glauconitic greenish-grey to greenish black sand, silt and clay overlies the Magothy. This member acts as an upper confining unit for the Magothy, however, it has a very limited areal extent, pinching out about three miles inland from the south shore and disappearing altogether at the far eastern end of the island. Further west, in Kings and Queens counties, the Jameco Gravel, a mix of poorly sorted sands and small gravel, can be found in a layer approximately 100-ft thick extending from the south shore to the middle of the island (USGS, 1989).

The Gardiners Clay is another confining unit for the Magothy Formation or Jameco Gravel (if present) but it also has a relatively small areal extent. The occurence of the Gardiners Clay is limited to the south shore of the island, pinching out 5 to 10 miles inland from the shore. As the name implies, the Gardiners is characterized by greyish-green, glauconitic, silty clay with a maximum thickness of approximately 150-ft (more typically about 50-ft) (USGS, 1989).

Above the Gardiners Clay or the Magothy (where the Gardiners is absent) are upper Pleistocene deposits of clay, sand, gravel and boulders commonly referred to as the UGA (upper glacial aquifer). These deposits are composed of glacial till (morainal materials to the north and outwash deposits to the south) and constitute another important water source for the island (Buxton and Modica, 1992).

4.7.2 **Study Area Geology**

The geology underlying the NCIA site in east-central Nassau County is somewhat simpler than the regional geology detailed above. The upper Pleistocene deposits of poorly sorted sands and gravel that make up the UGA are found from the surface to a depth of approximately 50 to 70-ft below the surface. The site is located far enough north and east in Nassau County such that the Gardiners Clay, Jameco Gravel and Monmouth greensand are all absent between the UGA and the underlying Magothy Formation. In general, the upper surface of the Magothy Formation is found at least 100-ft below ground surface (USGS, 1989). However, based on observations made during installation of wells for this investigation and on published cross sections of the area (USGS, 1989), the Magothy is found at significantly shallower depths (50 to 70-ft bgs) in the Westbury (New Cassel) area than in many other areas of the island. The available data indicates that an abrupt contact from glacial sands and gravels to the Magothy Formation does not exist in this area. Rather than an abrupt contact, a transition zone exists which is composed of glacial sands and reworked Magothy sediments. In describing the stratigraphic sequence these sediments should be included within the Pleistocene deposits, however the deposits in the transition zone likely exhibit hydraulic characteristics which are similar to the upper portions of the Magothy Formation.

The nature of the materials collected in split spoons during installation of the four new monitoring wells (NRMW-1 to NRMW-4) was relatively consistent. In each of the wells, with the exception of NRMW-4, tan/orange sands and gravels were found to approximately 60 ft. These sands and gravels are believed to be upper Pleistocene sediments, below 60 feet the deposit contained a higher percentage of fine sand and silts to the completion depth of the well at 70 feet. These deposits are interpreted as being within the transition zone from the upper Pleistocene sediments to the Cretaceous sediments (Magothy Formation). In NRMW-4 the Cretaceous deposits were found at a much shallower depth at between 40 and 45 ft. below the ground surface. At this location a more noticeable change from sands and gravels to silts and colored clay were found in the recovered split spoons. Split spoons recovered during the hydropunch sampling showed a trend similar to that observed in the monitoring wells. The coarse upper Pleistocene sands and gravels graded into a finer sand and silt between 60 and 90 feet. Once below 90 to 100 feet the materials were characteristic of Cretaceous sediments containing a larger percentage of silt and clay. In many instances the deposit is composed of a laminated sand, silt and clay.

Additional subsurface explorations deeper than 150 ft. were not conducted as part of this RI. During previous investigations, two borings were advanced into the lower basal portion of the Magothy formation and both Bowling Green wells were logged during the their construction. The available logs indicate that the formation tends to fine with depth below 150 ft. A generalized description of the sediments below 150 ft includes multiple layers of fine sand, silt, and clay that extend to a depth of approximately 450 feet. The basal portion of the formation consists of sand, silts, and gravels typical of a high-energy depositional environment. The sediments found within the study area appear to conform to the regional description and depositional history of the formation.

4.8 HYDROGEOLOGY

4.8.1 Regional Hydrogeology

As outlined in the description of the regional geology of the area, there are three principal aquifers in the stratigraphic sequence of Long Island (Figure 4-1). The deepest of these aquifers is the Lloyd Sand member of the Raritan Formation, which is confined on the bottom by the metamorphic and igneous basement rock and by the overlying Raritan confining unit. The Lloyd is characterized as poorly to moderately permeable with hydraulic conductivities on the order of 10-ft/d. The anisotropy ratio (K_x:K_z) of the Lloyd aquifer is approximately 10:1 (USGS, 1989). Above the Lloyd aquifer is the Magothy Aquifer, confined on the bottom by the Raritan confining unit and, in places, on top by the Monmouth greensand or the Gardiners Clay. The Magothy is an extensive aquifer with horizontal hydraulic conductivities averaging about 50-ft/d and an anisotropy ratio of 100:1. The Jameco Gravel is a relatively thin water- bearing unit stratigraphically above the Magothy that is found only in the far western extent of Long Island. Overlying the Magothy is another extensive aquifer, the UGA (upper glacial aquifer). The UGA serves as the unconfined, water table aquifer from the ground surface to depths up to 700-ft and covers all of Long Island. Horizontal hydraulic conductivities in the UGA average over 200-ft/d with an anisotropy ratio of 10:1. Conductivities of UGA material from the southern half of the island (outwash) are about twice that of northern UGA material (morainal)(Buxton and Modica, 1992).

Water enters the regional groundwater system in recharge areas and moves through it, as driven by the hydraulic gradient and hydraulic conductivity, to discharge areas. The groundwater flow system on Long Island is well understood on a regional basis. The primary recharge areas for the deeper Magothy drinking water supply aquifer is limited to a narrow band located approximately mid-island. The groundwater flow direction is both to the south and north from the recharge area and the ultimate discharge area is the Atlantic Ocean to the south and Long Island Sound to the north.

4.8.2 Study Area Hydrogeology

The hydrogeology of the area surrounding the NCIA site is relatively simple, consisting of two main water-bearing hydrogeologic units, the UGA and the deeper Magothy Aquifer. The Lloyd Sand Member of the Raritan Formation was not considered in this investigation as it is found at a depth over 600-ft in the study area. The UGA is an unconfined aquifer consisting of poorly sorted sands and gravels which extend from the ground surface to approximately 60 feet. The Magothy is the sole source aquifer for the study area and consists of finer sand, silt and small amounts of clay.

The upper portions of the Magothy Aquifer extends from approximately 60 ft to 450 ft below the ground surface. This portion of the aquifer tends to fine with depth and serves to confine the lower water-bearing portion of the aquifer. The upper portion of the aquifer generally does not yield sufficient quantities of water for municipal use. The lower basal portion of the Magothy aquifer extends from approximately 500 ft to 580 ft. in the study area and consists of varying amounts of sand, gravel, and silt. The upper and lower boundaries of the hydrogeologic units were made based on gross differences in the lithology. For the purposes of this investigation these positions have no time stratigraphic significance. It is quite possible that some deposits of Pleistocene age have been included in the upper part of the Magothy Aquifer.

Following NYSDEC and USEPA regulations, both the UGA and Magothy are protected as sole source aquifers on Long Island. A confining layer between the UGA and the Magothy, the Gardiners clay, is not evident in the study area and the UGA and Magothy are in direct hydraulic connection. Depth to water is about 45 to 55 ft below the ground surface in the study area and the hydraulic gradient is approximately .0006 ft/ft to the southwest.

Based on analysis of in-situ hydraulic tests performed on the four newly installed shallow monitoring wells, hydraulic conductivity values for the UGA in the study area range from 291 to 85 ft/day (slug out). A compilation of the data used in determining these values are contained in Appendix C. During previous investigations at the NCIA forty other in-situ hydraulic test were conducted by LMS. The data from each of these tests indicate that the average value for hydraulic conductivity for the shallow wells (completion depth of 70 or less) averages 162 ft/day. For the intermediate well completed between 70 and 90 feet the average hydraulic conductivity is 71 ft/day, and the deepest wells (90 to 150 ft) exhibit an average hydraulic conductivity of 51 ft/day. The data is in general agreement with reported values for the hydraulic conductivity in the UGA and Magothy. Overall the data suggests a decreasing trend in hydraulic conductivity with depth, but this could not be statistically proven.

The Bowling Green Estates Water District uses two production wells (Well #1 and Well #2) located south of Old Country Road in the Town of Hempstead. Both wells were installed in 1975 and are completed in the basal portion of the Magothy Aquifer. Each have a permitted capacity of 1400 gpm. Well #1 is 532.5 ft deep with a screened zone from 478 to 527.5 ft. Well #2 is 583.5 ft deep with a screened zone from 524 ft to 583.5 ft. Raw water from both wells currently contains VOCs in excess of the NYSDOH drinking water standards. In Well #1 both 1,1,1-TCA and TCE predominate, while in Well #2 TCE predominates. An air stripper and carbon filters currently treat the well water; its average pumping rate is approximately 1200 gpm, with one well pumped at a time.

Under pumping conditions the two supply wells reportedly result in drawdowns of approximately 50 feet in the vicinity of the well. The drawdown from the well extends outward radially from the well creating a cone of depression in the potentiometric surface of the lower water bearing portion of the Magothy Aquifer. The lower values in head within the cone of depression create a significant downward vertical gradient across the confining sands, silts and clays found between the 150 and 450 foot level. This portion of the formation would appear to be the only limiting factor in preventing the migration of the contaminants to the supply wells. Due to it deep depth the data available to describe this portion of the formation is limited. Based on the four borings which have penetrated to the basal section of the formation (the two supply wells and the two deep early warning wells) it appears that some of the clay layers are relatively thick and continuous in the vicinity of the supply wells. It is believed the hydraulic conductivity of the formation between 150 ft and 450 ft is generally low. However, it is not known if zones of higher permeability might serve as downward conduits for the contamination. This is especially true under pumping conditions at the public water supply wells.

CHAPTER 5

NATURE AND EXTENT OF CONTAMINATION

5.1 PREVIOUS INVESTIGATIONS

Previous investigations on the nature and extent of the groundwater contamination associated with the NCIA have been conducted since the 1980's. The data sets which were incorporated into the RI evaluation were compiled from a number of sources including NYSDEC, Nassau County, USGS, and the Town of North Hempstead (Table 5-1). Each data set that was used has documented sampling procedures and analytical protocols and all of the data is usable for the purposes of the RI evaluations.

5.1.1 NCIA Investigation History and Previous Data

The previous analytical results for the area surrounding the NCIA historically dates back to the early 1980's (Table 5-1). The sampling and analysis that was conducted included an initial sampling effort to determine if contamination was present and which areas exhibited impacts. This sampling effort began in 1985 and continued until approximately 1992 (NCDOH 1986). After 1992 the NYSDEC began the State Superfund sponsored PSA sampling and analysis, a majority of this effort was completed by early 1997 (LMS 1996, LMS 1997). The PSA activities resulted in 17 sites listed on the New York State Registry of Inactive Hazardous Waste Sites as Class 2 sites. In order to efficiently investigate this large number of sites the NYSDEC adopted a three-prong approach that included remedial investigations to determine;

1. the nature and extent of any remaining sources of contamination in the soil,
2. the nature and extent of the groundwater contamination attributable to the site within the NCIA (on-site groundwater RI's) and,
3. to determine the nature and extent of the off-site groundwater contamination.

The on-site RI activities were largely completed by 1999 with the completion of the RI investigations at the Frost Street sites (LMS 1999). The investigation to determine the nature and extent of the off-site groundwater contamination began in 1997 (NCIA Off-site Groundwater IIWA) (LMS 1997) and continues as part of this groundwater RI.

TABLE 5-1 (Page 1 of 1)

Groundwater Investigations Incorporated into the Database
As of July 2000
New Cassel Off-Site Groundwater RI/FS Site #1-30-143

Investigation	Date
Town of Hempstead Routine Water Quality Monitoring	1977-present
NCDOH- Investigation of Contaminated Aquifer Segments	1984-1985
Phase I SI Monitoring Well Sampling	1993
Phase I Geoprobe Groundwater Sampling	1993
Phase II SI Geoprobe Groundwater Sampling	1994
NYSDEC Monitoring Well Sampling Round	1995
LMS Monitoring Well Sampling Round	1995
Multi-PSA Geoprobe GW Sampling	1996
Mutli-PSA Task 4	1996
Former Tischon (1-30-043F) RI/FS	1996
IMC Magnetics RI/FS	1997
LAKA Task 10 - Bowling Green Early Warning Wells	1997
Atlas Graphics IIWA	1997
NCIA Off-Site Groundwater IIWA	1997
125 State Street (1-30-043C)	1998
LAKA RI/FS	1998
Arkwin Industries RI/FS	1998
Frost Street Sites RI/FS	1998
"P-Sites" Groundwater Probes	1998
Tischon at Brooklyn Avenue (1-30-043E) RI/FS	1998 , 1999
NCIA Off-Site Groundwater RI/FS - Task 10 - "P-Sites"	1999
29 New York Avenue (1-30-043V) RI/FS	1999
118-130 Swalm Avenue RI/FS	1999
299 Main Street RI/FS	1999
NCIA Off-Site Groundwater RI/FS	1999-present

Each of the individual data sets of groundwater analytical results were incorporated into a Access database and this database was then used to produce a summary of all of the groundwater data for the NCIA area (Appendix F, Table 5-2). This summary table includes all of the historical data and the additional analytical data collected during the RI sampling activities.

5.2 REMEDIAL INVESTIGATION ANALYTICAL RESULTS

5.2.1 Monitoring Well Sampling Results- April 1999

Groundwater samples were collected from 49 monitoring wells in and around the NCIA from 12 April to 21 April 1999. The 49 wells included 41 existing wells, 4 newly installed wells, and the 4 Bowling Green early warning wells (Figure 3-4). Groundwater from each well was collected and analyzed for VOC contamination. Analytical data summary sheets for all monitoring well samples from the April 1999 sampling event can be found in Appendix E.

5.2.1.1 ***VOC Results.*** Summaries of the monitoring well groundwater samples are presented in Table 5-3 and shown on Figure 5-1. Total VOCs in the wells which were sampled ranged from not detected (ND) to 10852 μg/l (N-10470). VOC concentrations exceeded NYSDEC Class GA Standards in 21 of the monitoring well that were sampled. PCE, TCE and their breakdown products were the primary contaminant of concern in 13 of the 21 samples that exceeded the Class GA standards. In 7 of the 21 samples 1,1,1-TCA was the primary contaminant while the remaining sample exhibited similar concentrations of PCE, TCE, and 1,1,1-TCA.

5.2.2 Monitoring Well Sampling Results- August 1999

Groundwater samples were collected from 50 monitoring wells in and around the NCIA during August 1999. The wells included the same subset of wells sampled during the first round of sampling in April 1999 (Figure 3-5). Groundwater from each well was collected and analyzed for VOC contamination. Analytical data summary sheets for all monitoring well samples from the August 1999 sampling event can be found in Appendix

TABLE 5-3 (Page 1 of 7)

GROUNDWATER DATA SUMMARY
NCIA OFF-SITE PROJECT
Analytical Laboratory
April 1999

SDG Number	**127**	**127A**	**127C**	**127A**	**127C**	**127**	**127A**	**NYSDEC**
Lab Sample Number	**9910142**	**9910428**	**9910968**	**9910429**	**9910969**	**9910364**	**9910367**	**CLASS GA**
LMS Sample ID	**ANSON MW-8**	**EW-1B**	**EW-1C**	**EW-2B**	**EW-2C**	**FLMW-204B**	**FLMW-205B**	**STANDARDS (b)**
Date Collected	**4/12/1999**	**4/16/1999**	**4/21/1999**	**4/16/1999**	**4/21/1999**	**4/15/1999**	**4/15/1999**	
VOLATILE ORGANICS (µg/l)								
1,1-Dichloroethane	ND	5 j	ND	3 j	ND	1 j	**11**	5
1,1-Dichloroethylene	ND	**27**	ND	**9 j**	ND	1 j	**17**	5
1,1,1-Trichloroethane	ND	**51**	ND	**6 j**	ND	**6 j**	**64**	5
1,2-Dichloroethane	ND	ND	ND	2 j	ND	ND	ND	0.6
1,2-Dichloroethylene(total)	ND	**63**	ND	**65**	ND	**7 j**	**16**	5
2 Butanone	ND	ND	ND	ND	ND	ND	ND	50*
2 Hexanone	ND	ND	ND	ND	ND	**52**	ND	50*
4 Methyl 2 Pentanone	ND	ND	ND	ND	ND	ND	ND	N/A
Acetone	ND	ND	ND	ND	ND	5 j b	ND	50*
Bromodichloromethane	ND	ND	ND	ND	ND	ND	ND	50*
Chlorobenzene	ND	ND	ND	3 j	ND	ND	ND	5
Chloroethane	ND	ND	ND	ND	ND	ND	ND	5
Chloroform	ND	ND	ND	ND	ND	ND	2 j	7
Dibromochloromethane	ND	ND	ND	ND	ND	ND	ND	50*
Ethylbenzene	ND	ND	ND	1 j	ND	ND	ND	5
Methylene Chloride	ND	ND	ND	ND	ND	ND	ND	5
Tetrachloroethylene	ND	**620**	ND	**31**	ND	ND	**110**	5
Styrene	ND	2 j	ND	2 j	ND	ND	ND	5
Trichloroethylene	ND	**75**	9 j	**220**	ND	**46**	**67**	5
Toluene	ND	3 j	ND	**6 j**	ND	ND	ND	5
Vinyl Chloride	ND	ND	ND	**130**	ND	ND	ND	2
Xylenes (total)	ND	5 j	ND	**6 J**	ND	ND	ND	5
Total VOCs	ND	**851**	9	**484**	ND	**118**	**287**	100[1]

1 - This value applies to the total of all organic substances listed in the New York State Groundwater Effluent Limitations table from the Division of Water Technical and Operational Guidance Series (1.1.1) with a groundwater effluent limitation less than 100 ug/l.
* - Value taken from NYSDEC Class GA Guidance Value.
(b) - Division of Water Technical and Operational Guidance Series (1.1.1) June 1998.
b - Found in associated blanks.
j - Estimated concentration; compound present below quantitation limit.
N/A - Not available.
ND - Not detected at analytical detection limit.
Note: - Numbers in bold exceed standard.

TABLE 5-3 (Page 2 of 7)

GROUNDWATER DATA SUMMARY
NCIA OFF-SITE PROJECT
Analytical Laboratory
April 1999

SDG Number	**127**	**127**	**127C**	**127**	**127A**	**127**	**127**	**127A**	**NYSDEC**
Lab Sample Number	**9910143**	**9910144**	**9910970**	**9910146**	**9910370**	**9910146**	**9910147**	**9910371**	**CLASS GA**
LMS Sample ID	**N-9938**	**N-9939**	**N-10321**	**N-10322**	**N-10324**	**N-10325**	**N-10326**	**N-10327**	**STANDARDS (b)**
Date Collected	**4/12/1999**	**4/12/1999**	**4/21/1999**	**4/12/1999**	**4/15/1999**	**4/13/1999**	**4/13/1999**	**4/15/1999**	
VOLATILE ORGANICS (µg/l)									
1,1-Dichloroethane	**27**	ND	ND	ND	5 j	ND	3 j	ND	5
1,1-Dichloroethene	**21**	ND	ND	ND	2 j	ND	**7 j**	ND	5
1,1,1-Trichloroethane	**170**	2 j	6 j	5 j	**47**	ND	**42**	ND	5
1,2-Dichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	0.6
1,2-Dichloroethene(total)	ND	ND	ND	ND	ND	ND	**110**	ND	5
2 Butanone	ND	ND	ND	ND	ND	ND	ND	ND	50*
2 Hexanone	ND	ND	ND	ND	ND	ND	ND	ND	50*
4 Methyl 2 Pentanone	ND	ND	ND	ND	ND	ND	ND	ND	N/A
Acetone	ND	ND	ND	ND	3 j b	ND	ND	5 j b	50*
Bromodichloromethane	ND	ND	ND	ND	ND	ND	ND	ND	50*
Chlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	5
Chloroethane	ND	ND	ND	ND	ND	ND	ND	ND	5
Chloroform	ND	ND	ND	ND	ND	ND	2 j	3 j	7
Dibromochloromethane	ND	ND	ND	ND	ND	ND	ND	ND	50*
Ethylbenzene	ND	ND	ND	ND	ND	ND	ND	ND	5
Methylene Chloride	ND	ND	ND	ND	ND	ND	ND	ND	5
Tetrachloroethene	8 j	1 j	7 j	**12**	**18**	**42**	**89**	ND	5
Styrene	ND	ND	ND	ND	ND	ND	ND	ND	5
Trichloroethene	**12**	ND	ND	ND	**13**	2 j	**11**	ND	5
Toluene	ND	ND	ND	ND	2 j	ND	ND	ND	5
Vinyl Chloride	ND	ND	ND	ND	ND	ND	ND	ND	2
Xylenes (total)	ND	ND	ND	ND	3 j	ND	ND	ND	5
Total VOCs	**238**	3	13	17	98	44	**264**	8	100¹

1 - This value applies to the total of all organic substances listed in the New York State Groundwater Effluent Limitations table from the Division of Water Technical and Operational Guidance Series (1.1.1) with a groundwater effluent limitation less than 100 ug/l.

* - Value taken from NYSDEC Class GA Guidance Value.

(b) - Division of Water Technical and Operational Guidance Series (1.1.1) June 1998.

b - Found in associated blanks.

j - Estimated concentration; compound present below quantitation limit.

N/A - Not available.

ND - Not detected at analytical detection limit.

Note: - Numbers in bold exceed standard.

TABLE 5-3 (Page 3 of 7)

GROUNDWATER DATA SUMMARY
NCIA OFF-SITE PROJECT
Analytical Laboratory
April 1999

SDG Number	**127**	**127A**	**127A**	**127C**	**127**	**127**	**127**	**127A**	**NYSDEC**
Lab Sample Number	**9910365**	**9910372**	**9910373**	**9910971**	**9910148**	**9910149**	**9910150**	**9910374**	**CLASS GA**
LMS Sample ID	**N-10328**	**N-10329**	**N-10459**	**N-10462**	**N-10464**	**N-10465**	**N-10470**	**N-10471**	**STANDARDS (b)**
Date Collected	**4/14/1999**	**4/14/1999**	**4/14/1999**	**4/21/1999**	**4/13/1999**	**4/13/1999**	**4/13/1999**	**4/14/1999**	
VOLATILE ORGANICS (µg/l)									
1,1-Dichloroethane	**36**	ND	ND	ND	ND	ND	**460 j d**	ND	5
1,1-Dichloroethene	**63**	ND	ND	ND	ND	ND	**420 j d**	1 j	5
1,1,1-Trichloroethane	**540**	ND	ND	ND	ND	ND	**9600**	**10**	5
1,2-Dichloroethane	ND	ND	ND	ND	ND	ND	**3 j**	ND	0.6
1,2-Dichloroethene(total)	ND	ND	ND	ND	ND	ND	**18**	ND	5
2 Butanone	ND	ND	ND	ND	ND	ND	ND	ND	50*
2 Hexanone	ND	ND	ND	ND	ND	ND	ND	ND	50*
4 Methyl 2 Pentanone	ND	ND	ND	ND	ND	ND	ND	ND	N/A
Acetone	3 j b	ND	2 j b	ND	ND	ND	ND	3 j b	50*
Bromodichloromethane	ND	ND	ND	ND	ND	ND	ND	ND	50*
Chlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	5
Chloroethane	ND	ND	ND	ND	ND	ND	**19**	ND	5
Chloroform	ND	ND	ND	ND	ND	ND	ND	ND	7
Dibromochloromethane	ND	ND	ND	ND	ND	ND	ND	ND	50*
Ethylbenzene	ND	ND	ND	ND	ND	ND	ND	ND	5
Methylene Chloride	ND	ND	ND	ND	ND	ND	1 j	ND	5
Tetrachloroethene	ND	ND	ND	**14**	ND	2 j	**51**	1 j	5
Styrene	ND	ND	ND	ND	ND	ND	ND	ND	5
Trichloroethene	4 j	ND	ND	ND	ND	ND	**8 j**	ND	5
Toluene	ND	ND	ND	ND	ND	ND	ND	ND	5
Vinyl Chloride	ND	ND	ND	ND	ND	ND	2 j	ND	2
Xylenes (total)	ND	ND	ND	ND	ND	ND	ND	ND	5
Total VOCs	**646**	ND	2	14	ND	2	**10582**	15	100[1]

1	- This value applies to the total of all organic substances listed in the New York State Groundwater Effluent Limitations table from the Division of Water Technical and Operational Guidance Series (1.1.1) with a groundwater effluent limitation less than 100 ug/l.
*	- Value taken from NYSDEC Class GA Guidance Value.
(b)	- Division of Water Technical and Operational Guidance Series (1.1.1) June 1998.
b	- Found in associated blanks.
j	- Estimated concentration; compound present below quantitation limit.
N/A	- Not available.
ND	- Not detected at analytical detection limit.
Note:	- Numbers in bold exceed standard.

TABLE 5-3 (Page 4 of 7)

GROUNDWATER DATA SUMMARY
NCIA OFF-SITE PROJECT
Analytical Laboratory
April 1999

SDG Number **Lab Sample Number** **LMS Sample ID** **Date Collected**	**127A** **9910375** **N-10472** **4/15/1999**	**127A** **9910376** **N-10474** **4/15/1999**	**127A** **9910377** **N-10475** **4/15/1999**	**127A** **9910378** **N-10476** **4/15/1999**	**127** **9910151** **N-10477** **4/12/1999**	**127** **9910152** **N-10478** **4/12/1999**	**127** **9910153** **N-10479** **4/12/1999**	**127A** **9910379** **N-11848** **4/14/1999**	**NYSDEC CLASS GA STANDARDS (b)**
VOLATILE ORGANICS (µg/l)									
1,1-Dichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	5
1,1-Dichloroethene	ND	ND	ND	ND	ND	ND	ND	ND	5
1,1,1-Trichloroethane	ND	**9 j**	ND	ND	2 j	ND	ND	ND	5
1,2-Dichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	0.6
1,2-Dichloroethene(total)	ND	ND	ND	1 j	ND	ND	ND	ND	5
2 Butanone	1 j	ND	ND	ND	ND	ND	ND	ND	50*
2 Hexanone	ND	ND	ND	ND	ND	ND	ND	ND	50*
4 Methyl 2 Pentanone	ND	ND	ND	ND	ND	ND	ND	ND	N/A
Acetone	4 j b	ND	6 j b	2 j b	2 j	ND	ND	2 j b	50*
Bromodichloromethane	ND	2 j	ND	ND	ND	ND	ND	ND	50*
Chlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	5
Chloroethane	ND	ND	ND	ND	ND	ND	ND	ND	5
Chloroform	ND	2 j	ND	ND	ND	ND	ND	ND	7
Dibromochloromethane	ND	2 j	ND	ND	ND	ND	ND	ND	50*
Ethylbenzene	ND	1 j	ND	ND	ND	ND	ND	ND	5
Methylene Chloride	ND	ND	ND	ND	ND	ND	ND	ND	5
Tetrachloroethene	ND	ND	ND	ND	1 j	1 j	ND	ND	5
Styrene	ND	ND	ND	ND	ND	ND	ND	ND	5
Trichloroethene	ND	ND	ND	ND	ND	ND	ND	ND	5
Toluene	ND	**7 j**	1 j	ND	ND	ND	ND	ND	5
Vinyl Chloride	ND	ND	ND	ND	ND	ND	ND	ND	2
Xylenes (total)	ND	**8 j**	ND	ND	ND	ND	ND	ND	5
Total VOCs	5	31	7	3	5	1	ND	2	100[1]

1 - This value applies to the total of all organic substances listed in the New York State Groundwater Effluent Limitations table from the Division of Water Technical and Operational Guidance Series (1.1.1) with a groundwater effluent limitation less than 100 ug/l.

* - Value taken from NYSDEC Class GA Guidance Value.

(b) - Division of Water Technical and Operational Guidance Series (1.1.1) June 1998.

b - Found in associated blanks.

j - Estimated concentration; compound present below quantitation limit.

N/A - Not available.

ND - Not detected at analytical detection limit

Note: - Numbers in bold exceed standard

GROUNDWATER DATA SUMMARY

NCIA OFF-SITE PROJECT

Analytical Laboratory

April 1999

SDG Number	**127A**	**127**	**127A**	**127A**	**127**	**127**	**127A**	**NYSDEC**
Lab Sample Number	**9910380**	**9910154**	**9910381**	**9910382**	**9910155**	**9910156**	**9910383**	**CLASS GA**
LMS Sample ID	**N-11849**	**N-11850**	**N-11851**	**N-11852**	**N-11854**	**N-11855**	**N-11858**	**STANDARDS (b)**
Date Collected	**4/14/1999**	**4/13/1999**	**4/14/1999**	**4/14/1999**	**4/13/1999**	**4/13/1999**	**4/14/1999**	
VOLATILE ORGANICS (µg/l)								
1,1-Dichloroethane	ND	ND	ND	ND	ND	4	ND	5
1,1-Dichloroethene	ND	ND	ND	ND	ND	**13**	ND	5
1,1,1-Trichloroethane	ND	1 j	ND	ND	ND	**190**	ND	5
1,2-Dichloroethane	ND	ND	ND	ND	ND	ND	ND	0.6
1,2-Dichloroethene(total)	ND	ND	ND	ND	ND	ND	ND	5
2 Butanone	ND	ND	ND	ND	ND	ND	ND	50*
2 Hexanone	ND	ND	ND	ND	ND	ND	ND	50*
4 Methyl 2 Pentanone	ND	ND	ND	ND	ND	ND	ND	N/A
Acetone	2 j b	ND	ND	ND	ND	ND	ND	50*
Bromodichloromethane	ND	ND	ND	ND	ND	ND	ND	50*
Chlorobenzene	ND	ND	ND	ND	ND	ND	ND	5
Chloroethane	ND	ND	ND	ND	ND	ND	ND	5
Chloroform	ND	ND	ND	2 j	ND	ND	ND	7
Dibromochloromethane	ND	ND	ND	ND	ND	ND	ND	50*
Ethylbenzene	ND	ND	ND	ND	ND	ND	ND	5
Methylene Chloride	ND	ND	ND	ND	ND	ND	ND	5
Tetrachloroethene	ND	**35**	ND	2 j	2 j	ND	ND	5
Styrene	ND	ND	ND	ND	ND	ND	ND	5
Trichloroethene	ND	**12**	2 j	**7 j**	ND	ND	ND	5
Toluene	ND	ND	ND	ND	ND	ND	ND	5
Vinyl Chloride	ND	ND	ND	ND	ND	ND	ND	2
Xylenes (total)	ND	ND	ND	ND	ND	ND	ND	5
Total VOCs	2	48	2	11	2	**207**	ND	100[1]

1	- This value applies to the total of all organic substances listed in the New York State Groundwater Effluent Limitations table from the Division of Water Technical and Operational Guidance Series (1.1.1) with a groundwater effluent limitation less than 100 ug/l.
*	- Value taken from NYSDEC Class GA Guidance Value.
(b)	- Division of Water Technical and Operational Guidance Series (1.1.1) June 1998
b	- Found in associated blanks.
j	- Estimated concentration; compound present below quantitation limit.
N/A	- Not available.
ND	- Not detected at analytical detection limit.
Note:	- Numbers in bold exceed standard.

TABLE 5-3 (Page 6 of 7)

GROUNDWATER DATA SUMMARY
NCIA OFF-SITE PROJECT
Analytical Laboratory
April 1999

SDG Number	**127C**	**127A**	**127A**	**127**	**127A**	**127A**	**NYSDEC**
Lab Sample Number	**9910972**	**9910431**	**9910432**	**9910157**	**9910368**	**9910369**	**CLASS GA**
LMS Sample ID	**N-11859**	**N-11860**	**N-11861**	**N-11862**	**N-72301**	**N-92301**	**STANDARDS (b)**
Date Collected	**4/21/1999**	**4/16/1999**	**4/16/1999**	**4/12/1999**	**4/12/1999**	**4/12/1999**	
VOLATILE ORGANICS (µg/l)							
1,1-Dichloroethane	ND	ND	ND	ND	ND	ND	5
1,1-Dichloroethene	ND	ND	ND	ND	ND	ND	5
1,1,1-Trichloroethane	ND	2 j	ND	ND	ND	ND	5
1,2-Dichloroethane	ND	ND	ND	ND	ND	ND	0.6
1,2-Dichloroethene(total)	ND	ND	ND	ND	ND	ND	5
2 Butanone	ND	ND	ND	ND	ND	ND	50*
2 Hexanone	ND	ND	ND	ND	ND	ND	50*
4 Methyl 2 Pentanone	ND	ND	ND	ND	ND	ND	N/A
Acetone	ND	5 jb	ND	ND	ND	3 j b	50*
Bromodichloromethane	ND	ND	ND	ND	ND	ND	50*
Chlorobenzene	ND	ND	ND	ND	ND	ND	5
Chloroethane	ND	ND	ND	ND	ND	ND	5
Chloroform	ND	5 j	ND	ND	3 j	ND	7
Dibromochloromethane	ND	ND	ND	ND	ND	ND	50*
Ethylbenzene	ND	ND	ND	ND	ND	ND	5
Methylene Chloride	ND	ND	ND	ND	ND	ND	5
Tetrachloroethene	ND	ND	ND	ND	ND	ND	5
Styrene	ND	ND	ND	ND	ND	ND	5
Trichloroethene	ND	ND	ND	ND	ND	ND	5
Toluene	ND	ND	ND	ND	ND	ND	5
Vinyl Chloride	ND	ND	ND	ND	ND	ND	2
Xylenes (total)	ND	ND	ND	ND	ND	ND	5
Total VOCs	ND	12	ND	ND	3	3	100[1]

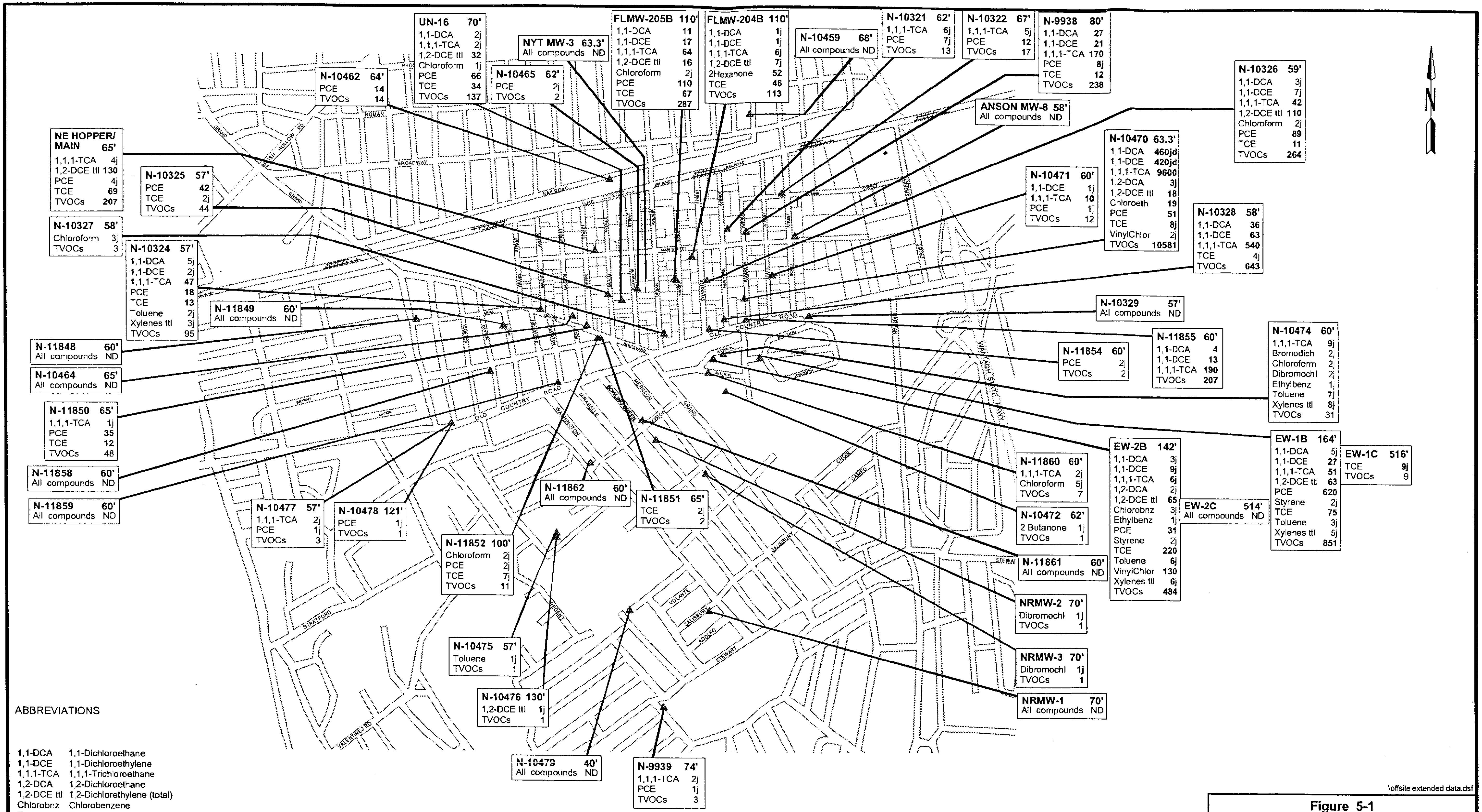
1 - This value applies to the total of all organic substances listed in the New York State Groundwater Effluent Limitations table from the Division of Water Technical and Operational Guidance Series (1.1.1) with a groundwater effluent limitation less than 100 ug/l.
* - Value taken from NYSDEC Class GA Guidance Value.
(b) - Division of Water Technical and Operational Guidance Series (1.1.1) June 1998.
b - Found in associated blanks.
j - Estimated concentration; compound present below quantitation limit.
N/A - Not available.
ND - Not detected at analytical detection limit.
Note: - Numbers in bold exceed standard.

TABLE 5-3 (Page 7 of 7)

GROUNDWATER DATA SUMMARY
NCIA OFF-SITE PROJECT
Analytical Laboratory
April 1999

SDG Number	**127A**	**127C**	**127C**	**127C**	**127**	**127**	**NYSDEC**
Lab Sample Number	**9910433**	**9910973**	**9910974**	**9910975**	**9910158**	**9910159**	**CLASS GA**
LMS Sample ID	**NE HOPPER/MAIN**	**NRMW-1**	**NRMW-2**	**NRMW-3**	**NYT MW-3**	**UN-16**	**STANDARDS (b)**
Date Collected	**4/16/1999**	**2/21/1999**	**4/21/1999**	**4/21/1999**	**4/13/1999**	**4/13/1999**	
VOLATILE ORGANICS (µg/l)							
1,1-Dichloroethane	ND	ND	ND	ND	ND	2 j	5
1,1-Dichloroethene	ND	ND	ND	ND	ND	ND	5
1,1,1-Trichloroethane	4 j	ND	ND	ND	ND	2 j	5
1,2-Dichloroethane	ND	ND	ND	ND	ND	ND	0.6
1,2-Dichloroethene(total)	**130**	ND	ND	ND	ND	**32**	5
2 Butanone	ND	ND	ND	ND	ND	ND	50*
2 Hexanone	ND	ND	ND	ND	ND	ND	50*
4 Methyl 2 Pentanone	ND	ND	ND	ND	ND	ND	N/A
Acetone	ND	3 j	2 j	ND	ND	ND	50*
Bromodichloromethane	ND	ND	ND	ND	ND	ND	50*
Chlorobenzene	ND	ND	ND	ND	ND	ND	5
Chloroethane	ND	ND	ND	ND	ND	ND	5
Chloroform	ND	ND	ND	ND	ND	1 j	7
Dibromochloromethane	ND	ND	1 j	1 j	ND	ND	50*
Ethylbenzene	ND	ND	ND	ND	ND	ND	5
Methylene Chloride	ND	ND	ND	ND	ND	ND	5
Tetrachloroethene	4 j	ND	ND	ND	ND	**66**	5
Styrene	ND	ND	ND	ND	ND	ND	5
Trichloroethene	**69**	ND	ND	ND	ND	**34**	5
Toluene	ND	ND	ND	ND	ND	ND	5
Vinyl Chloride	ND	ND	ND	ND	ND	ND	2
Xylenes (total)	ND	ND	ND	ND	ND	ND	5
Total VOCs	**207**	3	3	1	ND	137	100[1]

1 - This value applies to the total of all organic substances listed in the New York State Groundwater Effluent Limitations table from the Division of Water Technical and Operational Guidance Series (1.1.1) with a groundwater effluent limitation less than 100 ug/l.
* - Value taken from NYSDEC Class GA Guidance Value.
(b) - Division of Water Technical and Operational Guidance Series (1.1.1) June 1998.
b - Found in associated blanks.
j - Estimated concentration; compound present below quantitation limit.
N/A - Not available.
ND - Not detected at analytical detection limit.
Note: - Numbers in bold exceed standard.



ABBREVIATIONS

1,1-DCA	1,1-Dichloroethane
1,1-DCE	1,1-Dichloroethylene
1,1,1-TCA	1,1,1-Trichloroethane
1,2-DCA	1,2-Dichloroethane
1,2-DCE ttl	1,2-Dichlorethylene (total)
Chlorobnz	Chlorobenzene
Ethylbenz	Ethylbenzene
PCE	Tetrachloroethylene
Dibromochl	Dibromochloromethane
Bromodich	Bromodichloromethane
TCE	Trichloroethylene
VinylChlor	Vinyl Chloride
Xylenes ttl	Xylenes (total)
TVOCs	Total volatile organic compounds
ND	Not detected at analytical detection limit

NOTE TVOC includes only chlorinated solvents

QUALIFIERS

B	Value is less than contract required detection limit but greater than instrument detection limit
b	Found in associated blanks
d	Concentration recovered from diluted sample
j	Estimated concentration; compound present below quantitation limit

\offsite extended data.dsf

LEGEND:

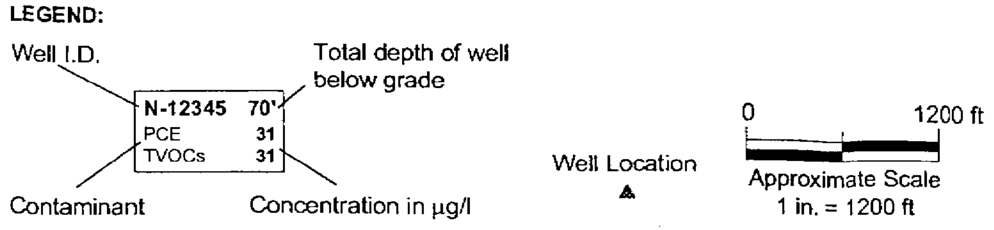


Figure 5-1

April 1999 (Round 1) Well Sampling Groundwater Data Summary

OFFSITE INVESTIGATION
NEW CASSEL INDUSTRIAL AREA
NYSDEC I.D. No. 130043

LAWLER, MATUSKY & SKELLY ENGINEERS LLP
Pearl River, New York

E.

5.2.2.1 ***VOC Results.*** Summaries of the monitoring well groundwater samples are presented in Table 5-4 and shown on Figure 5-2. Total VOCs in the wells which were sampled ranged from not detected (ND) to 29230 µg/l (N-10470). VOC concentrations exceeded NYSDEC Class GA Standards in 25 of the 50 monitoring well that were sampled. PCE, TCE and their breakdown products were the primary contaminant of concern in 14 of the 25 samples that exceeded the Class GA standards. In 7 of the 25 samples 1,1,1-TCA was the primary contaminant while the remaining 4 samples exhibited similar concentrations of PCE, TCE, and 1,1,1-TCA.

5.2.3 Monitoring Well Sampling Results- January 2000

Groundwater samples were collected from 24 monitoring wells in and around the NCIA during January 2000 (Figure 3-6). The 24 wells included a selected subset of the monitoring wells sampled during the first two sampling rounds. Groundwater from each well was collected and analyzed for VOC contamination. Analytical data summary sheets for all monitoring well samples from the August 1999 sampling event can be found in Appendix E.

5.2.3.1 ***VOC Results.*** A summary of the monitoring well groundwater samples is summarized on Table 5-5 and shown on Figure 5-3. The results indicate that 12 of the 24 samples collected exhibit concentrations of VOCs in excess of the Class GA Standard. Total VOCs ranged from ND to 27339 µg/l (N-11855). PCE, TCE and their breakdown products were the primary contaminant of concern in 6 of the 12 samples that exceeded the Class GA standards, in the remaining 6 samples 1,1,1-TCA was the primary contaminant.

5.2.3.2 ***MNA Evaluation Parameters.*** A summary of the monitoring well groundwater samples results for the MNA parameters are summarized on Table 5-5. Methane/ethene was detected in 7 of the 24 groundwater samples that were collected. In a majority of the samples methane/ethene were not detected at the method detection limit. Most of the samples that exhibited methane and ethene had only trace concentrations of these compounds. The highest concentrations were found in NRMW-01 that exhibited a concentration of 6 µg/l of methane and 9 µg/l of ethene. Arsenic was found in 9 of the 24

TABLE 5-4 (Page 1 of 7)

GROUNDWATER DATA SUMMARY
MONITORING WELL SAMPLING
Round 2 - August 1999

SDG Number Lab Sample Number LMS Sample ID Date Collected	809 B94825 FLMW-204B 8/16/1999	809 B94826 UN-16 8/16/1999	809 B94827 N-11848 8/17/1999	809 B94828 NRMW-4 8/17/1999	809 B94829 N-11862 8/17/1999	809 B94830 DOAK-MW-1 8/17/1999	809 B94831 AIM-33-1 8/17/1999	809 B94832 TB-4 8/18/1999	809 B94833 N-10479 8/18/1999	NYSDEC CLASS GA STANDARDS (b)
Volatile Organic Compounds (ug/L)										
Vinyl Chloride	ND	ND	ND	ND	ND	ND	ND	ND	ND	2
Chloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	5
Methylene Chloride	ND	ND	ND	ND	ND	ND	ND	ND	ND	5
Acetone	ND	ND	ND	ND	ND	ND	ND	ND	ND	50*
1,1-Dichloroethylene	ND	ND	ND	ND	ND	**6 j**	**9 j**	ND	ND	5
1,1-Dichloroethane	ND	1 j	ND	ND	ND	**8 j**	1 j	ND	ND	5
1,2-Dichloroethylene (total)	**7 j**	**32**	ND	ND	ND	3 j	**20**	ND	ND	5
2-Butanone	ND	ND	ND	ND	ND	ND	ND	ND	ND	50*
Chloroform	ND	1 j	ND	ND	ND	ND	1 j	ND	ND	7
1,2-Dichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.6
1,1,1-Trichloroethane	3 j	2 j	ND	ND	ND	**43**	**23**	ND	1 j	5
Carbon Tetrachloride	ND	ND	ND	ND	ND	ND	ND	ND	ND	5
Trichloroethylene	**42**	**36**	ND	ND	ND	**6 j**	**18**	ND	ND	5
Benzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
Tetrachloroethylene	**43**	**96**	ND	ND	ND	**47**	**41**	ND	ND	5
Chlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	5
Xylene (total)	ND	ND	ND	ND	ND	ND	ND	ND	ND	5
Total Organics	95	**168**	ND	ND	ND	**113**	**113**	ND	**1**	100¹

1 - This value applies to the total of all organic substances listed in the New York State Groundwater Effluent Limitations table from the Division of Water Technical and Operational Guidance Series (1.1.1) with a groundwater effluent limitation less than 100 ug/L.
* - Value taken from NYSDEC Class GA Guidance Value.
(b) - Division of Water Technical and Operational Guidance Series (1.1.1) June 1998.
d - Concentration recovered from diluted sample.
e - Estimated concentration; exceeds GC/MS calibration range.
j - Estimated concentration; compound present below quantitation limit.
ND - Not detected at analytical detection limit.
Note: - Numbers in bold exceed standard.

TABLE 5-4 (Page 2 of 7)

GROUNDWATER DATA SUMMARY

MONITORING WELL SAMPLING

Round 2 - August 1999

SDG Number	**809**	**809**	**809**	**809**	**809**	**809**	**809**	**809**	**809**	**NYSDEC**
Lab Sample Number	**B94834**	**B94835**	**B94836**	**B94837**	**B94838**	**B94839**	**B94840**	**B94841**	**B94842**	**CLASS GA**
LMS Sample ID	**N-10478**	**N-10477**	**N-11850**	**RGMW-1**	**N-10321**	**TB-5**	**N-11852**	**N-11851**	**N-10470**	**STANDARDS (b)**
Date Collected	**8/18/1999**	**8/18/1999**	**8/18/1999**	**8/18/1999**	**8/18/1999**	**8/19/1999**	**8/19/1999**	**8/19/1999**	**8/19/1999**	
Volatile Organic Compounds (ug/L)									[DL:500:1]	
Vinyl Chloride	ND	ND	ND	ND	ND	ND	ND	ND	ND	2
Chloroethane	ND	ND	ND	ND	ND	ND	ND	ND	**68**	5
Methylene Chloride	ND	ND	ND	ND	ND	ND	ND	ND	3 j	5
Acetone	14	ND	ND	ND	ND	ND	ND	ND	ND	50*
1,1-Dichloroethylene	ND	ND	ND	ND	ND	ND	ND	ND	**1400 j d**	5
1,1-Dichloroethane	ND	ND	ND	ND	ND	ND	4 j	ND	**1700 j d**	5
1,2-Dichloroethylene (total)	ND	ND	ND	**100**	ND	ND	**17**	ND	**13**	5
2-Butanone	ND	ND	ND	ND	ND	ND	ND	ND	ND	50*
Chloroform	ND	ND	ND	ND	ND	ND	2 j	ND	2 j	7
1,2-Dichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	**8 j**	0.6
1,1,1-Trichloroethane	ND	ND	ND	4 j	2 j	ND	3 j	ND	**26000 d**	5
Carbon Tetrachloride	ND	ND	ND	ND	ND	ND	ND	ND	ND	5
Trichloroethylene	ND	ND	**8 j**	**73**	ND	ND	**8 j**	3 j	**7 j**	5
Benzene	ND	ND	ND	ND	ND	ND	ND	ND	**2 j**	1
Tetrachloroethylene	ND	2 j	**20**	5 j	3 j	ND	4 j	ND	**27**	5
Chlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	5
Xylene (total)	ND	ND	ND	ND	ND	ND	ND	ND	ND	5
Total Organics •	14	2	28	**182**	5	ND	38	3	**29230**	100[1]

1 - This value applies to the total of all organic substances listed in the New York State Groundwater Effluent Limitations table from the Division of Water Technical and Operational Guidance Series (1.1.1) with a groundwater effluent limitation less than 100 ug/L.

* - Value taken from NYSDEC Class GA Guidance Value.

(b) - Division of Water Technical and Operational Guidance Series (1.1.1) June 1998.

d - Concentration recovered from diluted sample.

e - Estimated concentration; exceeds GC/MS calibration range.

j - Estimated concentration; compound present below quantitation limit.

ND - Not detected at analytical detection limit.

Note: - Numbers in bold exceed standard.

TABLE 5-4 (Page 3 of 7)

GROUNDWATER DATA SUMMARY
MONITORING WELL SAMPLING
Round 2 - August 1999

SDG Number Lab Sample Number LMS Sample ID Date Collected	809 B94843 N-10328 8/19/1999	809 B94844 N-10326 8/19/1999	809 B94845 ANSON-MW-8 8/19/1999	809 B94846 N-10476 8/19/1999	809 B94847 N-11849 8/19/1999	809 B94848 N-10471D 8/20/1999	809 B94849 N-10471S 8/20/1999	NYSDEC CLASS GA STANDARDS (b)
Volatile Organic Compounds (ug/L	[DL:5:1]	[DL:2.5:1]						
Vinyl Chloride	ND	ND	ND	ND	ND	ND	ND	2
Chloroethane	ND	ND	ND	ND	ND	ND	ND	5
Methylene Chloride	ND	ND	ND	ND	ND	ND	ND	5
Acetone	ND	ND	ND	ND	ND	6 j	ND	50*
1,1-Dichloroethylene	**58**	**9 j**	ND	ND	ND	ND	3 j	5
1,1-Dichloroethane	**28**	3 j	ND	ND	ND	ND	**8 j**	5
1,2-Dichloroethylene (total)	ND	**210 d**	ND	1 j	ND	ND	**17**	5
2-Butanone	10 j	ND	ND	ND	ND	ND	ND	50*
Chloroform	ND	2 j	ND	ND	ND	ND	ND	7
1,2-Dichloroethane	ND	ND	ND	ND	ND	ND	ND	0.6
1,1,1-Trichloroethane	**320 d**	**50**	3 j	2 j	2 j	2 j	**23**	5
Carbon Tetrachloride	ND	ND	ND	ND	ND	ND	ND	5
Trichloroethylene	2 j	**18**	ND	ND	ND	ND	4 j	5
Benzene	ND	ND	ND	ND	ND	ND	ND	1
Tetrachloroethylene	2 j	**160**	ND	ND	ND	ND	**19**	5
Chlorobenzene	ND	ND	ND	ND	ND	ND	ND	5
Xylene (total)	ND	ND	ND	ND	ND	ND	ND	5
Total Organics	**420**	**452**	3	3	2	8	74	100¹

1 - This value applies to the total of all organic substances listed in the New York State Groundwater Effluent Limitations table from the Division of Water Technical and Operational Guidance Series (1.1.1) with a groundwater effluent limitation less than 100 ug/L.
* - Value taken from NYSDEC Class GA Guidance Value.
(b) - Division of Water Technical and Operational Guidance Series (1.1.1) June 1998.
d - Concentration recovered from diluted sample.
e - Estimated concentration; exceeds GC/MS calibration range.
j - Estimated concentration; compound present below quantitation limit.
ND - Not detected at analytical detection limit.
Note: - Numbers in bold exceed standard.

TABLE 5-4 (Page 4 of 7)

GROUNDWATER DATA SUMMARY

MONITORING WELL SAMPLING

Round 2 - August 1999

SDG Number	809	809	809	809	809	809	809	809	NYSDEC CLASS GA STANDARDS (b)
Lab Sample Number	B94850	B94851	B94852	B94853	B94854	B94855	B94856	B94857	
LMS Sample ID	N-10327	FLMW-205B	N-10325	N-11855	TB-6	N-11860	N-11858	N-10464	
Date Collected	8/20/1999	8/20/1999	8/20/1999	8/20/1999	8/23/1999	8/23/1999	8/23/1999	8/23/1999	
Volatile Organic Compounds (ug/L)				[DL:10:1]					
Vinyl Chloride	ND	ND	ND	ND	ND	ND	ND	ND	2
Chloroethane	ND	ND	ND	ND	ND	ND	ND	ND	5
Methylene Chloride	ND	ND	ND	ND	3 j	ND	ND	ND	5
Acetone	ND	ND	ND	ND	ND	ND	ND	ND	50*
1,1-Dichloroethylene	ND	**14**	ND	**20**	ND	ND	ND	ND	5
1,1-Dichloroethane	ND	**7 j**	ND	5 j	ND	ND	ND	ND	5
1,2-Dichloroethylene (total)	ND	**46**	3 j	ND	ND	ND	ND	ND	5
2-Butanone	ND	ND	4 j	6 j	ND	ND	ND	ND	50*
Chloroform	4 j	2 j	ND	1 j	ND	3 j	ND	ND	7
1,2-Dichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	0.6
1,1,1-Trichloroethane	1 j	**32**	ND	**320 d**	ND	1 j	1 j	ND	5
Carbon Tetrachloride	ND	ND	ND	ND	ND	ND	ND	ND	5
Trichloroethylene	ND	**100**	5 j	ND	ND	ND	ND	ND	5
Benzene	ND	ND	ND	ND	ND	ND	ND	ND	1
Tetrachloroethylene	2 j	**130**	**33**	2 j	ND	ND	ND	ND	5
Chlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	5
Xylene (total)	ND	ND	ND	3 j	ND	ND	ND	ND	5
Total Organics	7	**331**	45	**357**	3	4	1	ND	100[1]

1	- This value applies to the total of all organic substances listed in the New York State Groundwater Effluent Limitations table from the Division of Water Technical and Operational Guidance Series (1.1.1) with a groundwater effluent limitation less than 100 ug/L.
•	- Value taken from NYSDEC Class GA Guidance Value.
(b)	- Division of Water Technical and Operational Guidance Series (1.1.1) June 1998.
d	- Concentration recovered from diluted sample.
e	- Estimated concentration; exceeds GC/MS calibration range.
j	- Estimated concentration; compound present below quantitation limit.
ND	- Not detected at analytical detection limit.
Note:	- Numbers in bold exceed standard.

TABLE 5-4 (Page 5 of 7)

GROUNDWATER DATA SUMMARY

MONITORING WELL SAMPLING

Round 2 - August 1999

SDG Number Lab Sample Number LMS Sample ID Date Collected	809 B94858 N-10465 8/23/1999	809 B94859 N-10322 8/23/1999	809 B94860 UN-23 8/24/1999	809 B94804 EW-1B 8/9/1999	809 B94803 EW-1C 8/9/1999	809 B94802 EW-2B 8/9/1999	809 B94801 EW-2C 8/9/1999	809 B94809 N-11861 8/10/1999	NYSDEC CLASS GA STANDARDS (b)
Volatile Organic Compounds (ug/L)				[DL:5:1]					
Vinyl Chloride	ND	ND	ND	ND	ND	**53**	ND	ND	2
Chloroethane	ND	ND	ND	ND	ND	ND	ND	ND	5
Methylene Chloride	ND	ND	ND	ND	ND	ND	ND	ND	5
Acetone	ND	ND	ND	ND	ND	10	ND	ND	50*
1,1-Dichloroethylene	ND	ND	ND	**33**	ND	**7 j**	ND	ND	5
1,1-Dichloroethane	ND	ND	ND	5 j	ND	3 j	ND	ND	5
1,2-Dichloroethylene (total)	ND	ND	**7 j**	**68**	ND	**32**	ND	ND	5
2-Butanone	ND	ND	ND	ND	ND	ND	ND	ND	50*
Chloroform	ND	ND	ND	ND	ND	ND	ND	ND	7
1,2-Dichloroethane	ND	ND	ND	ND	ND	**1 j**	ND	ND	0.6
1,1,1-Trichloroethane	ND	**6 j**	1 j	**56**	ND	**7 j**	ND	ND	5
Carbon Tetrachloride	ND	ND	ND	ND	ND	ND	ND	ND	5
Trichloroethylene	ND	2 j	**11**	**90**	**10**	**130**	ND	ND	5
Benzene	ND	ND	ND	ND	ND	ND	ND	ND	1
Tetrachloroethylene	ND	**19**	**21**	**780 d**	ND	**20**	ND	ND	5
Chlorobenzene	ND	ND	ND	ND	ND	2 j	ND	ND	5
Xylene (total)	ND	ND	ND	ND	ND	ND	ND	ND	5
Total Organics	ND	27	40	**1032**	10	**265**	ND	ND	100[1]

1 - This value applies to the total of all organic substances listed in the New York State Groundwater Effluent Limitations table from the Division of Water Technical and Operational Guidance Series (1.1.1) with a groundwater effluent limitation less than 100 ug/L.
* - Value taken from NYSDEC Class GA Guidance Value.
(b) - Division of Water Technical and Operational Guidance Series (1.1.1) June 1998.
d - Concentration recovered from diluted sample.
e - Estimated concentration; exceeds GC/MS calibration range.
j - Estimated concentration; compound present below quantitation limit.
ND - Not detected at analytical detection limit.
Note: - Numbers in bold exceed standard.

TABLE 5-4 (Page 6 of 7)

GROUNDWATER DATA SUMMARY
MONITORING WELL SAMPLING
Round 2 - August 1999

SDG Number Lab Sample Number LMS Sample ID Date Collected	809 B94810 N-9937 8/10/1999	809 B94811 N-9938 8/10/1999	809 B94805 N-9939 8/10/1999	809 B94806 NRMW-1 8/10/1999	809 B94808 NRMW-2 8/10/1999	809 B94807 NRMW-3 8/10/1999	809 9923527 TB-1 8/9/1999	NYSDEC CLASS GA STANDARDS (b)
Volatile Organic Compounds (ug/L)	[DL:2.5:1]	[DL:2:1]						
Vinyl Chloride	ND	ND	ND	ND	ND	ND	ND	2
Chloroethane	ND	2 j	ND	ND	ND	ND	ND	5
Methylene Chloride	ND	ND	ND	ND	ND	ND	ND	5
Acetone	ND	ND	ND	ND	ND	ND	ND	50*
1,1-Dichloroethylene	**39**	**44**	ND	ND	ND	ND	ND	5
1,1-Dichloroethane	**48**	**51**	ND	ND	ND	ND	ND	5
1,2-Dichloroethylene (total)	2 j	2 j	ND	ND	ND	ND	ND	5
2-Butanone	ND	ND	ND	ND	ND	ND	ND	50*
Chloroform	ND	ND	ND	1 j	ND	ND	ND	7
1,2-Dichloroethane	**2 j**	**2 j**	ND	ND	ND	ND	ND	0.6
1,1,1-Trichloroethane	**320 d**	**280 d**	2 j	ND	ND	ND	ND	5
Carbon Tetrachloride	ND	ND	ND	ND	ND	ND	ND	5
Trichloroethylene	**29**	**31**	ND	ND	ND	ND	ND	5
Benzene	ND	ND	ND	ND	ND	ND	ND	1
Tetrachloroethylene	**14**	**15**	ND	ND	ND	ND	ND	5
Chlorobenzene	ND	ND	ND	ND	ND	ND	ND	5
Xylene (total)	ND	ND	ND	ND	ND	ND	ND	5
Total Organics	**454**	**427**	2	1	ND	ND	ND	100[1]

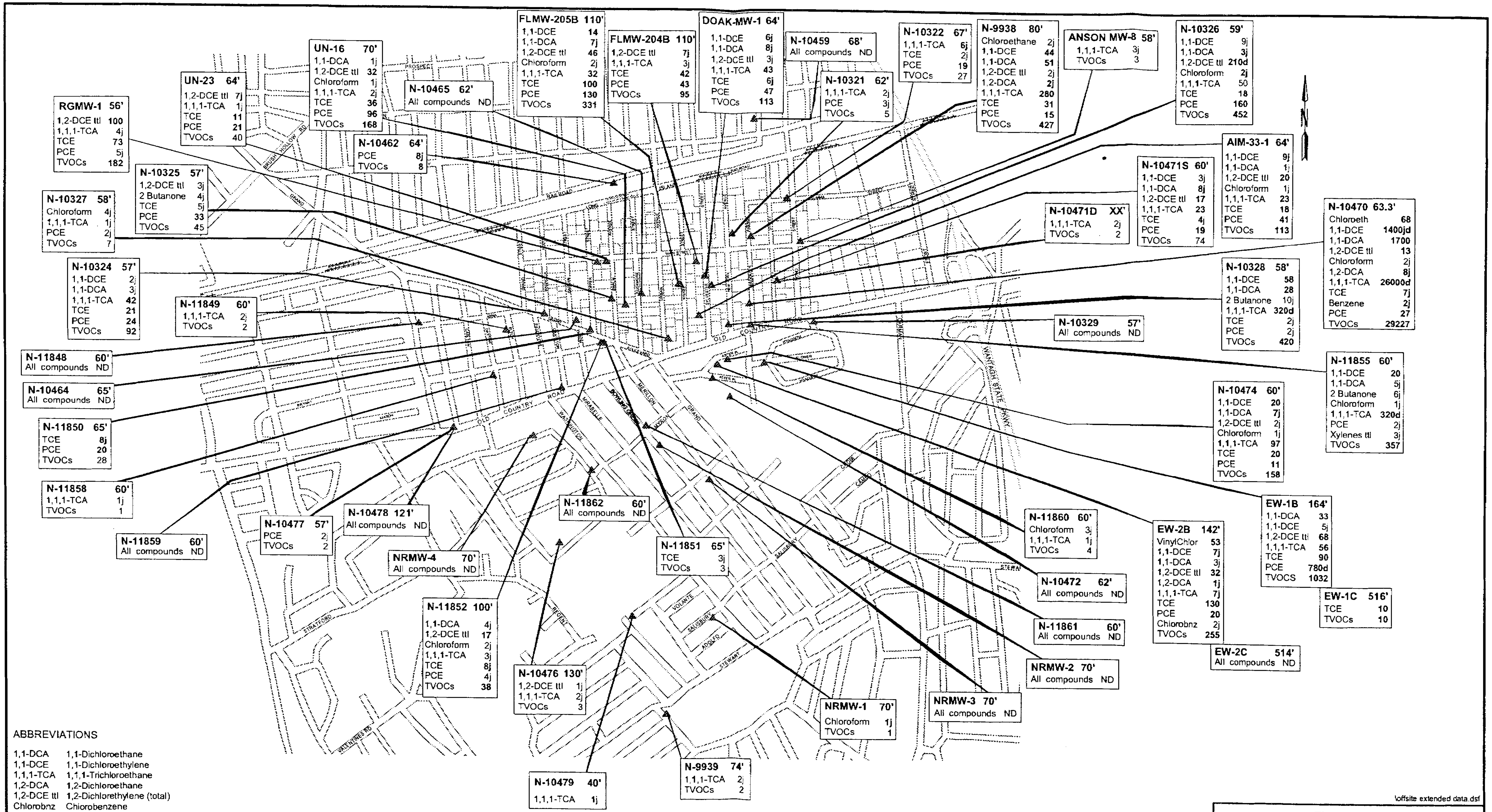
1 - This value applies to the total of all organic substances listed in the New York State Groundwater Effluent Limitations table from the Division of Water Technical and Operational Guidance Series (1.1.1) with a groundwater effluent limitation less than 100 ug/L.
* - Value taken from NYSDEC Class GA Guidance Value.
(b) - Division of Water Technical and Operational Guidance Series (1.1.1) June 1998.
d - Concentration recovered from diluted sample.
e - Estimated concentration; exceeds GC/MS calibration range.
j - Estimated concentration; compound present below quantitation limit.
ND - Not detected at analytical detection limit.
Note: - Numbers in bold exceed standard.

TABLE 5-4 (Page 7 of 7)

GROUNDWATER DATA SUMMARY
MONITORING WELL SAMPLING
Round 2 - August 1999

SDG Number	809	809	809	809	809	809	809	809	809	809	NYSDEC
Lab Sample Number	9923882	B94814	B94815	B94816	B94817	B94818	B94819	B94820	B94821	B94822	CLASS GA
LMS Sample ID	TB-2	N-10459	N-10329	N-10462	N-10323	N-10324	N-10472	TB-3	N-10474	N-11859	STANDARDS (b)
Date Collected	8/12/1999	8/12/1999	8/12/1999	8/12/1999	8/12/1999	8/13/1999	8/13/1999	8/16/1999	8/16/1999	8/16/1999	
Volatile Organic Compounds (ug/L)											
Vinyl Chloride	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2
Chloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	5
Methylene Chloride	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	5
Acetone	2 j	ND	ND	ND	ND	ND	ND	ND	ND	ND	50*
1,1-Dichloroethylene	ND	ND	ND	ND	2 j	2 j	ND	ND	**20**	ND	5
1,1-Dichloroethane	ND	ND	ND	ND	3 j	3 j	ND	ND	**7 j**	ND	5
1,2-Dichloroethylene (total)	ND	ND	ND	ND	ND	ND	ND	ND	2 j	ND	5
2-Butanone	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	50*
Chloroform	ND	ND	ND	ND	ND	ND	ND	ND	1 j	ND	7
1,2-Dichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.6
1,1,1-Trichloroethane	ND	ND	ND	ND	**45**	**42**	ND	ND	**97**	ND	5
Carbon Tetrachloride	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	5
Trichloroethylene	ND	ND	ND	ND	**22**	**21**	ND	ND	**20**	ND	5
Benzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
Tetrachloroethylene	ND	ND	ND	**8 j**	**26**	**24**	ND	ND	**11**	ND	5
Chlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	5
Xylene (total)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	5
Total Organics	2	ND	ND	8	98	92	ND	ND	**158**	ND	100¹

1 - This value applies to the total of all organic substances listed in the New York State Groundwater Effluent Limitations table from the Division of Water Technical and Operational Guidance Series (1.1.1) with a groundwater effluent limitation less than 100 ug/L.
* - Value taken from NYSDEC Class GA Guidance Value.
(b) - Division of Water Technical and Operational Guidance Series (1.1.1) June 1998.
d - Concentration recovered from diluted sample.
e - Estimated concentration; exceeds GC/MS calibration range.
j - Estimated concentration; compound present below quantitation limit.
ND - Not detected at analytical detection limit.
Note: - Numbers in bold exceed standard.



RGMW-1	56'
1,2-DCE ttl	100
1,1,1-TCA	4j
TCE	73
PCE	5j
TVOCs	182

UN-23	64'
1,2-DCE ttl	7j
1,1,1-TCA	1j
TCE	11
PCE	21
TVOCs	40

UN-16	70'
1,1-DCA	1j
1,2-DCE ttl	32
Chloroform	1j
1,1,1-TCA	2j
TCE	36
PCE	96
TVOCs	168

N-10465	62'
All compounds	ND

N-10462	64'
PCE	8j
TVOCs	8

FLMW-205B	110'
1,1-DCE	14
1,1-DCA	7j
1,2-DCE ttl	46
Chloroform	2j
1,1,1-TCA	32
TCE	100
PCE	130
TVOCs	331

FLMW-204B	110'
1,2-DCE ttl	7j
1,1,1-TCA	3j
TCE	42
PCE	43
TVOCs	95

DOAK-MW-1	64'
1,1-DCE	6j
1,1-DCA	8j
1,2-DCE ttl	3j
1,1,1-TCA	43
TCE	6j
PCE	47
TVOCs	113

N-10459	68'
All compounds	ND

N-10321	62'
1,1,1-TCA	2j
PCE	3j
TVOCs	5

N-10322	67'
1,1,1-TCA	6j
TCE	2j
PCE	19
TVOCs	27

N-9938	80'
Chloroethane	2j
1,1-DCE	44
1,1-DCA	51
1,2-DCE ttl	2j
1,2-DCA	2j
1,1,1-TCA	280
TCE	31
PCE	15
TVOCs	427

ANSON MW-8	58'
1,1,1-TCA	3j
TVOCs	3

N-10326	59'
1,1-DCE	9j
1,1-DCA	3j
1,2-DCE ttl	210d
Chloroform	2j
1,1,1-TCA	50
TCE	18
PCE	160
TVOCs	452

N-10325	57'
1,2-DCE ttl	3j
2 Butanone	4j
TCE	5j
PCE	33
TVOCs	45

N-10327	58'
Chloroform	4j
1,1,1-TCA	1j
PCE	2j
TVOCs	7

AIM-33-1	64'
1,1-DCE	9j
1,1-DCA	1j
1,2-DCE ttl	20
Chloroform	1j
1,1,1-TCA	23
TCE	18
PCE	41
TVOCs	113

N-10471S	60'
1,1-DCE	3j
1,1-DCA	8j
1,2-DCE ttl	17
1,1,1-TCA	23
TCE	4j
PCE	19
TVOCs	74

N-10471D	XX'
1,1,1-TCA	2j
TVOCs	2

N-10470	63.3'
Chloroeth	68
1,1-DCE	1400jd
1,1-DCA	1700
1,2-DCE ttl	13
Chloroform	2j
1,2-DCA	8j
1,1,1-TCA	26000d
TCE	7j
Benzene	2j
PCE	27
TVOCs	29227

N-10324	57'
1,1-DCE	2j
1,1-DCA	3j
1,1,1-TCA	42
TCE	21
PCE	24
TVOCs	92

N-11849	60'
1,1,1-TCA	2j
TVOCs	2

N-10328	58'
1,1-DCE	58
1,1-DCA	28
2 Butanone	10j
1,1,1-TCA	320d
TCE	2j
PCE	2j
TVOCs	420

N-10329	57'
All compounds	ND

N-11848	60'
All compounds	ND

N-11855	60'
1,1-DCE	20
1,1-DCA	5j
2 Butanone	6j
Chloroform	1j
1,1,1-TCA	320d
PCE	2j
Xylenes ttl	3j
TVOCs	357

N-10464	65'
All compounds	ND

N-10474	60'
1,1-DCE	20
1,1-DCA	7j
1,2-DCE ttl	2j
Chloroform	1j
1,1,1-TCA	97
TCE	20
PCE	11
TVOCs	158

N-11850	65'
TCE	8j
PCE	20
TVOCs	28

N-11858	60'
1,1,1-TCA	1j
TVOCs	1

N-11862	60'
All compounds	ND

N-11860	60'
Chloroform	3j
1,1,1-TCA	1j
TVOCs	4

EW-1B	164'
1,1-DCA	33
1,1-DCE	5j
1,2-DCE ttl	68
1,1,1-TCA	56
TCE	90
PCE	780d
TVOCS	1032

N-10478	121'
All compounds	ND

N-10477	57'
PCE	2j
TVOCs	2

N-11859	60'
All compounds	ND

N-11851	65'
TCE	3j
TVOCs	3

EW-2B	142'
VinylChlor	53
1,1-DCE	7j
1,1-DCA	3j
1,2-DCE ttl	32
1,2-DCA	1j
1,1,1-TCA	7j
TCE	130
PCE	20
Chlorobnz	2j
TVOCs	255

NRMW-4	70'
All compounds	ND

N-10472	62'
All compounds	ND

EW-1C	516'
TCE	10
TVOCs	10

N-11852	100'
1,1-DCA	4j
1,2-DCE ttl	17
Chloroform	2j
1,1,1-TCA	3j
TCE	8j
PCE	4j
TVOCs	38

N-11861	60'
All compounds	ND

EW-2C	514'
All compounds	ND

NRMW-2	70'
All compounds	ND

N-10476	130'
1,2-DCE ttl	1j
1,1,1-TCA	2j
TVOCs	3

NRMW-1	70'
Chloroform	1j
TVOCs	1

NRMW-3	70'
All compounds	ND

N-10479	40'
1,1,1-TCA	1j

N-9939	74'
1,1,1-TCA	2j
TVOCs	2

ABBREVIATIONS

1,1-DCA	1,1-Dichloroethane
1,1-DCE	1,1-Dichloroethylene
1,1,1-TCA	1,1,1-Trichloroethane
1,2-DCA	1,2-Dichloroethane
1,2-DCE ttl	1,2-Dichlorethylene (total)
Chlorobnz	Chlorobenzene
Ethylbenz	Ethylbenzene
PCE	Tetrachloroethylene
Dibromochl	Dibromochloromethane
Bromodich	Bromodichloromethane
TCE	Trichloroethylene
VinylChlor	Vinyl Chloride
Xylenes ttl	Xylenes (total)
TVOCs	Total volatile organic compounds
ND	Not detected at analytical detection limit

NOTE TVOC includes only chlorinated solvents

QUALIFIERS

B	Value is less than contract required detection limit but greater than instrument detection limit
b	Found in associated blanks
d	Concentration recovered from diluted sample
j	Estimated concentration; compound present below quantitation limit

LEGEND:

Well I.D.
Total depth of well below grade

N-12345	70'
PCE	31
TVOCs	31

Contaminant
Concentration in µg/l

Well Location ▲

0 1200 ft
Approximate Scale
1 in. = 1200 ft

\offsite extended data.dsf

Figure 5-2

August 1999 (Round 2)
Well Sampling
Groundwater Data Summary

OFFSITE INVESTIGATION
NEW CASSEL INDUSTRIAL AREA
NYSDEC I.D. No. 130043

LAWLER, MATUSKY & SKELLY ENGINEERS LLP
Pearl River, New York

TABLE 5-5 (Page 1 of 4)

GROUNDWATER DATA SUMMARY
MONITORING WELL SAMPLING
Round 3 - January 2000

SDG Number **Lab Sample Number** **LMS Sample ID** **Date Collected**	**110** **B94801** **EW-1C** **1/10/2000**	**110** **B94802** **EW-2C** **1/10/2000**	**110** **B94803** **BD of EW-2C** **1/10/2000**	**110** **B94804** **NRMW-1** **1/11/2000**	**110** **B94805** **NRMW-2** **1/11/2000**	**110** **B94806** **NRMW-3** **1/11/2000**	**NYSDEC CLASS GA STANDARDS (b)**
VOLATILE ORGANICS (µg/l)							
Methane	ND	ND	ND	6	ND	ND	N/A
Ethene	ND	ND	ND	9	ND	ND	N/A
1,1-Dichloroethane	ND	ND	ND	ND	ND	ND	5
1,1-Dichloroethylene	ND	ND	ND	ND	ND	ND	5
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	ND	5
1,2-Dichloroethane	ND	ND	ND	ND	ND	ND	0.6
1,2-Dichloroethylene(total)	ND	ND	ND	ND	ND	ND	5
Chloroform	ND	ND	ND	ND	ND	ND	7
Methylene Chloride	ND	ND	ND	ND	ND	ND	5
Tetrachloroethylene	ND	ND	ND	ND	ND	ND	5
Trichloroethylene	**10**	ND	ND	ND	ND	ND	5
Toluene	ND	ND	ND	ND	ND	ND	5
Vinyl Chloride	ND	ND	ND	ND	ND	ND	2
1,3-Dichlorobenzene	ND	ND	ND	ND	ND	ND	3
1,4-Dichlorobenzene	ND	ND	ND	ND	ND	ND	3
Xylenes (total)	ND	ND	ND	2 j b	ND	ND	5
Total VOCs	10	ND	ND	17	ND	ND	100[1]
Metals (ug/l)							
Arsenic	ND	ND	ND	ND	ND	ND	25
Iron	**427**	**379**	**380**	227	67.1 B	124	300
Manganese	34.2	26.3	29.3	**579**	236	5.3 B	300

1 - This value applies to the total of all organic substances listed in the New York State Groundwater Effluent Limitations table from the Division of Water Technical and Operational Guidance Series (1.1.1) with a groundwater effluent limitation less than 100 ug/l.
• - Value taken from NYSDEC Class GA Guidance Value.
(b) - Division of Water Technical and Operational Guidance Series (1.1.1) June 1998.
b - Found in associated blanks.
j - Estimated concentration; compound present below quantitation limit.
B - Value is less than the contract-required detection limit but greater than the instrument detection limit.
N/A - Not available.
ND - Not detected at analytical detection limit.
Note: - Numbers in bold exceed standard.

TABLE 5-5 (Page 2 of 4)

GROUNDWATER DATA SUMMARY
MONITORING WELL SAMPLING
Round 3 - January 2000

SDG Number	**110**	**110**	**110**	**110**	**110**	**110**	**110**	**110**	**NYSDEC**
Lab Sample Number	**B94807**	**B94808**	**B94809**	**B94810**	**B94811**	**B94812**	**B94813**	**B94814**	**CLASS GA**
LMS Sample ID	**NRMW-4**	**TB-1**	**TB-2**	**FSMW-7A**	**FSMW-7B**	**N-10477**	**N-10478**	**FSMW-6A**	**STANDARDS (b)**
Date Collected	**1/11/2000**	**1/10/2000**	**1/12/2000**	**1/12/2000**	**1/12/2000**	**1/12/2000**	**1/12/2000**	**1/13/2000**	
VOLATILE ORGANICS (µg/l)									
Methane	ND	ND	ND	ND	ND	ND	ND	0.9 j	N/A
Ethene	ND	ND	ND	ND	ND	ND	ND	ND	N/A
1,1-Dichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	5
1,1-Dichloroethene	ND	ND	ND	ND	ND	ND	ND	ND	5
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	5
1,2-Dichloroethane*	ND	ND	ND	ND	ND	ND	ND	ND	0.6
1,2-Dichloroethene(total)	ND	ND	ND	ND	ND	ND	ND	ND	5
Chloroform	ND	ND	ND	ND	ND	ND	ND	ND	7
Methylene Chloride	ND	ND	ND	ND	ND	ND	ND	ND	5
Tetrachloroethene	ND	ND	ND	ND	ND	ND	1 j	ND	5
Trichloroethene	ND	ND	ND	ND	ND	ND	ND	ND	5
Toluene	ND	ND	ND	ND	ND	ND	ND	ND	5
Vinyl Chloride	ND	ND	ND	ND	ND	ND	ND	ND	2
1,3-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	3
1,4-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	3
Xylenes (total)	ND	ND	ND	ND	ND	ND	ND	ND	5
Total VOCs	ND	ND	ND	ND	ND	ND	1	0.9	100[1]
Metals (ug/l)									
Arsenic	ND	N/A	N/A	ND	ND	3.4 B	ND	ND	25
Iron	101	N/A	N/A	**470**	**449**	**1500**	**495**	262	300
Manganese	123	N/A	N/A	20.5	24.4	**301**	38.6	10.8 B	300

1 - This value applies to the total of all organic substances listed in the New York State Groundwater Effluent Limitations table from the Division of Water Technical and Operational Guidance Series (1.1.1) with a groundwater effluent limitation less than 100 ug/l.

* - Value taken from NYSDEC Class GA Guidance Value.

(b) - Division of Water Technical and Operational Guidance Series (1.1.1) June 1998.

b - Found in associated blanks.

j - Estimated concentration; compound present below quantitation limit.

B - Value is less than the contract-required detection limit but greater than the instrument detection limit.

N/A - Not available.

ND - Not detected at analytical detection limit.

Note: - Numbers in bold exceed standard.

TABLE 5-5 (Page 3 of 4)

GROUNDWATER DATA SUMMARY
MONITORING WELL SAMPLING
Round 3 - January 2000

SDG Number	**110**	**110**	**110**	**110**	**110**	**110**	**110**	**110**	**NYSDEC**
Lab Sample Number	**B94815**	**B94816**	**B94817**	**B94818**	**B94819**	**B94820**	**B94821**	**B94823**	**CLASS GA**
LMS Sample ID	**FSMW-6B**	**EW-1B**	**EW-2B**	**N-10474**	**TB-3**	**N-11851**	**N-9938**	**FLMW-205B**	**STANDARDS (b)**
Date Collected	**1/13/2000**	**1/13/2000**	**1/13/2000**	**1/13/2000**	**1/13/2000**	**1/14/2000**	**1/14/2000**	**1/17/2000**	
VOLATILE ORGANICS (µg/l)		[DL:20:1]							
Methane	0.5 j	ND	1	ND	ND	ND	ND	0.6 j	N/A
Ethene	**4**	0.6 j	0.7 j	ND	ND	ND	ND	**1**	N/A
1,1-Dichloroethane	ND	**8**	3 j	3 j	ND	ND	**23**	**9**	5
1,1-Dichloroethene	ND	**51**	**6**	**6**	ND	ND	**16**	**17**	5
1,1,1-Trichloroethane	ND	**85**	**8**	**41**	ND	ND	**120**	**50**	5
1,2-Dichloroethane	ND	ND	ND	ND	ND	ND	**1 j**	ND	0.6
1,2-Dichloroethene(total)	ND	1 j	ND	ND	ND	ND	ND	ND	5
Chloroform	ND	ND	ND	ND	ND	ND	ND	2 j	7
Methylene Chloride	ND	ND	ND	ND	ND	ND	ND	ND	5
Tetrachloroethene	**52**	**1100 d**	**10**	3 j	ND	3 j	**9**	**150**	5
Trichloroethene	ND	**150**	**41**	2 j	ND	2 j	**10**	**98**	5
Toluene	2 j	ND	ND	ND	ND	ND	ND	ND	5
Vinyl Chloride	ND	ND	**6 j**	ND	ND	ND	ND	ND	2
1,3-Dichlorobenzene	ND	**4 j**	ND	ND	ND	ND	ND	ND	3
1,4-Dichlorobenzene	ND	1 j	ND	ND	ND	ND	ND	ND	3
Xylenes (total)	ND	ND	ND	ND	ND	ND	ND	ND	5
Total VOCs	58.5	1400.6	75.7	55	ND	5	179	327.6	100[1]
Metals (ug/l)									
Arsenic	ND	ND	ND	1.9 B	N/A	2.2 B	ND	ND	25
Iron	180	**837**	**385**	**354**	N/A	**316**	**2160**	118	300
Manganese	34.2	57.4	33.6	**899**	N/A	41.4	35.1	264	300

1	- This value applies to the total of all organic substances listed in the New York State Groundwater Effluent Limitations table from the Division of Water Technical and Operational Guidance Series (1.1.1) with a groundwater effluent limitation less than 100 ug/l.
•	- Value taken from NYSDEC Class GA Guidance Value.
(b)	- Division of Water Technical and Operational Guidance Series (1.1.1) June 1998.
b	- Found in associated blanks.
j	- Estimated concentration; compound present below quantitation limit.
B	- Value is less than the contract-required detection limit but greater than the instrument detection limit.
N/A	- Not available.
ND	- Not detected at analytical detection limit.
Note:	- Numbers in bold exceed standard.

TABLE 5-5 (Page 4 of 4)

GROUNDWATER DATA SUMMARY
MONITORING WELL SAMPLING
Round 3 - January 2000

SDG Number **Lab Sample Number** **LMS Sample ID** **Date Collected**	**110** **B94824** **N-11855** **1/18/2000**	**110** **B94825** **N-10328** **1/18/2000**	**110** **B94826** **N-10324** **1/18/2000**	**110** **B94827** **N-10470** **1/17/2000**	**110** **B94828** **N-10325** **1/18/2000**	**110** **B94829** **N-11860** **1/17/2000**	**NYSDEC** **CLASS GA** **STANDARDS (b)**
VOLATILE ORGANICS (µg/l)	[DL:500:1]	[DL:5:1]		[DL:20:1]			
Methane	ND	ND	ND	ND	ND	ND	N/A
Ethene	ND	ND	ND	ND	ND	ND	N/A
1,1-Dichloroethane	**2200 j d**	**27**	4 j	**94**	ND	ND	5
1,1-Dichloroethene	**1100 j d**	**60**	2 j	**150**	ND	ND	5
1,1,1-Trichloroethane	**24000 d**	**290 d**	**52**	**1500 d**	2 j	2 j	5
1,2-Dichloroethane	11	ND	ND	ND	ND	ND	0.6
1,2-Dichloroethene(total)	ND	ND	ND	ND	ND	ND	5
Chloroform	5	ND	ND	ND	ND	6	7
Methylene Chloride	**7**	ND	ND	ND	ND	ND	5
Tetrachloroethene	**12**	ND	**26**	**29**	**37**	ND	5
Trichloroethene	4 j	2 j	**20**	**10**	**7**	ND	5
Toluene	ND	ND	ND	ND	ND	ND	5
Vinyl Chloride	ND	ND	ND	ND	ND	ND	2
1,3-Dichlorobenzene	ND	ND	ND	ND	ND	ND	3
1,4-Dichlorobenzene	ND	ND	ND	ND	ND	ND	3
Xylenes (total)	ND	ND	ND	ND	ND	ND	5
Total VOCs	27339	379	104	1783	46	8	100[1]
Metals (ug/l)							
Arsenic	3.3 B	2.8 B	3.6 B	2.7 B	2.2 B	2.3 B	25
Iron	**14100**	**185**	**343**	**402**	**861**	205	300
Manganese	**2360**	**356**	26.9	149	149	108	300

1 - This value applies to the total of all organic substances listed in the New York State Groundwater Effluent Limitations table from the Division of Water Technical and Operational Guidance Series (1.1.1) with a groundwater effluent limitation less than 100 ug/l.

* - Value taken from NYSDEC Class GA Guidance Value.

(b) - Division of Water Technical and Operational Guidance Series (1.1.1) June 1998.

b - Found in associated blanks.

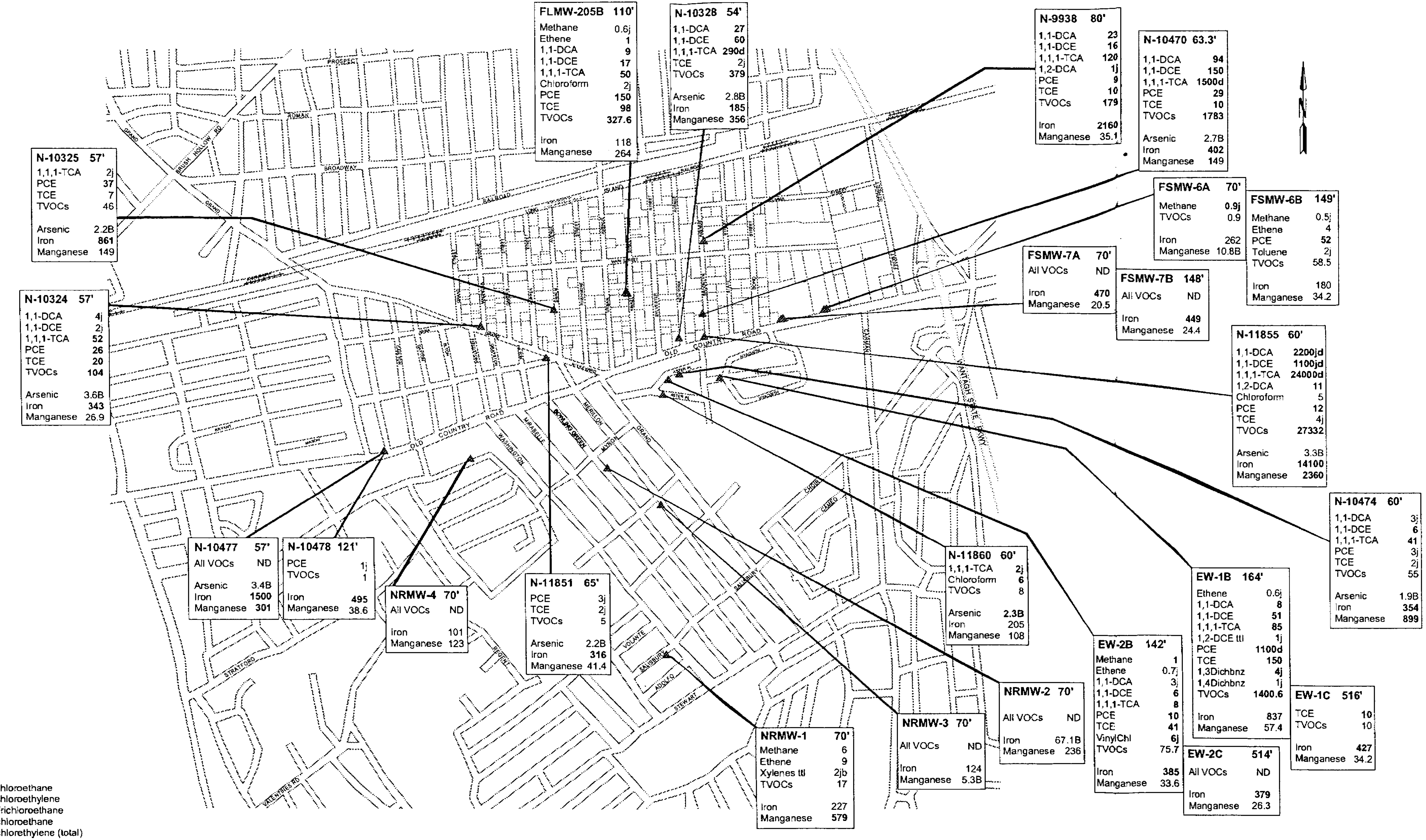
j - Estimated concentration; compound present below quantitation limit.

B - Value is less than the contract-required detection limit but greater than the instrument detection limit.

N/A - Not available.

ND - Not detected at analytical detection limit.

Note: - Numbers in bold exceed standard.



FLMW-205B	110'
Methane	0.6j
Ethene	1
1,1-DCA	9
1,1-DCE	17
1,1,1-TCA	50
Chloroform	2j
PCE	150
TCE	98
TVOCs	327.6
Iron	118
Manganese	264

N-10328	54'
1,1-DCA	27
1,1-DCE	60
1,1,1-TCA	290d
TCE	2j
TVOCs	379
Arsenic	2.8B
Iron	185
Manganese	356

N-9938	80'
1,1-DCA	23
1,1-DCE	16
1,1,1-TCA	120
1,2-DCA	1j
PCE	9
TCE	10
TVOCs	179
Iron	2160
Manganese	35.1

N-10470	63.3'
1,1-DCA	94
1,1-DCE	150
1,1,1-TCA	1500d
PCE	29
TCE	10
TVOCs	1783
Arsenic	2.7B
Iron	402
Manganese	149

N-10325	57'
1,1,1-TCA	2j
PCE	37
TCE	7
TVOCs	46
Arsenic	2.2B
Iron	861
Manganese	149

FSMW-6A	70'
Methane	0.9j
TVOCs	0.9
Iron	262
Manganese	10.8B

FSMW-6B	149'
Methane	0.5j
Ethene	4
PCE	52
Toluene	2j
TVOCs	58.5
Iron	180
Manganese	34.2

FSMW-7A	70'
All VOCs	ND
Iron	470
Manganese	20.5

FSMW-7B	148'
All VOCs	ND
Iron	449
Manganese	24.4

N-10324	57'
1,1-DCA	4j
1,1-DCE	2j
1,1,1-TCA	52
PCE	26
TCE	20
TVOCs	104
Arsenic	3.6B
Iron	343
Manganese	26.9

N-11855	60'
1,1-DCA	2200jd
1,1-DCE	1100jd
1,1,1-TCA	24000d
1,2-DCA	11
Chloroform	5
PCE	12
TCE	4j
TVOCs	27332
Arsenic	3.3B
Iron	14100
Manganese	2360

N-10474	60'
1,1-DCA	3j
1,1-DCE	6
1,1,1-TCA	41
PCE	3j
TCE	2j
TVOCs	55
Arsenic	1.9B
Iron	354
Manganese	899

N-10477	57'
All VOCs	ND
Arsenic	3.4B
Iron	1500
Manganese	301

N-10478	121'
PCE	1j
TVOCs	1
Iron	495
Manganese	38.6

NRMW-4	70'
All VOCs	ND
Iron	101
Manganese	123

N-11851	65'
PCE	3j
TCE	2j
TVOCs	5
Arsenic	2.2B
Iron	316
Manganese	41.4

N-11860	60'
1,1,1-TCA	2j
Chloroform	6
TVOCs	8
Arsenic	2.3B
Iron	205
Manganese	108

EW-1B	164'
Ethene	0.6j
1,1-DCA	8
1,1-DCE	51
1,1,1-TCA	85
1,2-DCE ttl	1j
PCE	1100d
TCE	150
1,3Dichbnz	4j
1,4Dichbnz	1j
TVOCs	1400.6
Iron	837
Manganese	57.4

EW-2B	142'
Methane	1
Ethene	0.7j
1,1-DCA	3j
1,1-DCE	6
1,1,1-TCA	8
PCE	10
TCE	41
VinylChl	6j
TVOCs	75.7
Iron	385
Manganese	33.6

NRMW-2	70'
All VOCs	ND
Iron	67.1B
Manganese	236

EW-1C	516'
TCE	10
TVOCs	10
Iron	427
Manganese	34.2

NRMW-1	70'
Methane	6
Ethene	9
Xylenes ttl	2jb
TVOCs	17
Iron	227
Manganese	579

NRMW-3	70'
All VOCs	ND
Iron	124
Manganese	5.3B

EW-2C	514'
All VOCs	ND
Iron	379
Manganese	26.3

ABBREVIATIONS

1,1-DCA	1,1-Dichloroethane
1,1-DCE	1,1-Dichloroethylene
1,1,1-TCA	1,1,1-Trichloroethane
1,2-DCA	1,2-Dichloroethane
1,2-DCE ttl	1,2-Dichlorethylene (total)
1,3Dichbnz	1,3-Dichlorobenzene
1,4Dichbnz	1,4-Dichlorobenzene
Chlorobnz	Chlorobenzene
Ethylbenz	Ethylbenzene
PCE	Tetrachloroethylene
Dibromochl	Dibromochloromethane
Bromodich	Bromodichloromethane
TCE	Trichloroethylene
VinylChlor	Vinyl Chloride
Xylenes ttl	Xylenes (total)
TVOCs	Total volatile organic compounds
ND	Not detected at analytical detection limit

NOTE TVOC includes only chlorinated solvents

QUALIFIERS

B	Value is less than contract required detection limit but greater than instrument detection limit
b	Found in associated blanks
d	Concentration recovered from diluted sample
j	Estimated concentration; compound present below quantitation limit

LEGEND:

Well I.D.

Total depth of well below grade

N-12345	70'
PCE	31
TVOCs	31

Contaminant

Concentration in µg/l

Well Location ▲

0 1200 ft

Approximate Scale
1 in. = 1200 ft

\offsite extended data.dsf

Figure 5-3

January 2000 (Round 3) Well Sampling Groundwater Data Summary

OFFSITE INVESTIGATION
NEW CASSEL INDUSTRIAL AREA
NYSDEC I.D. No. 130043

LAWLER, MATUSKY & SKELLY ENGINEERS LLP
Pearl River, New York

groundwater samples that were collected. The arsenic concentrations ranged from ND to 3.6 µg/l (N-10324). Iron was found in all of the samples that were collected and the concentrations ranged from 67.1 µg/l (NRMW-02) to 14100 µg/l (N-11855). Manganese was found in all of the samples that were collected and the concentrations ranged from 5.3 µg/l (NRMW-03) to 2360 µg/l (N-11855). Many of the samples exceeded the Class GA groundwater standards for iron and manganese. However it is believed the noted concentrations are the result of natural geochemical reactions in the aquifer and are not indicative of past disposal practices.

5.2.4 **Hydropunch Groundwater Sampling Results- January and February 2000**

Groundwater samples were collected at a 10-ft. sampling interval from 4 hydropunch groundwater sampling locations during January and February 2000. Each of the groundwater samples collected during this sampling effort were analyzed for VOC contamination. Analytical data summary sheets for these samples are also found in Appendix E.

5.2.4.1 ***VOC Results.*** A summary of the analytical results from the hydropunch groundwater samples is found on Table 5-6 and shown on Figure 5-4. The analytical results for GWHP-01 indicate that 7 of the 10 samples that were collected exhibit VOC concentration in excess of the Class GA groundwater standards. Total VOC concentrations at this location ranged from ND (70 to 72 ft. sample) to 5497 µg/l (138 to 140 ft. sample). TCE, PCE and their breakdown products were the primary contaminants detected, significant concentrations of 1,1,1-TCA and it's breakdown products were also found (Figure 5-4). In general total VOC concentrations increased with depth between 90 and 140 feet below the ground surface.

The analytical results for GWHP-02 indicate that only two of the samples that were collected exhibited VOC concentration in excess of the Class GA groundwater standards. The two samples which exceeded the Class GA standards were the 100 to 102 ft sample and the deepest sample collected at 148 to 150 ft. (Figure 5-4). Total VOCs in the 100 to 102 ft sample were 8 µg/l and 31 µg/l in the 148 to 150 ft. sample. 1,1,1-TCA was the predominant compound in both samples.

The analytical results for GWHP-03 indicate that 8 of the 9 samples that were collected

TABLE 5-6 (Page 1 of 12)

GROUNDWATER DATA SUMMARY
HYDROPUNCH SAMPLING
January February 2000

SDG Number	**120**	**120**	**120**	**120**	**NYSDEC**
Lab Sample Number	**B94839**	**B94840**	**B94841**	**B94842**	**CLASS GA**
LMS Sample ID	**GWHP-1 (TB-6)**	**GWHP-1 (128-130)**	**GWHP-1 (138-140)**	**GWHP-1 (148-150)**	**STANDARDS (b)**
Date Collected	**1/24/2000**	**1/24/2000**	**1/24/2000**	**1/24/2000**	
VOLATILE ORGANICS (µg/l)		[DL:25:1]	[DL:25:1]		
1,1-Dichloroethane	ND	**750 d**	**880 d**	ND	5
1,1-Dichloroethene	ND	**1600 d**	**1700 d**	4 j	5
1,1,1-Trichloroethane	ND	**790 d**	**820 d**	4 j	5
1,1,2-Trichloroethane	ND	**6 j**	**8 j**	ND	1
1,2-Dichloroethane	ND	**16**	**22**	ND	0.6
1,2-Dichloroethene(total)	ND	**94**	**77**	ND	5
Acetone	ND	ND	ND	ND	50*
Carbon Disulfide	ND	ND	ND	ND	N/A
Chloroethane	ND	ND	ND	ND	5
Chloroform	ND	**8 j**	**8 j**	ND	7
Methylene Chloride	ND	**11**	**17**	ND	5
Tetrachloroethene	ND	**180**	**160 j d**	ND	5
Trichloroethene	ND	**1800 d**	**1800 d**	**6 j**	5
Vinyl Chloride	ND	**6 j**	**5 j**	ND	2
Xylenes (total)	ND	ND	ND	ND	5
Total VOCs	ND	**5261**	**5497**	12	100[1]

1 - This value applies to the total of all organic substances listed in the New York State Groundwater Effluent Limitations table from the Division of Water Technical and Operational Guidance Series (1.1.1) with a groundwater effluent limitation less than 100 ug/l.
• - Value taken from NYSDEC Class GA Guidance Value.
(b) - Division of Water Technical and Operational Guidance Series (1.1.1) June 1998.
j - Estimated concentration; compound present below quantitation limit.
N/A - Not available.
ND - Not detected at analytical detection limit.
Note: - Numbers in bold exceed standard.

TABLE 5-6 (Page 2 of 12)

GROUNDWATER DATA SUMMARY
HYDROPUNCH SAMPLING
January February 2000

SDG Number	**120**	**120**	**120**	**120**	**NYSDEC**
Lab Sample Number	**B94834**	**B94836**	**B94838**	**B94837**	**CLASS GA**
LMS Sample ID	**GWHP-1 (BD of 90-92)**	**GWHP-1 (98-100)**	**GWHP-1 (108-110)**	**GWHP-1 (118-120)**	**STANDARDS (b)**
Date Collected	**1/20/2000**	**1/21/2000**	**1/21/2000**	**1/21/2000**	
VOLATILE ORGANICS (µg/l)		[DL:2.5:1]	[DL:5:1]	[DL:5:1]	
1,1-Dichloroethane	**13**	**110**	**200**	**190 d**	5
1,1-Dichloroethene	**25**	**260 d**	**360 d**	**460 d**	5
1,1,1-Trichloroethane	**21**	**180 d**	**270 d**	**260 d**	5
1,1,2-Trichloroethane	ND	1 j	**2 j**	**2 j**	1
1,2-Dichloroethane	ND	ND	ND	**4 j**	0.6
1,2-Dichloroethene(total)	2 j	**29**	**46**	**65**	5
Acetone	ND	ND	ND	ND	50*
Carbon Disulfide	ND	ND	ND	ND	N/A
Chloroethane	ND	2 j	ND	ND	5
Chloroform	ND	3 j	5 j	6 j	7
Methylene Chloride	ND	1 j	3 j	3 j	5
Tetrachloroethene	**6 j**	**51**	**76**	**86**	5
Trichloroethene	**19**	**220 d**	**300 d**	**420 d**	5
Vinyl Chloride	ND	ND	ND	ND	2
Xylenes (total)	ND	ND	ND	2 j	5
Total VOCs	86	**857**	**1262**	**1498**	100[1]

1 - This value applies to the total of all organic substances listed in the New York State Groundwater Effluent Limitations table from the Division of Water Technical and Operational Guidance Series (1.1.1) with a groundwater effluent limitation less than 100 ug/l.
* - Value taken from NYSDEC Class GA Guidance Value.
(b) - Division of Water Technical and Operational Guidance Series (1.1.1) June 1998.
j - Estimated concentration; compound present below quantitation limit.
N/A - Not available.
ND - Not detected at analytical detection limit.
Note: - Numbers in bold exceed standard.

TABLE 5-6 (Page 3 of 12)

GROUNDWATER DATA SUMMARY
HYDROPUNCH SAMPLING
January February 2000

SDG Number	**120**	**120**	**120**	**120**	**120**	**NYSDEC CLASS GA STANDARDS (b)**
Lab Sample Number	**B94831**	**B94830**	**B94832**	**B94833**	**B94835**	
LMS Sample ID	**GWHP-1 (TB-5)**	**GWHP-1 (60-62)**	**GWHP-1 (70-72)**	**GWHP-1 (80-82)**	**GWHP-1 (90-92)**	
Date Collected	**1/20/2000**	**1/20/2000**	**1/20/2000**	**1/20/2000**	**1/21/2000**	
VOLATILE ORGANICS (µg/l)						
1,1-Dichloroethane	ND	ND	ND	ND	**12**	5
1,1-Dichloroethylene	ND	ND	ND	ND	**24**	5
1,1,1-Trichloroethane	ND	ND	ND	ND	**21**	5
1,1,2-Trichloroethane	ND	ND	ND	ND	ND	1
1,2-Dichloroethane	ND	ND	ND	ND	ND	0.6
1,2-Dichloroethylene(total)	ND	ND	ND	ND	ND	5
Acetone	ND	3 j	ND	ND	ND	50*
Carbon Disulfide	ND	ND	ND	ND	ND	N/A
Chloroethane	ND	ND	ND	ND	ND	5
Chloroform	ND	2 j	ND	2 j	ND	7
Methylene Chloride	ND	ND	ND	ND	ND	5
Tetrachloroethylene	ND	ND	ND	ND	5 j	5
Trichloroethylene	ND	ND	ND	ND	**17**	5
Vinyl Chloride	ND	ND	ND	ND	ND	2
Xylenes (total)	ND	ND	ND	ND	ND	5
Total VOCs	ND	5	ND	2	79	100[1]

1 - This value applies to the total of all organic substances listed in the New York State Groundwater Effluent Limitations table from the Division of Water Technical and Operational Guidance Series (1.1.1) with a groundwater effluent limitation less than 100 ug/l.

* - Value taken from NYSDEC Class GA Guidance Value.

(b) - Division of Water Technical and Operational Guidance Series (1.1.1) June 1998.

j - Estimated concentration; compound present below quantitation limit.

N/A - Not available.

ND - Not detected at analytical detection limit.

Note: - Numbers in bold exceed standard.

TABLE 5-6 (Page 4 of 12)

GROUNDWATER DATA SUMMARY

HYDROPUNCH SAMPLING

January February 2000

SDG Number **Lab Sample Number** **LMS Sample ID** **Date Collected**	**128** **B94843** **TB-7** **1/28/2000**	**128** **B94844** **GWHP-2 (58-60)** **1/28/2000**	**128** **B94845** **GWHP-2 (70-72)** **1/28/2000**	**128** **B94846** **GWHP-2 (78-80)** **1/28/2000**	**128** **B94847** **GWHP-2 (94-96)** **1/31/2000**	**NYSDEC** **CLASS GA** **STANDARDS (b)**
VOLATILE ORGANICS (µg/l)						
1,1-Dichloroethane	ND	ND	ND	ND	ND	5
1,1-Dichloroethylene	ND	ND	ND	ND	ND	5
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	5
1,1,2-Trichloroethane	ND	ND	ND	ND	ND	1
1,2-Dichloroethane	ND	ND	ND	ND	ND	0.6
1,2-Dichloroethylene(total)	ND	ND	ND	ND	ND	5
Acetone	ND	ND	ND	ND	ND	50*
Carbon Disulfide	ND	ND	ND	ND	2 j	N/A
Chloroethane	ND	ND	ND	ND	ND	5
Chloroform	ND	ND	ND	ND	ND	7
Methylene Chloride	ND	ND	ND	ND	ND	5
Tetrachloroethylene	ND	ND	ND	ND	ND	5
Trichloroethylene	ND	ND	ND	ND	ND	5
Vinyl Chloride	ND	ND	ND	ND	ND	2
Xylenes (total)	ND	ND	ND	ND	ND	5
Total VOCs	ND	ND	ND	ND	2	100[1]

1 - This value applies to the total of all organic substances listed in the New York State Groundwater Effluent Limitations table from the Division of Water Technical and Operational Guidance Series (1.1.1) with a groundwater effluent limitation less than 100 ug/l.

* - Value taken from NYSDEC Class GA Guidance Value.

(b) - Division of Water Technical and Operational Guidance Series (1.1.1) June 1998.

j - Estimated concentration; compound present below quantitation limit.

N/A - Not available.

ND - Not detected at analytical detection limit.

Note: - Numbers in bold exceed standard.

GROUNDWATER DATA SUMMARY
HYDROPUNCH SAMPLING
January February 2000

SDG Number	**128**	**128**	**128**	**128**	**NYSDEC**
Lab Sample Number	**B94848**	**B94849**	**B94850**	**B94851**	**CLASS GA**
LMS Sample ID	**GWHP-2 (100-102)**	**GWHP-2 (108-110)**	**GWHP-2 (118-120)**	**GWHP-2 (128-130)**	**STANDARDS (b)**
Date Collected	**1/31/2000**	**1/31/2000**	**1/31/2000**	**1/31/2000**	
VOLATILE ORGANICS (µg/l)					
1,1-Dichloroethane	ND	ND	ND	ND	5
1,1-Dichloroethene	ND	ND	ND	ND	5
1,1,1-Trichloroethane	**8 j**	3 j	2 j	2 j	5
1,1,2-Trichloroethane	ND	ND	ND	ND	1
1,2-Dichloroethane	ND	ND	ND	ND	0.6
1,2-Dichloroethene(total)	ND	ND	ND	ND	5
Acetone	ND	ND	ND	ND	50*
Carbon Disulfide	ND	ND	ND	ND	N/A
Chloroethane	ND	ND	ND	ND	5
Chloroform	ND	ND	ND	ND	7
Methylene Chloride	ND	ND	ND	ND	5
Tetrachloroethene	ND	ND	ND	ND	5
Trichloroethene	ND	ND	ND	ND	5
Vinyl Chloride	ND	ND	ND	ND	2
Xylenes (total)	ND	3 j	3 j	3 j	5
Total VOCs	8	6	5	5	100[1]

1 - This value applies to the total of all organic substances listed in the New York State Groundwater Effluent Limitations table from the Division of Water Technical and Operational Guidance Series (1.1.1) with a groundwater effluent limitation less than 100 ug/l.

* - Value taken from NYSDEC Class GA Guidance Value.

(b) - Division of Water Technical and Operational Guidance Series (1.1.1) June 1998.

j - Estimated concentration; compound present below quantitation limit.

N/A - Not available.

ND - Not detected at analytical detection limit.

Note: - Numbers in bold exceed standard.

TABLE 5-6 (Page 6 of 12)

GROUNDWATER DATA SUMMARY
HYDROPUNCH SAMPLING
January February 2000

SDG Number **Lab Sample Number** **LMS Sample ID** **Date Collected**	**128** **B94852** **GWHP-2 (138-140)** **2/1/2000**	**128** **B94853** **GWHP-2 (148-150)** **2/1/2000**	**128** **B94854** **TB-8** **2/3/2000**	**128** **B94855** **GWHP-3 (58-60)** **2/3/2000**	**NYSDEC** **CLASS GA** **STANDARDS (b)**
VOLATILE ORGANICS (µg/l)					
1,1-Dichloroethane	ND	2 j	ND	**6 j**	5
1,1-Dichloroethene	ND	4 j	ND	ND	5
1,1,1-Trichloroethane	ND	**8 j**	ND	ND	5
1,1,2-Trichloroethane	ND	ND	ND	ND	1
1,2-Dichloroethane	ND	ND	ND	ND	0.6
1,2-Dichloroethene(total)	ND	2 j	ND	ND	5
Acetone	ND	ND	ND	ND	50*
Carbon Disulfide	ND	ND	ND	ND	N/A
Chloroethane	ND	ND	ND	ND	5
Chloroform	ND	ND	ND	ND	7
Methylene Chloride	ND	ND	ND	ND	5
Tetrachloroethene	ND	5 j	ND	ND	5
Trichloroethene	ND	**10**	ND	ND	5
Vinyl Chloride	ND	ND	ND	ND	2
Xylenes (total)	ND	ND	ND	ND	5
Total VOCs	ND	31	ND	6	100[1]

1 - This value applies to the total of all organic substances listed in the New York State Groundwater Effluent Limitations table from the Division of Water Technical and Operational Guidance Series (1.1.1) with a groundwater effluent limitation less than 100 ug/l.
* - Value taken from NYSDEC Class GA Guidance Value.
(b) - Division of Water Technical and Operational Guidance Series (1.1.1) June 1998.
j - Estimated concentration; compound present below quantitation limit.
N/A - Not available.
ND - Not detected at analytical detection limit.
Note: - Numbers in bold exceed standard.

TABLE 5-6 (Page 7 of 12)

GROUNDWATER DATA SUMMARY
HYDROPUNCH SAMPLING
January February 2000

SDG Number **Lab Sample Number** **LMS Sample ID** **Date Collected**	**128** **B94856** **GWHP-3 (68-70)** **2/3/2000**	**128** **B94857** **GWHP-3 (78-80)** **2/3/2000**	**128** **B94858** **GWHP-3 (BD of 68-70)** **2/3/2000**	**128** **B94859** **GWHP-3 (88-90)** **2/4/2000**	**NYSDEC** **CLASS GA** **STANDARDS (b)**
VOLATILE ORGANICS (µg/l)		[DL:2.5:1]		[DL:2.5:1]	
1,1-Dichloroethane	2 j	**46**	2 j	**36**	5
1,1-Dichloroethene	2 j	**24**	2 j	**26**	5
1,1,1-Trichloroethane	**23**	**230 d**	**23**	**230 d**	5
1,1,2-Trichloroethane	ND	ND	ND	ND	1
1,2-Dichloroethane	ND	ND	ND	ND	0.6
1,2-Dichloroethene(total)	ND	ND	ND	ND	5
Acetone	ND	ND	ND	ND	50*
Carbon Disulfide	ND	ND	ND	ND	N/A
Chloroethane	ND	ND	ND	ND	5
Chloroform	ND	ND	ND	ND	7
Methylene Chloride	ND	ND	ND	ND	5
Tetrachloroethene	1 j	11	1 j	**16**	5
Trichloroethene	ND	**6 j**	ND	**7 j**	5
Vinyl Chloride	ND	ND	ND	ND	2
Xylenes (total)	ND	ND	ND	ND	5
Total VOCs	28	**307**	28	**315**	100^{1}

1 - This value applies to the total of all organic substances listed in the New York State Groundwater Effluent Limitations table from the Division of Water Technical and Operational Guidance Series (1.1.1) with a groundwater effluent limitation less than 100 ug/l.
* - Value taken from NYSDEC Class GA Guidance Value.
(b) - Division of Water Technical and Operational Guidance Series (1.1.1) June 1998.
j - Estimated concentration; compound present below quantitation limit.
N/A - Not available.
ND - Not detected at analytical detection limit.
Note: - Numbers in bold exceed standard.

TABLE 5-6 (Page 8 of 12)

GROUNDWATER DATA SUMMARY
HYDROPUNCH SAMPLING
January February 2000

SDG Number	**128**	**128**	**128**	**128**	**NYSDEC**
Lab Sample Number	**B94860**	**B94861**	**B94862**	**B94863**	**CLASS GA**
LMS Sample ID	**GWHP-3 (98-100)**	**GWHP-3 (108-110)**	**GWHP-3 (118-120)**	**GWHP-3 (128-130)**	**STANDARDS (b)**
Date Collected	**2/4/2000**	**2/4/2000**	**2/4/2000**	**2/4/2000**	
VOLATILE ORGANICS (µg/l)					
1,1-Dichloroethane	2 j	ND	ND	1 j	5
1,1-Dichloroethene	3 j	ND	ND	ND	5
1,1,1-Trichloroethane	**38**	**7 j**	2 j	**9 j**	5
1,1,2-Trichloroethane	ND	ND	ND	ND	1
1,2-Dichloroethane	ND	ND	ND	ND	0.6
1,2-Dichloroethene(total)	ND	ND	ND	ND	5
Acetone	ND	ND	ND	ND	50*
Carbon Disulfide	ND	ND	ND	ND	N/A
Chloroethane	ND	ND	ND	ND	5
Chloroform	ND	ND	ND	ND	7
Methylene Chloride	ND	ND	ND	ND	5
Tetrachloroethene	**59**	**32**	**7 j**	**9 j**	5
Trichloroethene	**21**	**10**	2 j	3 j	5
Vinyl Chloride	ND	ND	ND	ND	2
Xylenes (total)	ND	ND	ND	ND	5
Total VOCs	**123**	49	11	22	100[1]

1 - This value applies to the total of all organic substances listed in the New York State Groundwater Effluent Limitations table from the Division of Water Technical and Operational Guidance Series (1.1.1) with a groundwater effluent limitation less than 100 ug/l.

* - Value taken from NYSDEC Class GA Guidance Value.

(b) - Division of Water Technical and Operational Guidance Series (1.1.1) June 1998.

j - Estimated concentration; compound present below quantitation limit.

N/A - Not available.

ND - Not detected at analytical detection limit.

Note: - Numbers in bold exceed standard.

TABLE 5-6 (Page 9 of 12)

GROUNDWATER DATA SUMMARY
HYDROPUNCH SAMPLING
January February 2000

SDG Number	**128A**	**128A**	**128A**	**128A**	**NYSDEC**
Lab Sample Number	**B94864**	**B94865**	**B94866**	**B94867**	**CLASS GA**
LMS Sample ID	**TB-9**	**GWHP-3 (138-140)**	**GWHP-3 (148-150)**	**TB-10**	**STANDARDS (b)**
Date Collected	**2/7/2000**	**2/7/2000**	**2/7/2000**	**2/9/2000**	
VOLATILE ORGANICS (µg/l)					
1,1-Dichloroethane	ND	**14**	3 j	ND	5
1,1-Dichloroethene	ND	**7 j**	2 j	ND	5
1,1,1-Trichloroethane	ND	**59**	**13**	ND	5
1,1,2-Trichloroethane	ND	ND	ND	ND	1
1,2-Dichloroethane	ND	ND	ND	ND	0.6
1,2-Dichloroethene(total)	ND	ND	1 j	ND	5
Acetone	ND	ND	ND	ND	50*
Carbon Disulfide	ND	ND	ND	ND	N/A
Chloroethane	ND	ND	ND	ND	5
Chloroform	ND	ND	ND	ND	7
Methylene Chloride	ND	ND	ND	ND	5
Tetrachloroethene	ND	**15**	**27**	ND	5
Trichloroethene	ND	**6 j**	**13**	ND	5
Vinyl Chloride	ND	ND	ND	ND	2
Xylenes (total)	ND	ND	ND	ND	5
Total VOCs	ND	**134**	59	ND	100[1]

1 - This value applies to the total of all organic substances listed in the New York State Groundwater Effluent Limitations table from the Division of Water Technical and Operational Guidance Series (1.1.1) with a groundwater effluent limitation less than 100 ug/l.
* - Value taken from NYSDEC Class GA Guidance Value.
(b) - Division of Water Technical and Operational Guidance Series (1.1.1) June 1998.
j - Estimated concentration; compound present below quantitation limit.
N/A - Not available.
ND - Not detected at analytical detection limit.
Note: - Numbers in bold exceed standard.

GROUNDWATER DATA SUMMARY
HYDROPUNCH SAMPLING
January February 2000

SDG Number	**128A**	**128A**	**128A**	**128A**	**NYSDEC**
Lab Sample Number	**B94868**	**B94869**	**B94871**	**B94870**	**CLASS GA**
LMS Sample ID	**GWHP-4 (58-60)**	**GWHP-4 (68-70)**	**GWHP-4 (78-80)**	**Equip. Rinsate**	**STANDARDS (b)**
Date Collected	**2/9/2000**	**2/9/2000**	**2/9/2000**	**2/9/2000**	
VOLATILE ORGANICS (µg/l)					
1,1-Dichloroethane	ND	ND	ND	ND	5
1,1-Dichloroethene	ND	ND	ND	ND	5
1,1,1-Trichloroethane	ND	ND	ND	ND	5
1,1,2-Trichloroethane	ND	ND	ND	ND	1
1,2-Dichloroethane	ND	ND	ND	ND	0.6
1,2-Dichloroethene(total)	ND	ND	ND	ND	5
Acetone	ND	ND	ND	ND	50*
Carbon Disulfide	ND	ND	ND	ND	N/A
Chloroethane	ND	ND	ND	ND	5
Chloroform	ND	3 j	1 j	ND	7
Methylene Chloride	ND	ND	ND	ND	5
Tetrachloroethene	**8 j**	ND	ND	ND	5
Trichloroethene	ND	ND	ND	ND	5
Vinyl Chloride	ND	ND	ND	ND	2
Xylenes (total)	ND	ND	ND	ND	5
Total VOCs	8	3	1	ND	100[1]

1 - This value applies to the total of all organic substances listed in the New York State Groundwater Effluent Limitations table from the Division of Water Technical and Operational Guidance Series (1.1.1) with a groundwater effluent limitation less than 100 ug/l.
* - Value taken from NYSDEC Class GA Guidance Value.
(b) - Division of Water Technical and Operational Guidance Series (1.1.1) June 1998.
j - Estimated concentration; compound present below quantitation limit.
N/A - Not available.
ND - Not detected at analytical detection limit.
Note: - Numbers in bold exceed standard.

TABLE 5-6 (Page 11 of 12)

GROUNDWATER DATA SUMMARY

HYDROPUNCH SAMPLING

January February 2000

SDG Number	128A	128A	128A	128A	NYSDEC
Lab Sample Number	B94872	B94873	B94874	B94875	CLASS GA
LMS Sample ID	GWHP-4 (88-90)	GWHP-4 (108-110)	GWHP-4 (118-120)	GWHP-4 (138-140)	STANDARDS (b)
Date Collected	2/9/2000	2/9/2000	2/10/2000	2/10/2000	
VOLATILE ORGANICS (µg/l)					
1,1-Dichloroethane	ND	ND	ND	ND	5
1,1-Dichloroethene	ND	ND	ND	ND	5
1,1,1-Trichloroethane	ND	ND	1 j	ND	5
1,1,2-Trichloroethane	ND	ND	ND	ND	1
1,2-Dichloroethane	ND	ND	ND	ND	0.6
1,2-Dichloroethene(total)	ND	ND	ND	ND	5
Acetone	1 j	ND	ND	ND	50*
Carbon Disulfide	ND	ND	ND	ND	N/A
Chloroethane	ND	ND	ND	ND	5
Chloroform	ND	1 j	ND	ND	7
Methylene Chloride	ND	ND	ND	ND	5
Tetrachloroethene	ND	ND	ND	ND	5
Trichloroethene	ND	ND	ND	ND	5
Vinyl Chloride	ND	ND	ND	ND	2
Xylenes (total)	ND	ND	ND	ND	5
Total VOCs	1	1	1	ND	100[1]

1	- This value applies to the total of all organic substances listed in the New York State Groundwater Effluent Limitations table from the Division of Water Technical and Operational Guidance Series (1.1.1) with a groundwater effluent limitation less than 100 ug/l.
*	- Value taken from NYSDEC Class GA Guidance Value.
(b)	- Division of Water Technical and Operational Guidance Series (1.1.1) June 1998.
j	- Estimated concentration; compound present below quantitation limit.
N/A	- Not available.
ND	- Not detected at analytical detection limit.
Note:	- Numbers in bold exceed standard.

TABLE 5-6 (Page 12 of 12)

GROUNDWATER DATA SUMMARY
HYDROPUNCH SAMPLING
January February 2000

SDG Number **Lab Sample Number** **LMS Sample ID** **Date Collected**	**128A** **B94878** **GWHP-4 (148-150)** **2/11/2000**	**128A** **B94877** **TB-11** **2/11/2000**	**NYSDEC** **CLASS GA** **STANDARDS (b)**
VOLATILE ORGANICS (µg/l)			
1,1-Dichloroethane	ND	ND	5
1,1-Dichloroethene	ND	ND	5
1,1,1-Trichloroethane	1 j	ND	5
1,1,2-Trichloroethane	ND	ND	1
1,2-Dichloroethane	ND	ND	0.6
1,2-Dichloroethene(total)	ND	ND	5
Acetone	ND	ND	50*
Carbon Disulfide	ND	ND	N/A
Chloroethane	ND	ND	5
Chloroform	ND	ND	7
Methylene Chloride	ND	ND	5
Tetrachloroethene	ND	ND	5
Trichloroethene	ND	ND	5
Vinyl Chloride	ND	ND	2
Xylenes (total)	ND	ND	5
Total VOCs	1	ND	100[1]

1	- This value applies to the total of all organic substances listed in the New York State Groundwater Effluent Limitations t the Division of Water Technical and Operational Guidance Series (1.1.1) with a groundwater effluent limitation less tha
*	- Value taken from NYSDEC Class GA Guidance Value.
(b)	- Division of Water Technical and Operational Guidance Series (1.1.1) June 1998.
j	- Estimated concentration; compound present below quantitation limit.
N/A	- Not available.
ND	- Not detected at analytical detection limit.
Note:	- Numbers in bold exceed standard.

GWHP-03
Fieldstone

	(58-60')	(68-70')	(78-80')	(88-90')	(98-100')	(108-110')	(118-120')	(128-130')	(138-140')	(148-150')
1,1-DCA	6	2j	46	36	2j	ND	ND	1j	14	5j
1,1-DCE	ND	2j	24	26	3j	ND	ND	ND	7j	2j
1,1,1-TCA	ND	23	230	230	38	7j	2j	9j	59	13
1,2-DCE	ND	ND	ND	ND	ND	ND	ND	ND	ND	15
PCE	ND	2	11	16	59	32	7j	9j	15	27
TCE	ND	ND	6	7	21	10	2j	3j	6j	13
TVOC	6	28	307	315	123	49	11	22	134	59

GWHP-01
Myron

	(60')	(70')	(80')	(90')	(98')	(108')	(118')	(128')	(138')	(148')
1,1-DCA	ND	ND	ND	**12**	**110**	**200**	**190d**	**750d**	**880d**	ND
1,1-DCE	ND	ND	ND	**24**	**260d**	**360d**	**460d**	**1600d**	**1700d**	4j
1,1,1-TCA	ND	ND	ND	**21**	**180d**	**270d**	**260d**	**790d**	**820d**	4j
1,1.2-TCA	ND	ND	ND	ND	1j	2j	2j	6j	8j	ND
1,2-DCA	ND	ND	ND	ND	ND	ND	4j	**16**	**22**	ND
1,2-DCE ttl	ND	ND	ND	ND	**29**	**46**	**65**	**94**	**77**	ND
Chloroethane	ND	ND	ND	ND	2j	ND	ND	ND	ND	ND
Chloroform	2j	ND	2j	2j	3j	5j	6j	8j	8j	2j
PCE	ND	ND	ND	5j	**51**	**76**	**86**	**180**	**160jd**	ND
TCE	ND	ND	ND	**17**	**220d**	**300d**	**420d**	**1800d**	**1800d**	6j
VinylChlor	ND	ND	ND	ND	ND	ND	ND	6j	5j	ND
Xylenes ttl	ND	ND	ND	ND	ND	ND	2j	ND	ND	ND
TVOCS	2	ND	2	79	**856**	**1262**	**1495**	**5250**	**5480**	12

GWHP-02
Basin 51

	(58-60')	(70-72')	(78-80')	(94-96')	(100-102')	(108-110')	(118-120')	(118-120')	(138-140')	(148-150')
1,1-DCA	ND	ND	ND	ND	8	3j	2j	2j	ND	8
1,1-DCE	ND	ND	ND	ND	ND	ND	ND	ND	ND	2
1,1,1-TCA	ND	ND	ND	ND	ND	ND	ND	ND	ND	4
Carbon Disulfide	ND	ND	ND	2j	ND	ND	ND	ND	ND	ND
1,2-DCE	ND	ND	ND	ND	ND	ND	ND	ND	ND	2
PCE	ND	ND	ND	ND	ND	ND	ND	ND	ND	5
TCE	ND	ND	ND	ND	ND	ND	ND	ND	ND	10
Toluene	ND	ND	ND	ND	ND	1	2j	1j	ND	ND
Xylene	ND	ND	ND	ND	ND	3j	3j	3j	ND	ND
TVOC	ND	ND	ND	2	8	7	6	6	ND	31

GWHP-04
Salisbury

	(58-60')	(68-70')	(78-80')	(88-90')	(108-110')	(118-120')	(138-140')	(148-150')
PCE	8	ND	ND	ND	ND	ND	ND	ND
Chloroform	ND	3j	1j	ND	1j	ND	ND	ND
1,1,1-TCA	ND	ND	ND	ND	ND	1j	ND	1j
TVOCs	8	3	1	ND	1j	1	ND	1

Legend

▲ Hydropunch location

All results given in ppb

0 600 ft
APPROX. SCALE
1 in. = 600 ft

Figure 5-4

Hydropunch
Groundwater Data Summary
January & February 2000

OFFSITE GROUNDWATER
NEW CASSEL INDUSTRIAL AREA
NYSDEC I.D. No. 130043

LAWLER, MATUSKY & SKELLY ENGINEERS LLP
Pearl River, New York

exhibit VOC concentration in excess of the Class GA groundwater standards. Total VOC concentrations at this location ranged from 6 (58 to 60 ft. sample) to 315 µg/l (78 to 80 ft. sample). 1,1,1-TCA was the primary contaminant detected, significant concentrations of PCE, TCE, and it's breakdown products were also found (Figure 5-4). The highest VOC concentrations were found between 80 and 100 ft below the ground surface.

The analytical results for GWHP-04 indicate that only trace levels of VOC are present at this location (Figure 5-4). Only one of the samples (58 to 60 ft.) that were collected exhibited VOC concentrations in excess of the Class GA groundwater standards. PCE was found in this sample at a concentration of 8 µg/l.

5.3 DATA ANALYSIS AND AREAS OF IMPACTED GROUNDWATER

The groundwater contamination problem associated with the NCIA was first discovered in 1985 (NCDOH 1986). Since that time several extensive sampling efforts have been conducted at the NCIA to determine the sources and extent of this contamination. A major portion of the effort of this off-site groundwater RI has been to compile and interpret the historical data to determine the fate and transport of the contaminants as they relate to off-site locations.

5.3.1 Area of Historically Impacted Groundwater

The area of historically impacted groundwater is shown on Figures 5-5 to Figure 5-8. The purpose of these figures is to illustrate the historical extent of the VOC contamination associated with the NCIA. The impacted area was determined by extracting the highest total VOC result for each of the availible groundwater sampling points including monitoring wells, geoprobes, and hydropunch sampling locations. These results were then contoured to provide an indication of the extent and maximum VOC concentrations that have historically been found within the impacted area between the late 1970's and the present. Each of the concentration areas enclosed by the contours is somewhat generalized in that some of the data points within them may exhibit higher or lower concentrations. The purpose of these figures is to depict the maximum extent of the groundwater contamination. The individual figures are broken down by depth to show the various levels of groundwater contamination with depth. The 0 to 64 ft below ground surface figure is intended to show

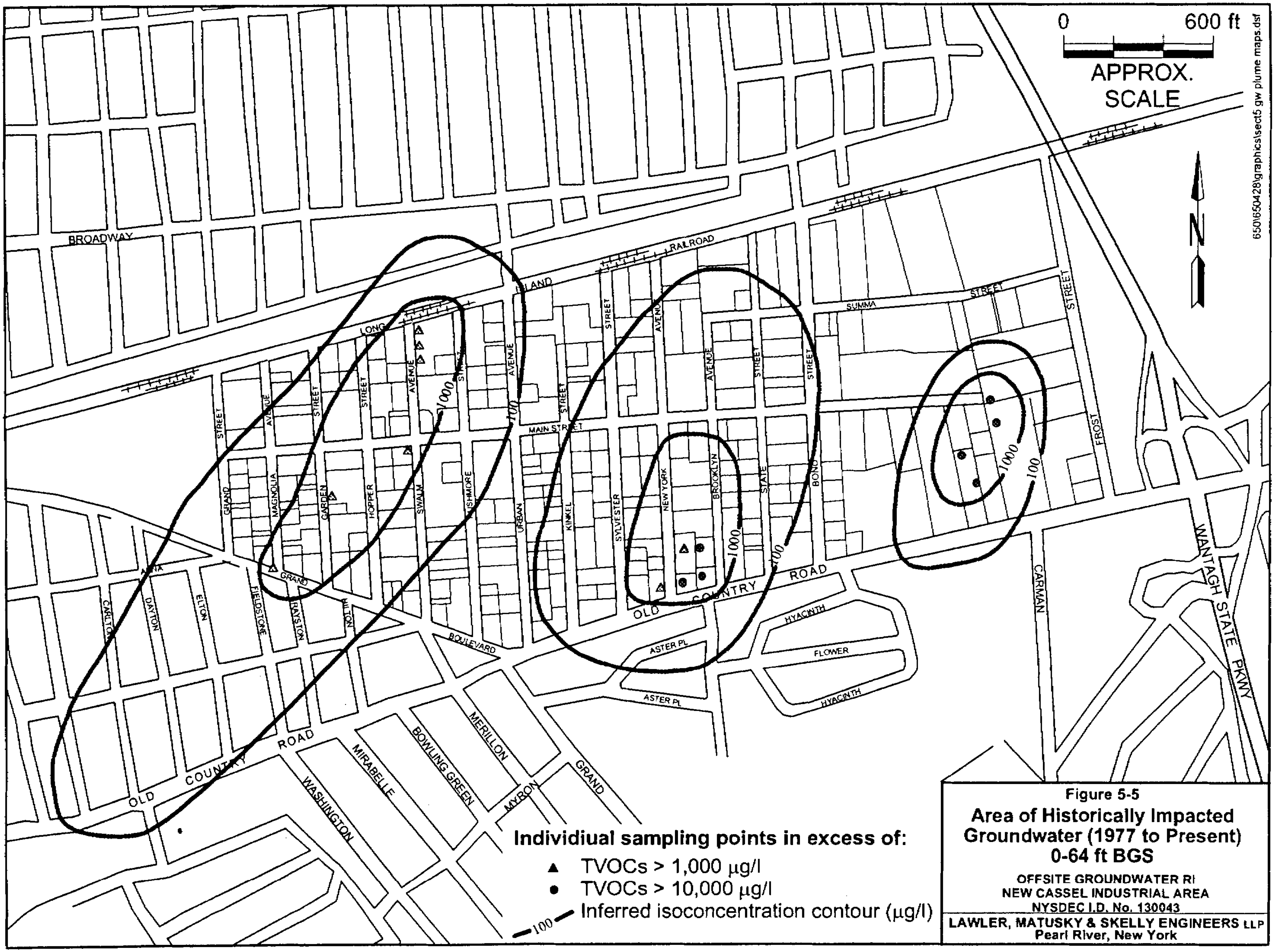


Figure 5-5

Area of Historically Impacted Groundwater (1977 to Present) 0-64 ft BGS

OFFSITE GROUNDWATER RI
NEW CASSEL INDUSTRIAL AREA
NYSDEC I.D. No. 130043

LAWLER, MATUSKY & SKELLY ENGINEERS LLP
Pearl River, New York

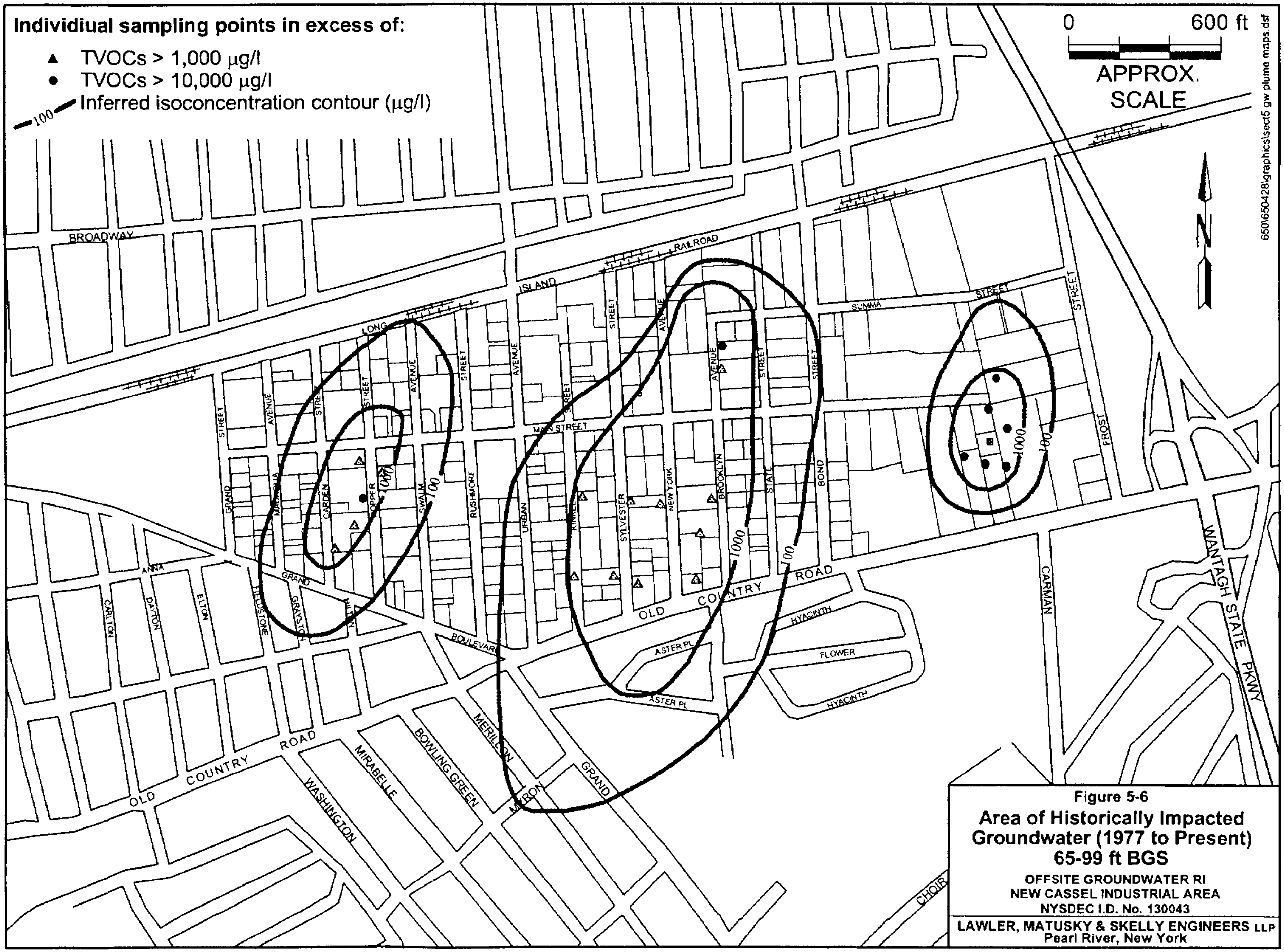


Figure 5-6

Area of Historically Impacted Groundwater (1977 to Present) 65-99 ft BGS

OFFSITE GROUNDWATER RI
NEW CASSEL INDUSTRIAL AREA
NYSDEC I.D. No. 130043

LAWLER, MATUSKY & SKELLY ENGINEERS LLP
Pearl River, New York

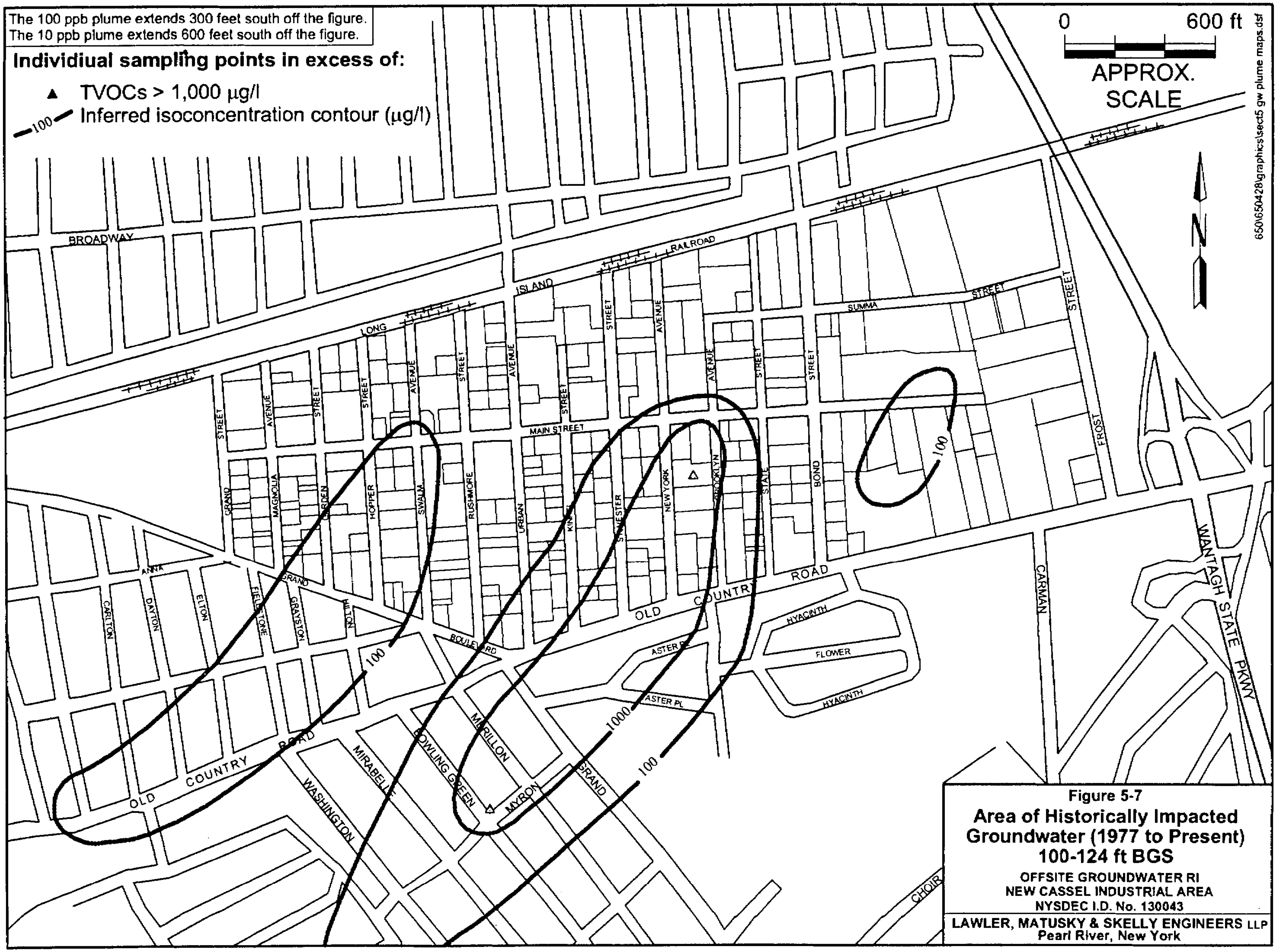


Figure 5-7

Area of Historically Impacted Groundwater (1977 to Present) 100-124 ft BGS

OFFSITE GROUNDWATER RI
NEW CASSEL INDUSTRIAL AREA
NYSDEC I.D. No. 130043

LAWLER, MATUSKY & SKELLY ENGINEERS LLP
Pearl River, New York

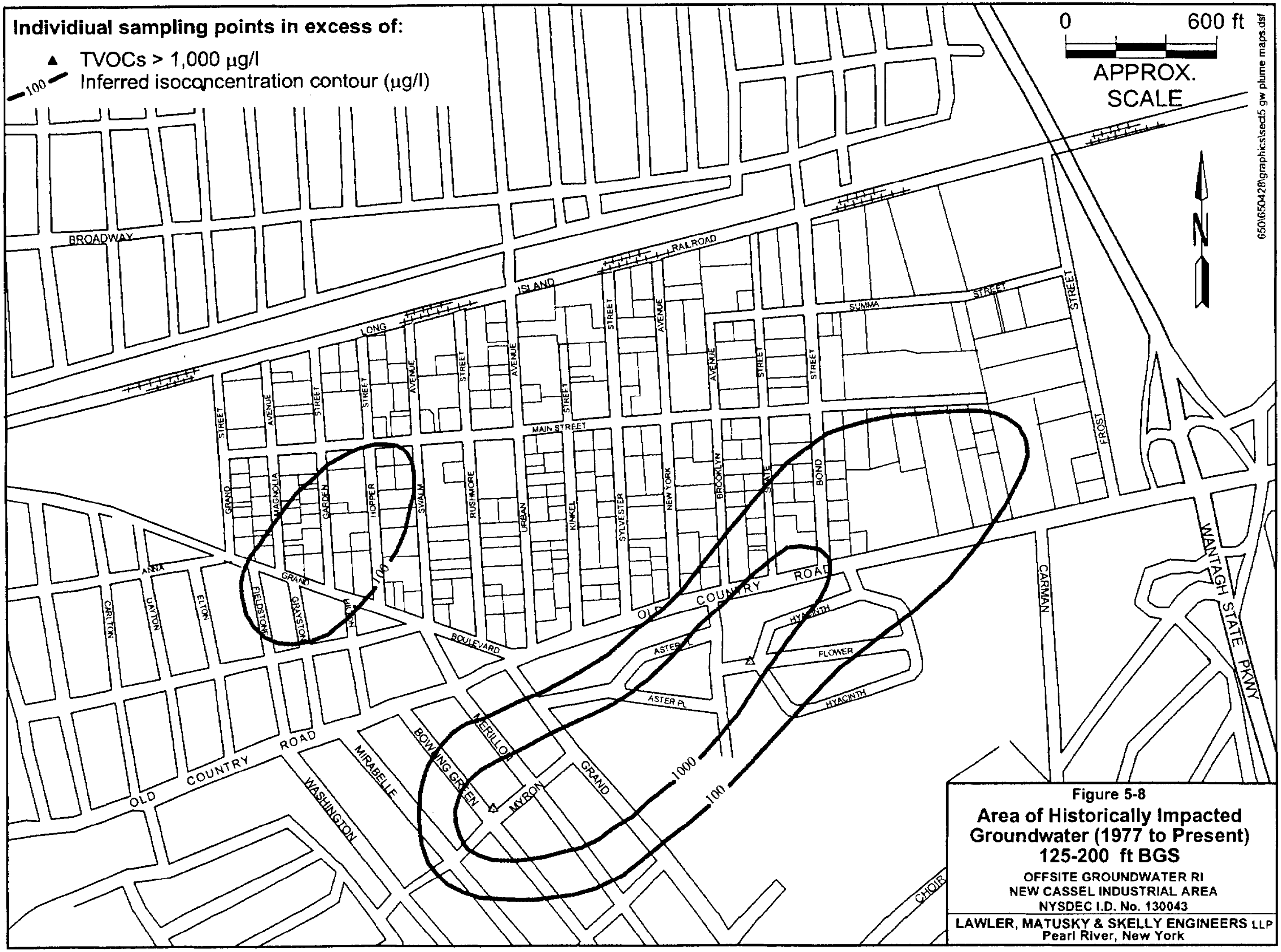


Figure 5-8

Area of Historically Impacted Groundwater (1977 to Present) 125-200 ft BGS

OFFSITE GROUNDWATER RI
NEW CASSEL INDUSTRIAL AREA
NYSDEC I.D. No. 130043

LAWLER, MATUSKY & SKELLY ENGINEERS LLP
Pearl River, New York

the levels of contamination found in the immediate vicinity of the watertable. The 65 to 99 ft. below ground surface depicts the contaminant levels at the transition zone between the UGA and the Magothy Aquifer. The remaining two figure depict the contaminant levels in the upper Magothy Aquifer. Two separate depth intervals (100 to 124 ft. and 125 to 200 ft.) are presented since to was noted that a distinctly different distribution of contaminants was noted between the two depth intervals. Due to the limited data available for depths greater than 200 ft the distribution of contaminants at the deeper depths was not plotted.

5.3.2 **Area of Impacted Groundwater 1998 to 2000**

The groundwater contaminant plume configuration based on the data collected since September 1998 is shown on Figure 5-9 to Figure 5-12. The purpose of these figures is to show the generalized present day configuration of the groundwater contamination plume. These figures are also broken down into the same depth intervals presented for the historical data.

5.3.3 **Temporal Variations in Groundwater Quality**

In order to compare the groundwater contaminant distribution to the present day distribution and the historical area of impacted groundwater plume configuration maps were prepared using the data collected over 3 separate intervals of time. Earliest data from the NCIA area dates back to 1977, however it is not until the early 1990's that sufficient data is available for analysis. The selected intervals of time include the data collected prior to 1993 (Figures 5-13 to 5-16), from 1993 to 1996 (Figure 5-17 to 5-20), and 1996 to 2000 (Figure 5-21 to 5-24). The intervals were selected based on an analysis of the database to insure that sufficient data fell between the time interval to provide a reasonable representation of the plume configuration. Over some of the time intervals only minimal data for the deeper depths are available for analysis. For those depth intervals over time with limited data the data was not contoured. For these figures the values for total VOCs for the individual points is presented directly on the figure.

In addition to the plume configuration maps concentration vs. time plots for individual wells were prepared and are presented in Appendix G. The wells included in this analysis were selected from the database based on the number of sampling events over the time period of interest. Currently the database contains groundwater quality information for 182

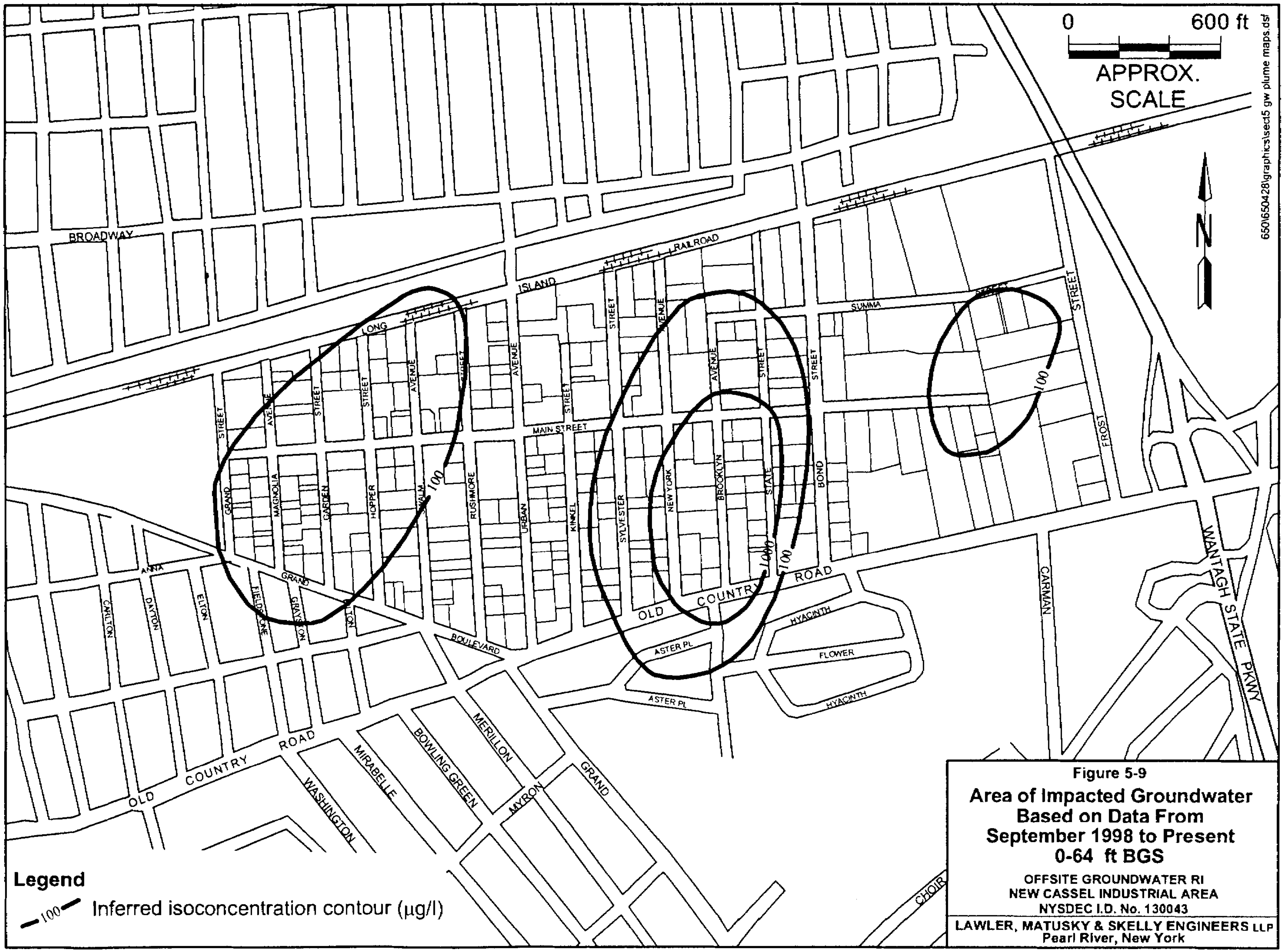


Figure 5-9

Area of Impacted Groundwater Based on Data From September 1998 to Present 0-64 ft BGS

OFFSITE GROUNDWATER RI
NEW CASSEL INDUSTRIAL AREA
NYSDEC I.D. No. 130043

LAWLER, MATUSKY & SKELLY ENGINEERS LLP
Pearl River, New York

650\650428\graphics\sect5 gw plume maps.dsf

Legend

100 Inferred isoconcentration contour (μg/l)

Figure 5-10

Area of Impacted Groundwater Based on Data From September 1998 to Present 65-99 ft BGS

OFFSITE GROUNDWATER RI
NEW CASSEL INDUSTRIAL AREA
NYSDEC I.D. No. 130043

LAWLER, MATUSKY & SKELLY ENGINEERS LLP
Pearl River, New York

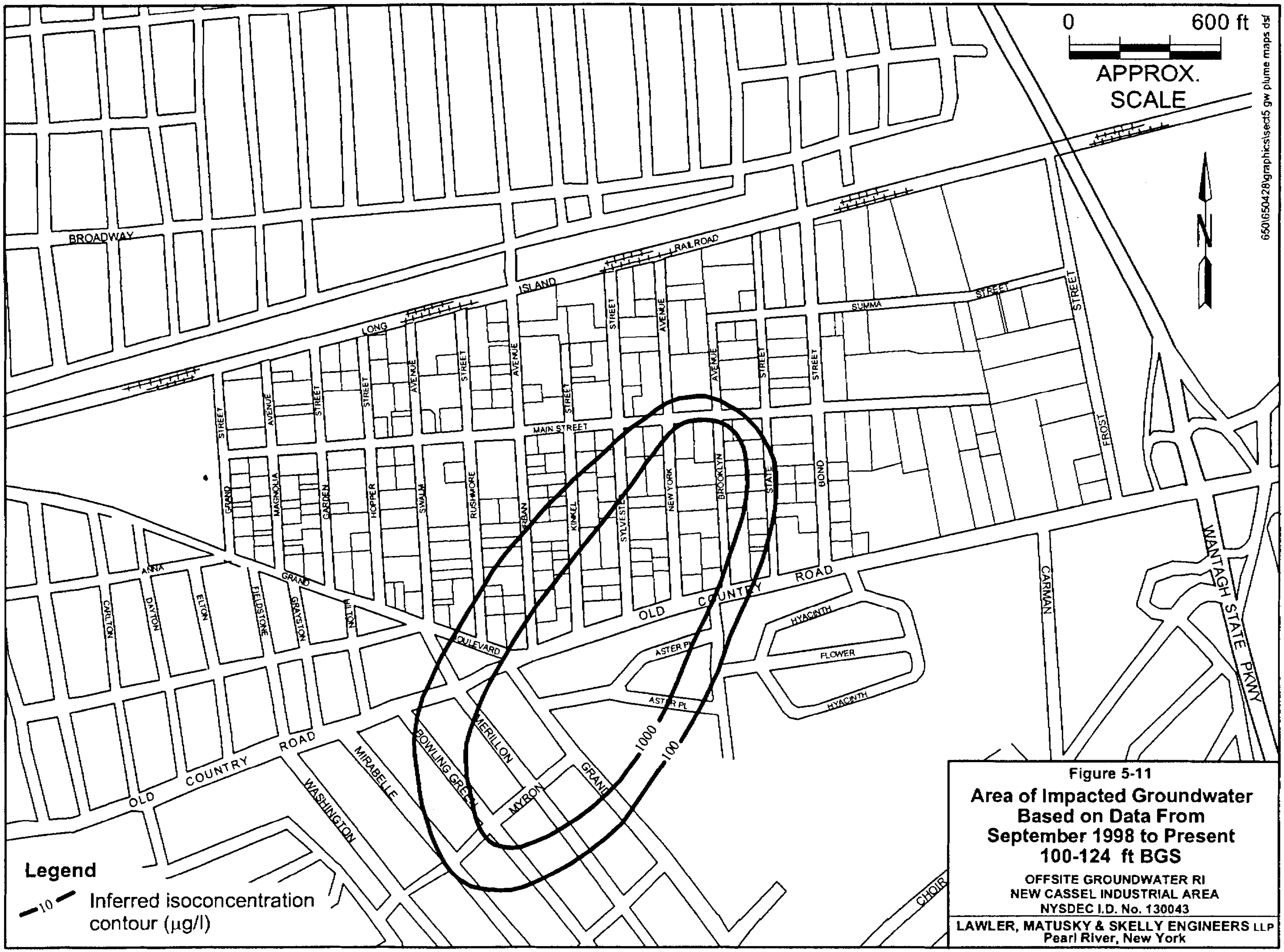


Figure 5-11

Area of Impacted Groundwater Based on Data From September 1998 to Present 100-124 ft BGS

OFFSITE GROUNDWATER RI
NEW CASSEL INDUSTRIAL AREA
NYSDEC I.D. No. 130043

LAWLER, MATUSKY & SKELLY ENGINEERS LLP
Pearl River, New York

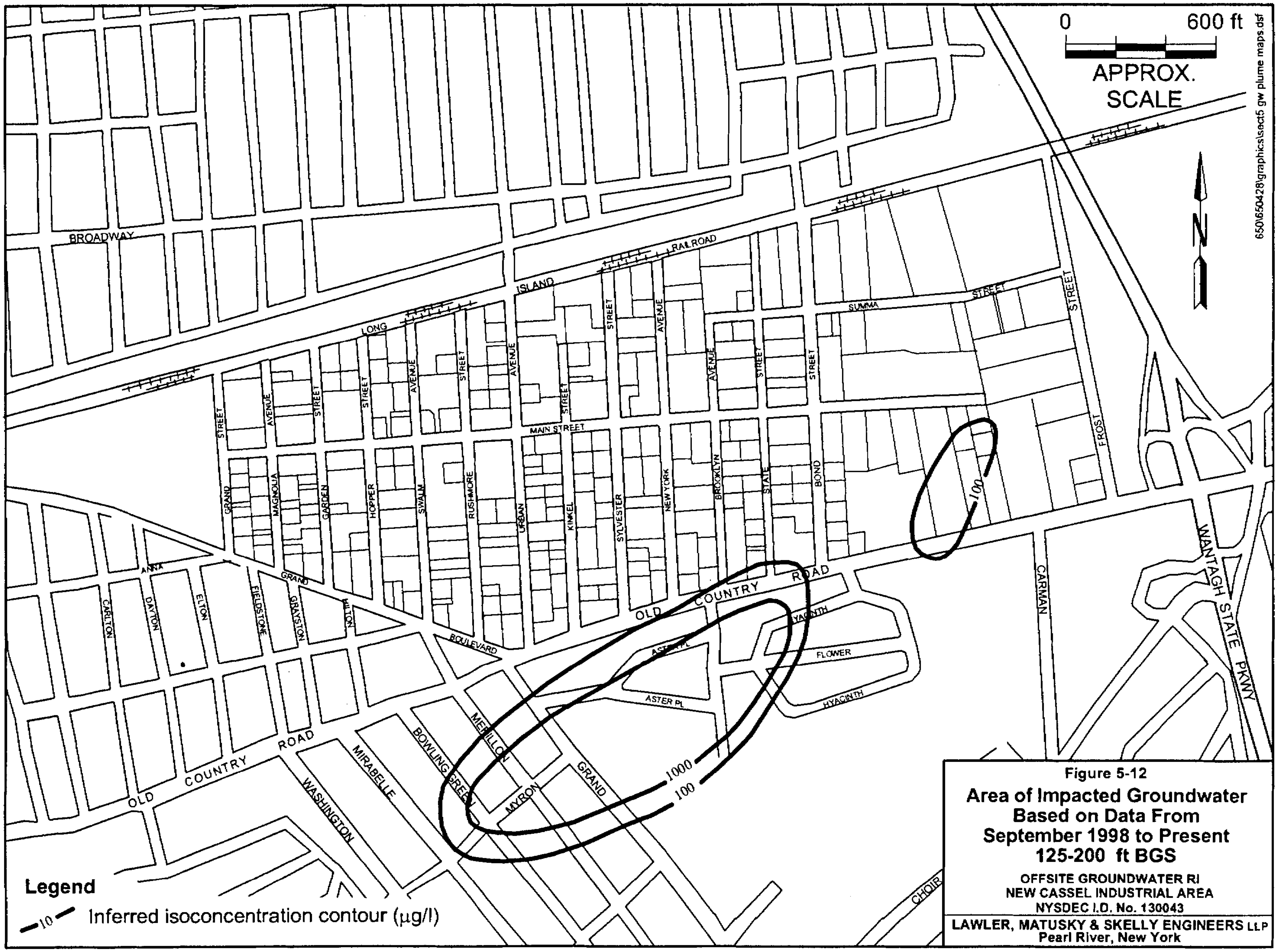


Figure 5-12

Area of Impacted Groundwater
Based on Data From
September 1998 to Present
125-200 ft BGS

OFFSITE GROUNDWATER RI
NEW CASSEL INDUSTRIAL AREA
NYSDEC I.D. No. 130043

LAWLER, MATUSKY & SKELLY ENGINEERS LLP
Pearl River, New York

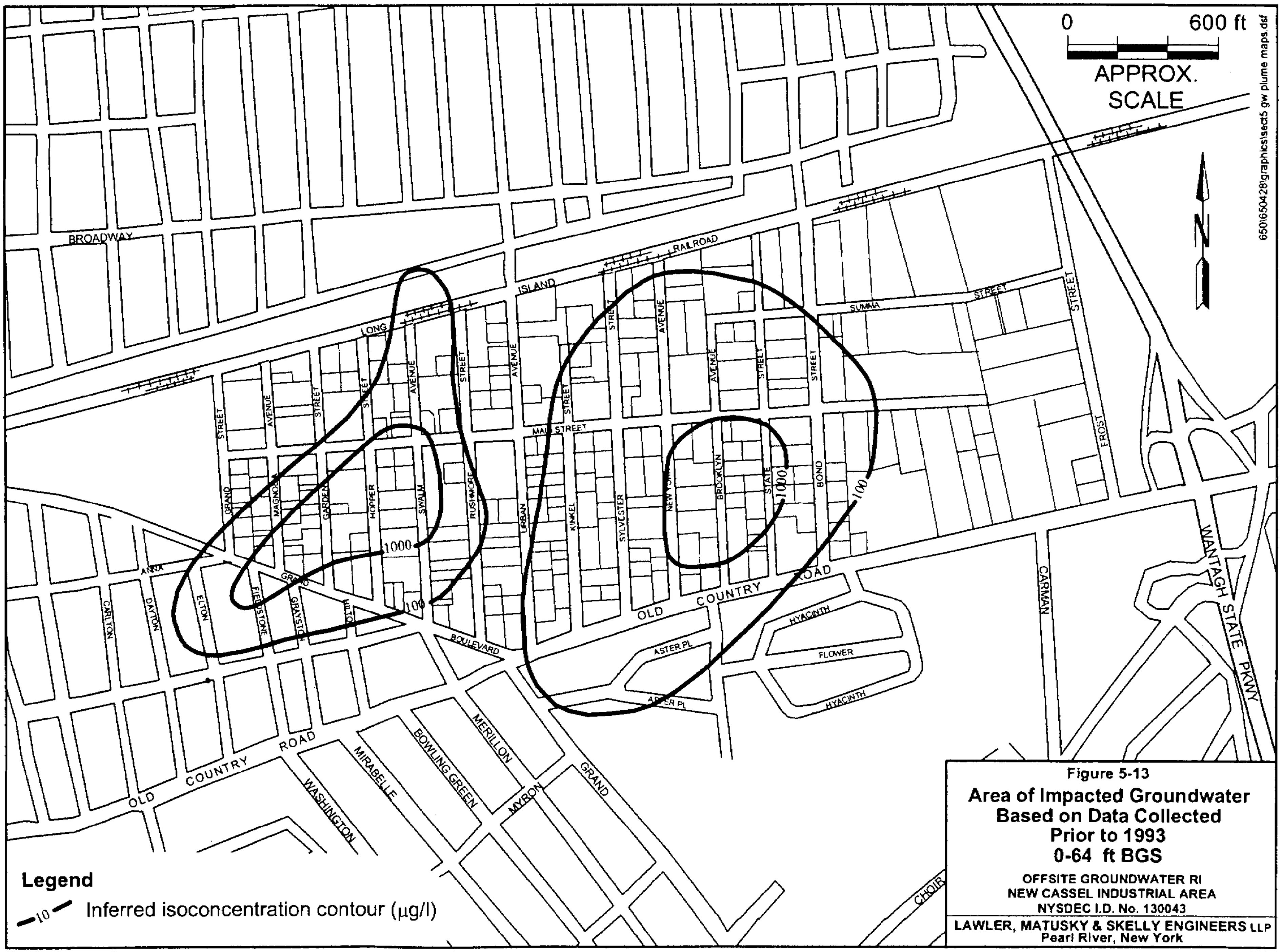
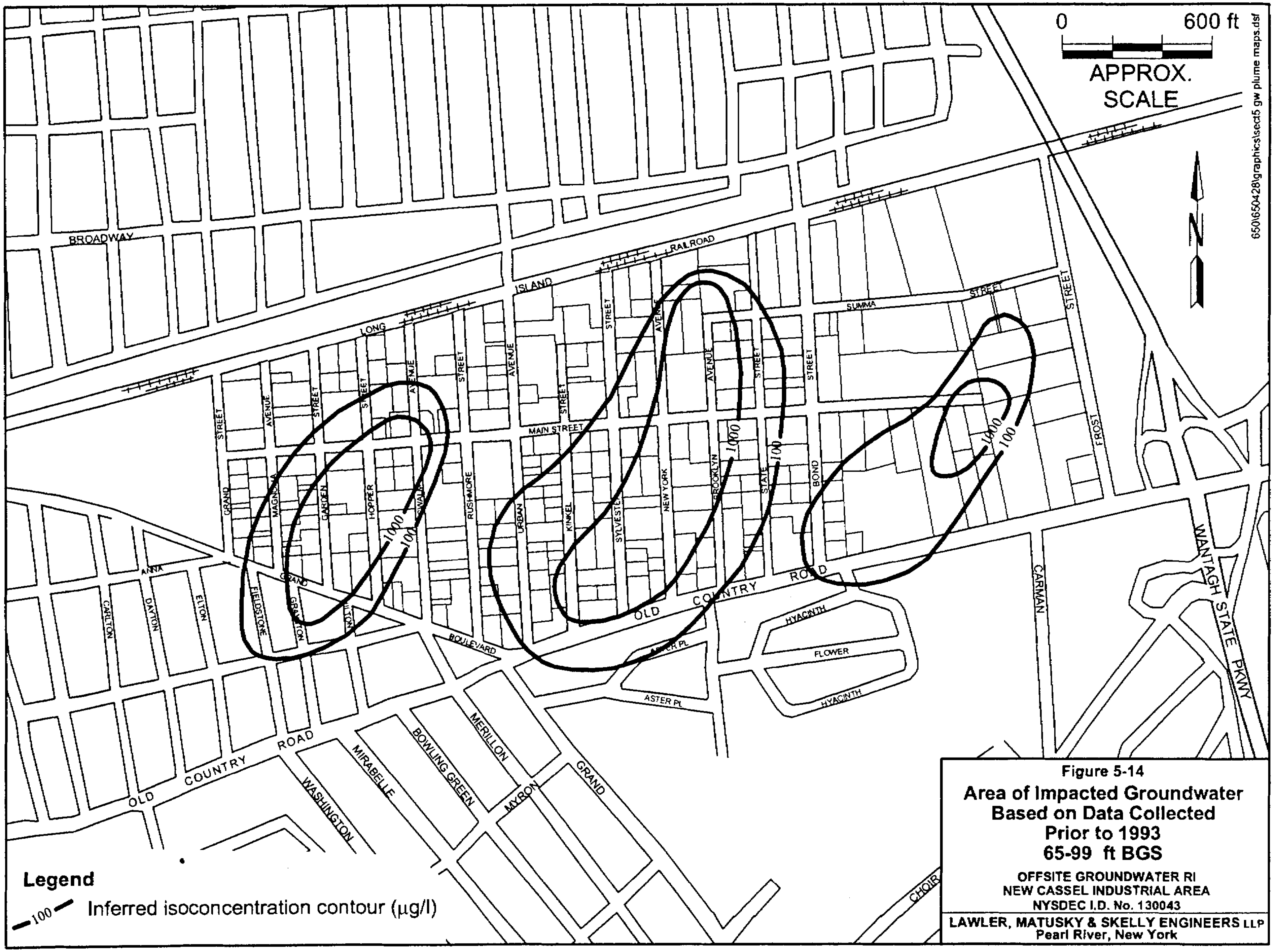


Figure 5-13

Area of Impacted Groundwater Based on Data Collected Prior to 1993 0-64 ft BGS

OFFSITE GROUNDWATER RI
NEW CASSEL INDUSTRIAL AREA
NYSDEC I.D. No. 130043

LAWLER, MATUSKY & SKELLY ENGINEERS LLP
Pearl River, New York



Legend

100 Inferred isoconcentration contour (µg/l)

Figure 5-14

Area of Impacted Groundwater Based on Data Collected Prior to 1993 65-99 ft BGS

OFFSITE GROUNDWATER RI
NEW CASSEL INDUSTRIAL AREA
NYSDEC I.D. No. 130043

LAWLER, MATUSKY & SKELLY ENGINEERS LLP
Pearl River, New York

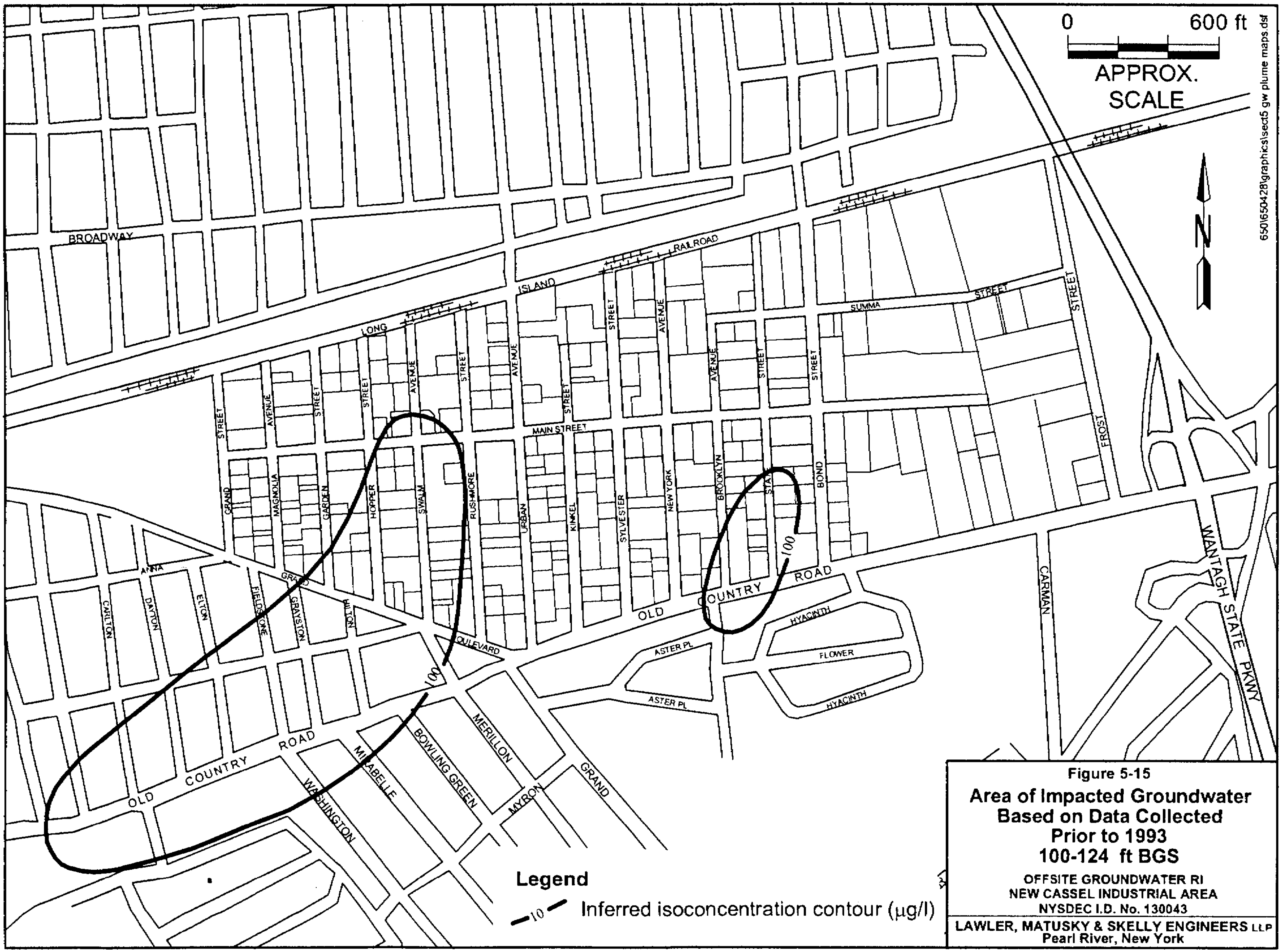


Figure 5-15

Area of Impacted Groundwater Based on Data Collected Prior to 1993 100-124 ft BGS

OFFSITE GROUNDWATER RI
NEW CASSEL INDUSTRIAL AREA
NYSDEC I.D. No. 130043

LAWLER, MATUSKY & SKELLY ENGINEERS LLP
Pearl River, New York

6501650428\graphics\sect5 gw plume maps.dsf

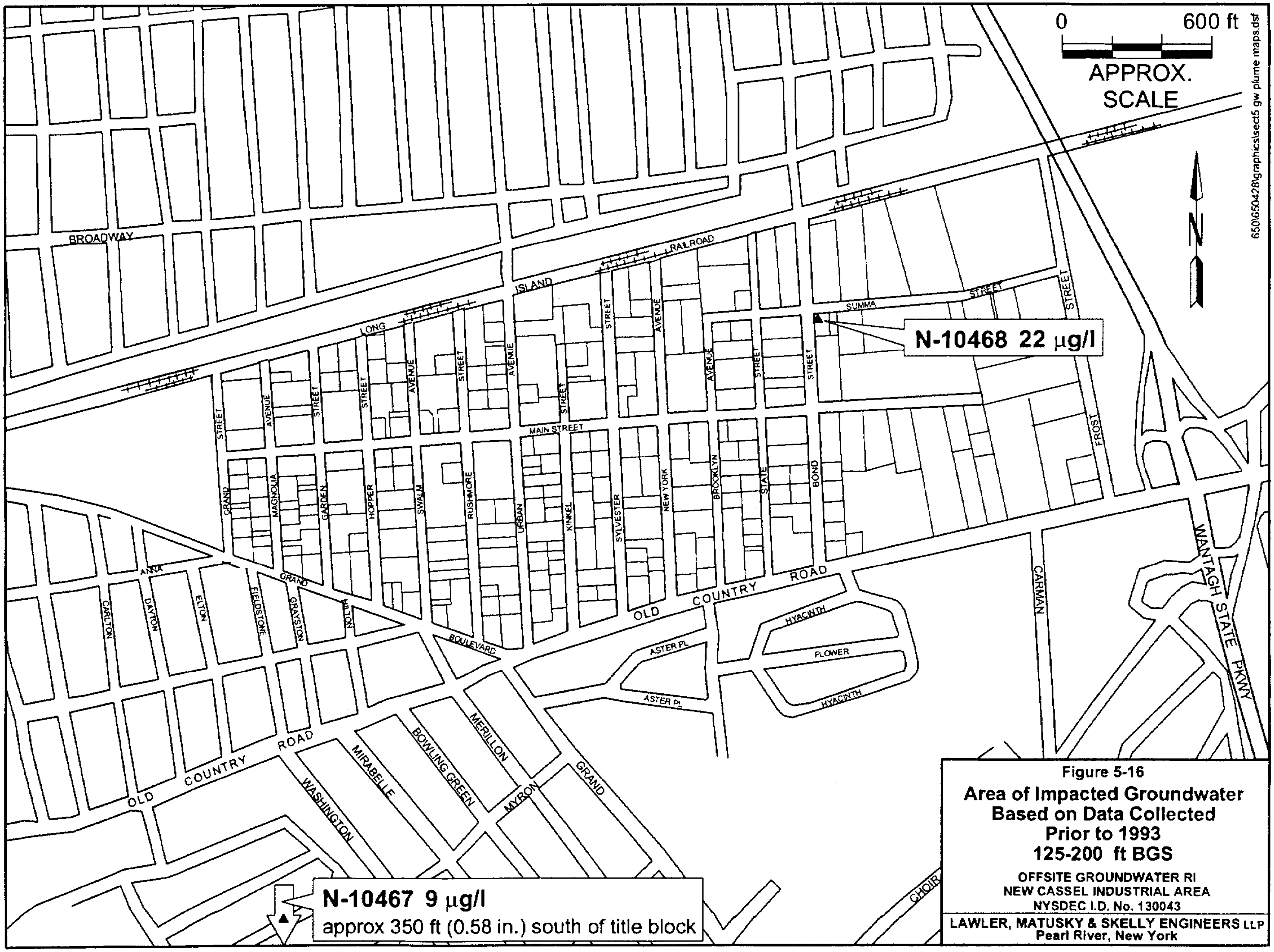


Figure 5-16

**Area of Impacted Groundwater
Based on Data Collected
Prior to 1993
125-200 ft BGS**

OFFSITE GROUNDWATER RI
NEW CASSEL INDUSTRIAL AREA
NYSDEC I.D. No. 130043

LAWLER, MATUSKY & SKELLY ENGINEERS LLP
Pearl River, New York

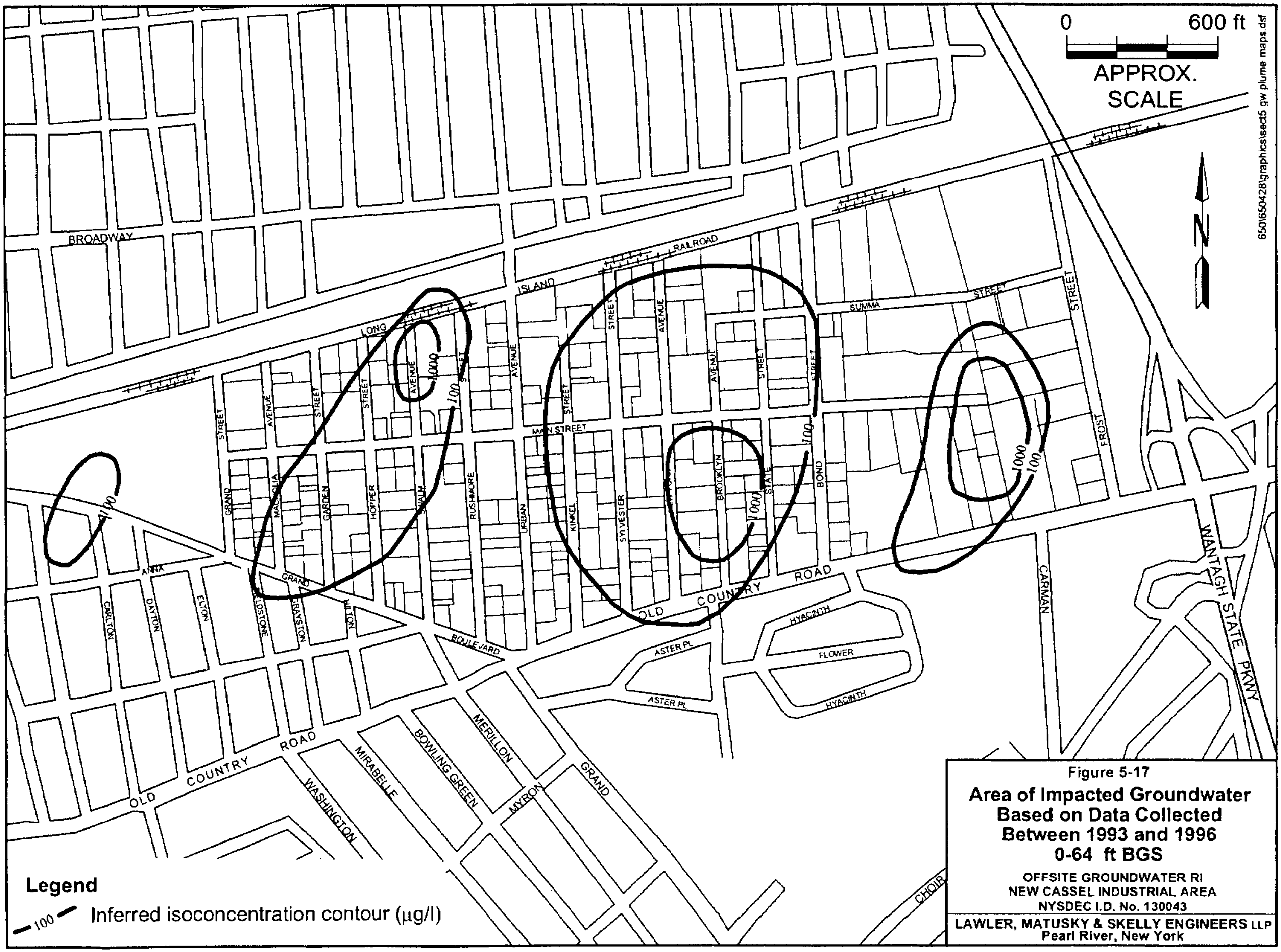


Figure 5-17

Area of Impacted Groundwater Based on Data Collected Between 1993 and 1996 0-64 ft BGS

OFFSITE GROUNDWATER RI
NEW CASSEL INDUSTRIAL AREA
NYSDEC I.D. No. 130043

LAWLER, MATUSKY & SKELLY ENGINEERS LLP
Pearl River, New York

Figure 5-18

Area of Impacted Groundwater Based on Data Collected Between 1993 and 1996 65-99 ft BGS

OFFSITE GROUNDWATER RI
NEW CASSEL INDUSTRIAL AREA
NYSDEC I.D. No. 130043

LAWLER, MATUSKY & SKELLY ENGINEERS LLP
Pearl River, New York

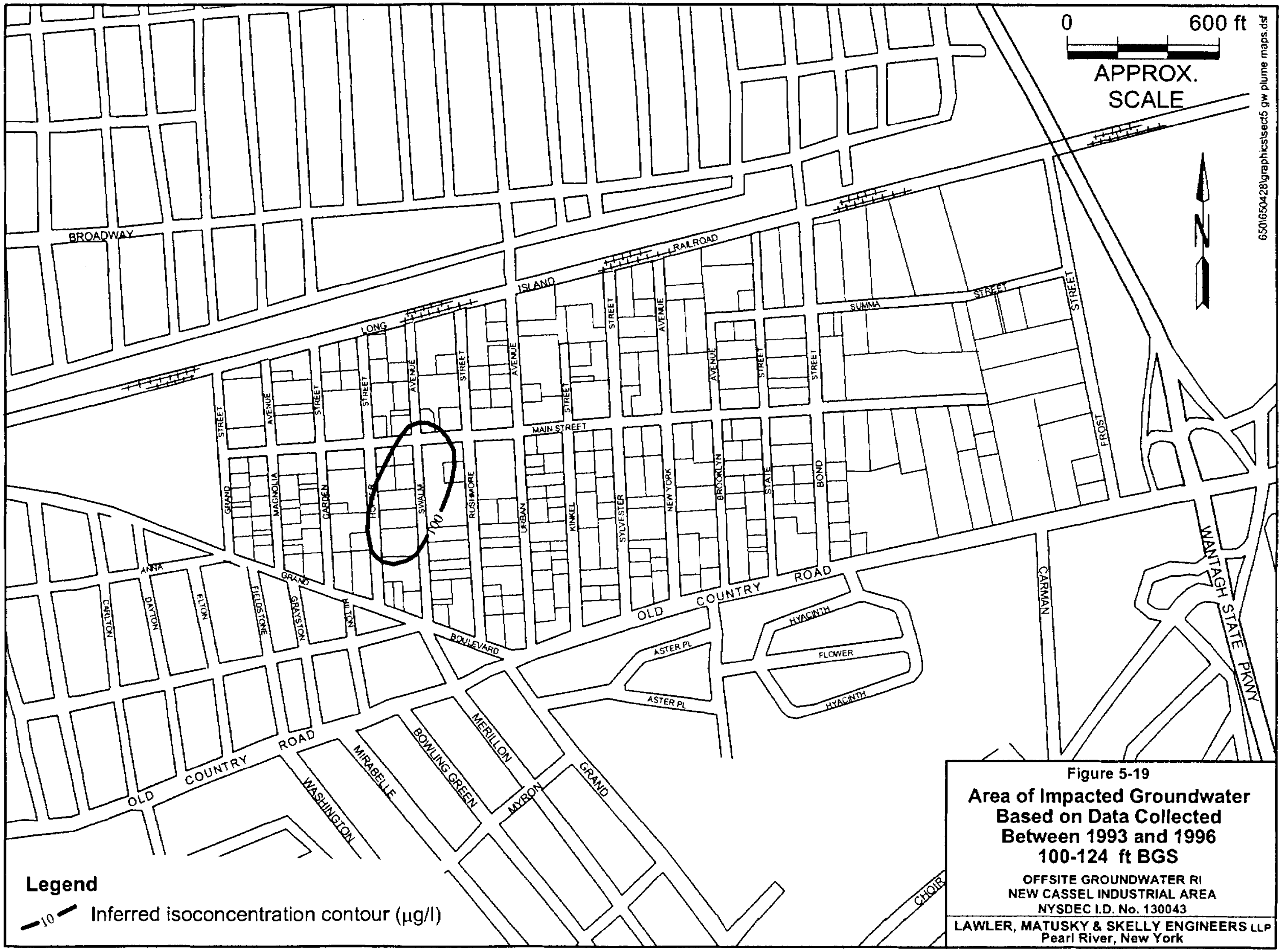
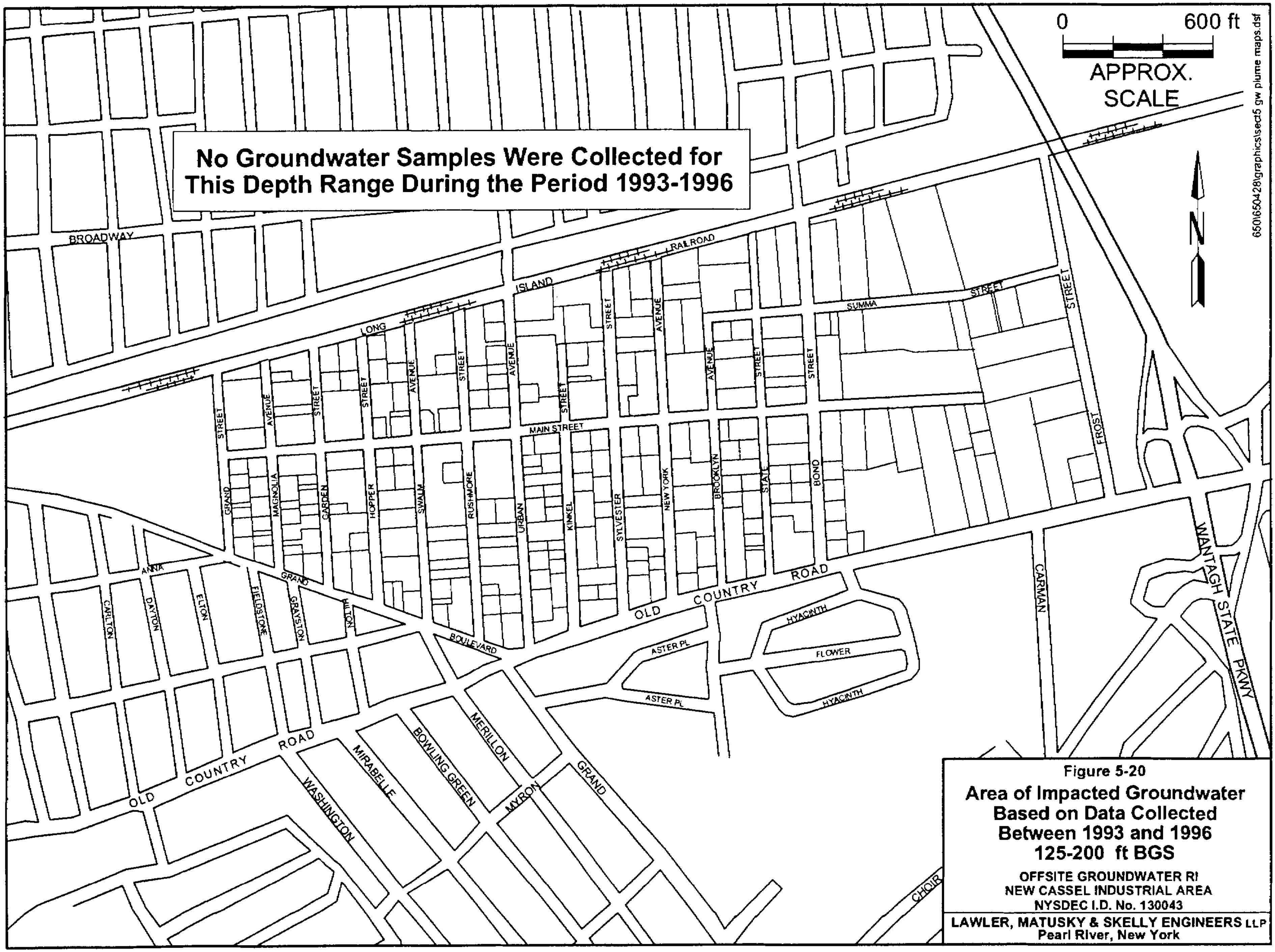


Figure 5-19

Area of Impacted Groundwater Based on Data Collected Between 1993 and 1996 100-124 ft BGS

OFFSITE GROUNDWATER RI
NEW CASSEL INDUSTRIAL AREA
NYSDEC I.D. No. 130043

LAWLER, MATUSKY & SKELLY ENGINEERS LLP
Pearl River, New York



No Groundwater Samples Were Collected for This Depth Range During the Period 1993-1996

Figure 5-20

Area of Impacted Groundwater Based on Data Collected Between 1993 and 1996 125-200 ft BGS

OFFSITE GROUNDWATER RI
NEW CASSEL INDUSTRIAL AREA
NYSDEC I.D. No. 130043

LAWLER, MATUSKY & SKELLY ENGINEERS LLP
Pearl River, New York

Figure 5-21

Area of Impacted Groundwater Based on Data Collected Between 1996 and 2000 0-64 ft BGS

OFFSITE GROUNDWATER RI
NEW CASSEL INDUSTRIAL AREA
NYSDEC I.D. No. 130043

LAWLER, MATUSKY & SKELLY ENGINEERS LLP
Pearl River, New York

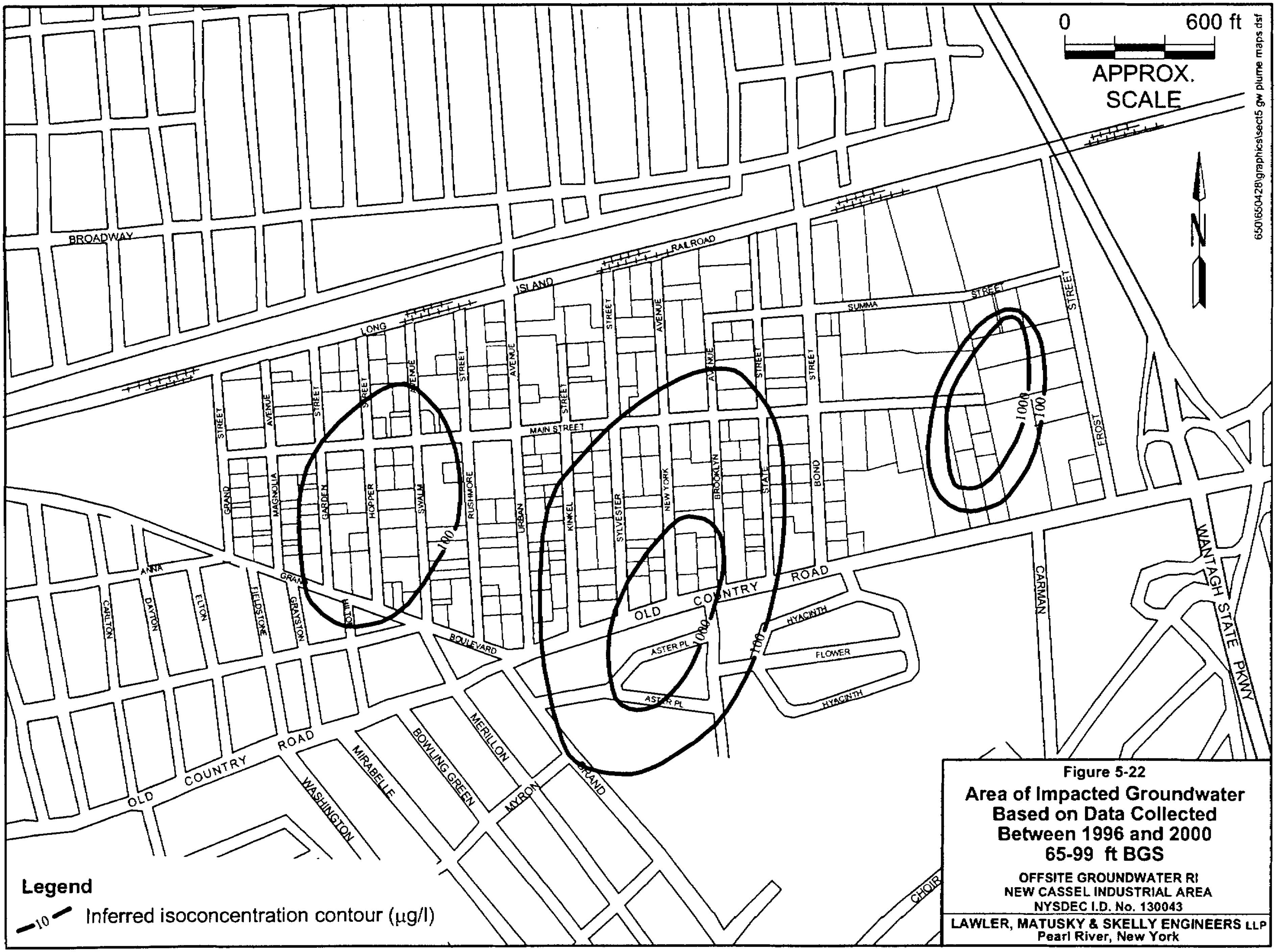


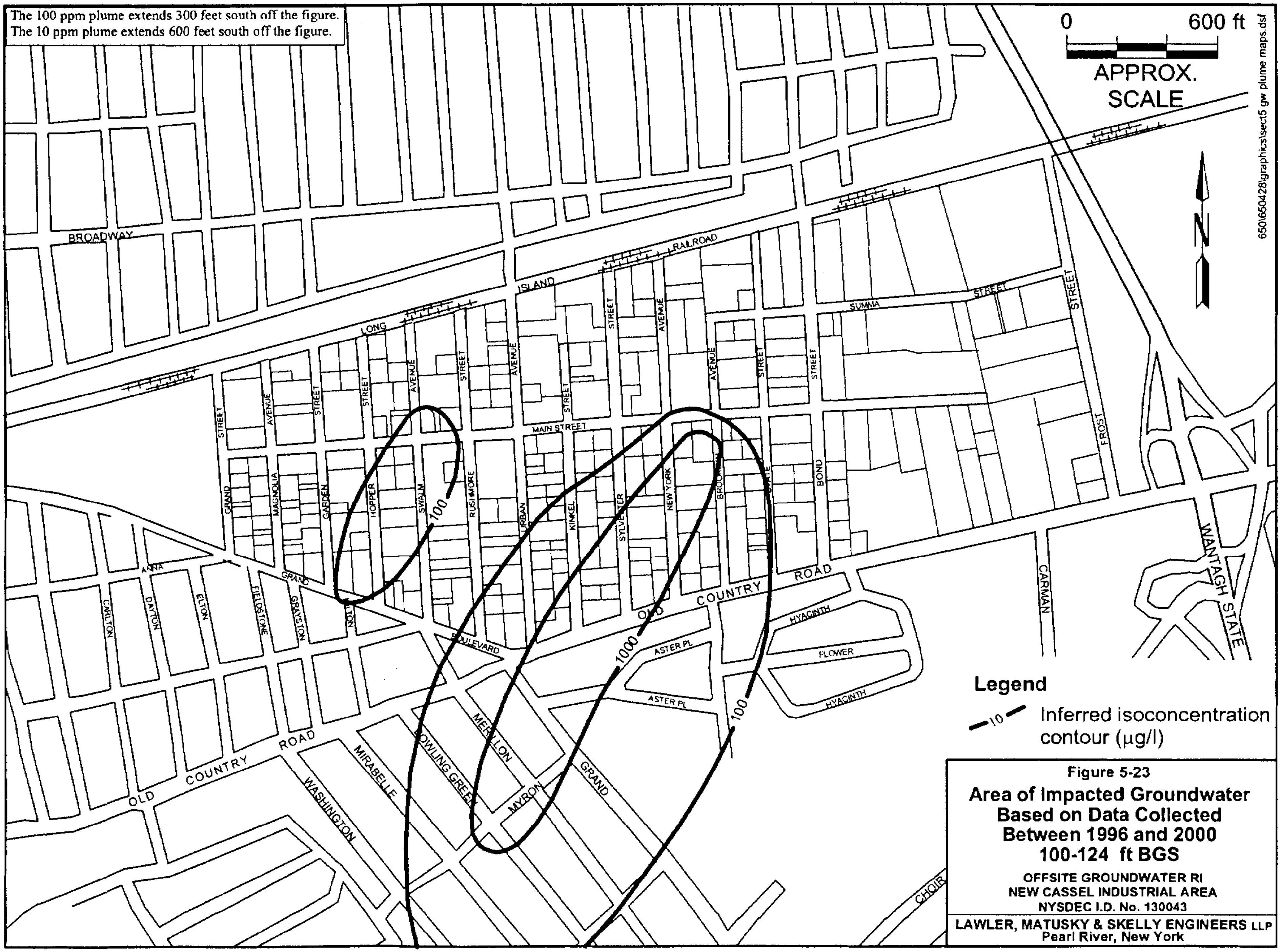
Figure 5-22

Area of Impacted Groundwater Based on Data Collected Between 1996 and 2000 65-99 ft BGS

OFFSITE GROUNDWATER RI
NEW CASSEL INDUSTRIAL AREA
NYSDEC I.D. No. 130043

LAWLER, MATUSKY & SKELLY ENGINEERS LLP
Pearl River, New York

The 100 ppm plume extends 300 feet south off the figure.
The 10 ppm plume extends 600 feet south off the figure.



Legend

10 Inferred isoconcentration contour (µg/l)

Figure 5-23

Area of Impacted Groundwater Based on Data Collected Between 1996 and 2000 100-124 ft BGS

OFFSITE GROUNDWATER RI
NEW CASSEL INDUSTRIAL AREA
NYSDEC I.D. No. 130043

LAWLER, MATUSKY & SKELLY ENGINEERS LLP
Pearl River, New York

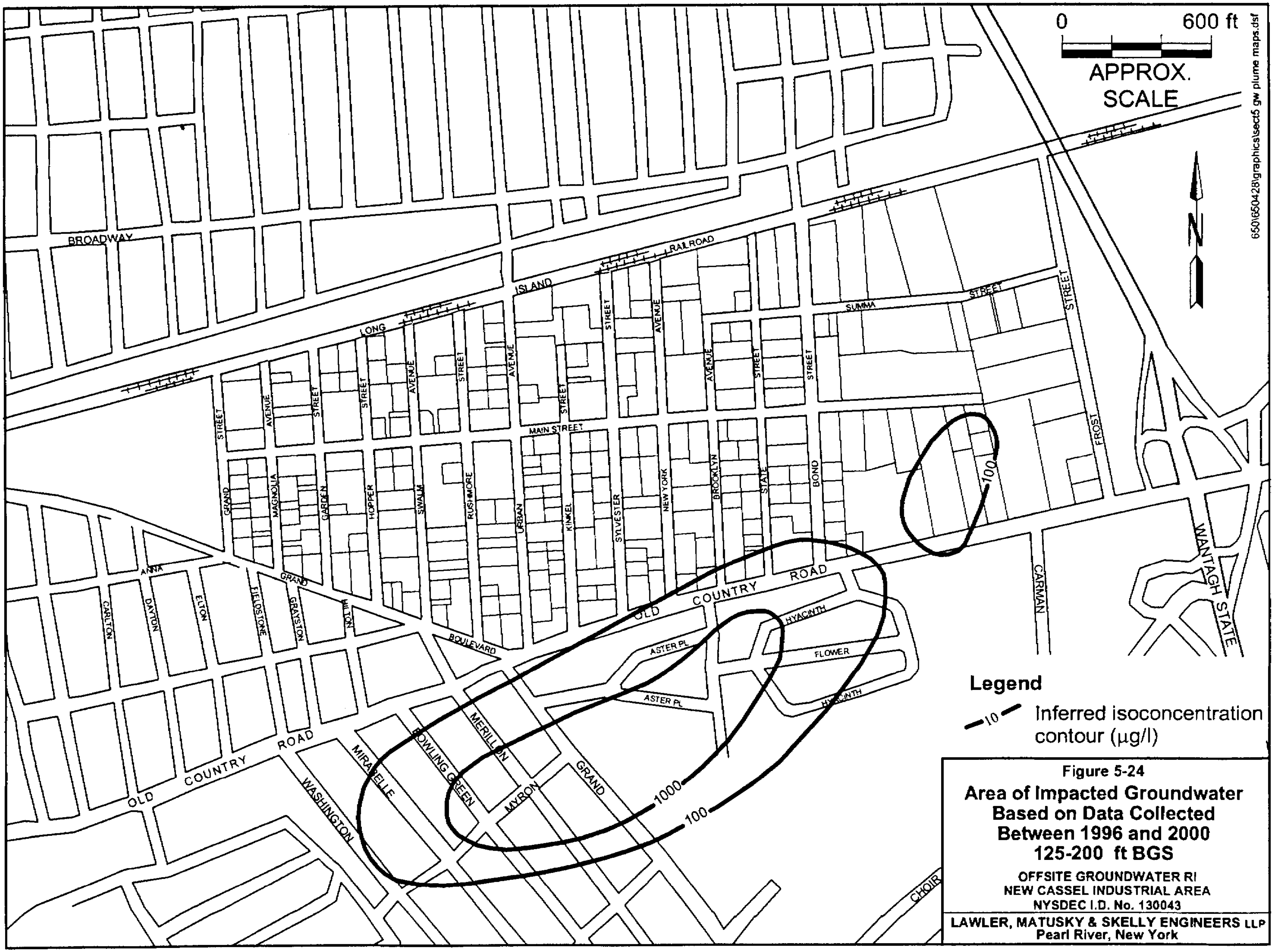


Figure 5-24

Area of Impacted Groundwater Based on Data Collected Between 1996 and 2000 125-200 ft BGS

OFFSITE GROUNDWATER RI
NEW CASSEL INDUSTRIAL AREA
NYSDEC I.D. No. 130043

LAWLER, MATUSKY & SKELLY ENGINEERS LLP
Pearl River, New York

natural variation it was believed that a minimum of six data points were needed to establish a trend. Of the 40 wells, 12% exhibit an apparent increasing trend in total VOC concentrations while 55% exhibit an apparent decreasing trend. The remaining wells either have historically only exhibited low levels of contamination (8% of the wells) or did not appear to have either a decreasing or increasing trend in concentration (25% of the wells).

Further analysis of the 40 well subset to determine if the distribution of individual VOCs has changed over the years indicates the concentrations of parent and breakdown products has remained in a relatively steady state over the years. Since this analysis was inconclusive in showing if naturally occurring degradation of the parent compounds (PCE, TCE, 1,1,1-TCA) was occurring the entire database was analyzed to determine if the relative percentages of breakdown products were increasing with time. This analysis was completed by comparing the relative percent of each individual compound to the total VOCs for the earliest availible, and latest availible sampling data. The results of this analysis were then plotted on the site base map (Figure 5-25 and 5-26) to determine if any spatial relationships are present. This analysis is further discussed in Chapter 6.

5.3.4 Contaminant Distribution with Depth

Groundwater sampling with depth was conducted as part of this investigation and several previous investigations. The analytical results from these sampling efforts indicate that the contaminants associated with the NCIA are vertically stratified both on-site and off-site. A series of cross sections across the major plume areas were prepared to clearly illustrate the stratified nature of the contaminants, and the plumes position in relation to the source areas and the Bowling Green supply wells. The total VOC values presented on the cross sections are from the data collected from September 1996 to the present and are representative of the current contaminant levels in the aquifer. As needed certain data points have been projected onto the cross section in areas of limited data. Cross section A-A' (Figure 5-27) runs southwest along the axis of the eastern plume downgradient through the Bowling Green supply wells. Cross section B-B' (Figure 5-28) and C-C' (Figure 5-29) also run in a southwestern direction along the axis of the central and western plumes respectively. The final cross section, D-D' (Figure 5-30), is oriented along the alignment of Old Country Road and Grand Boulevard.

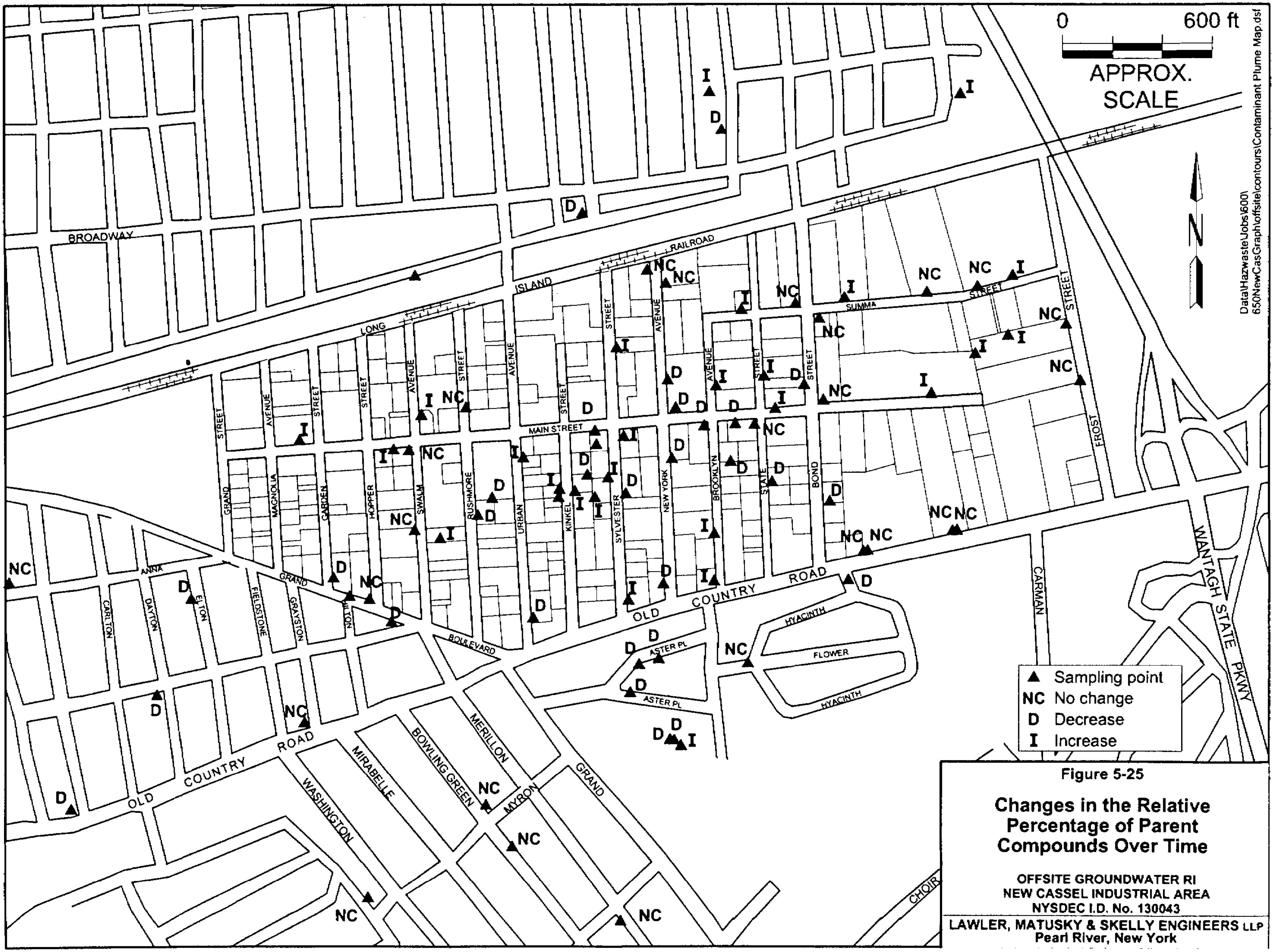


Figure 5-25

Changes in the Relative Percentage of Parent Compounds Over Time

OFFSITE GROUNDWATER RI
NEW CASSEL INDUSTRIAL AREA
NYSDEC I.D. No. 130043

LAWLER, MATUSKY & SKELLY ENGINEERS LLP
Pearl River, New York

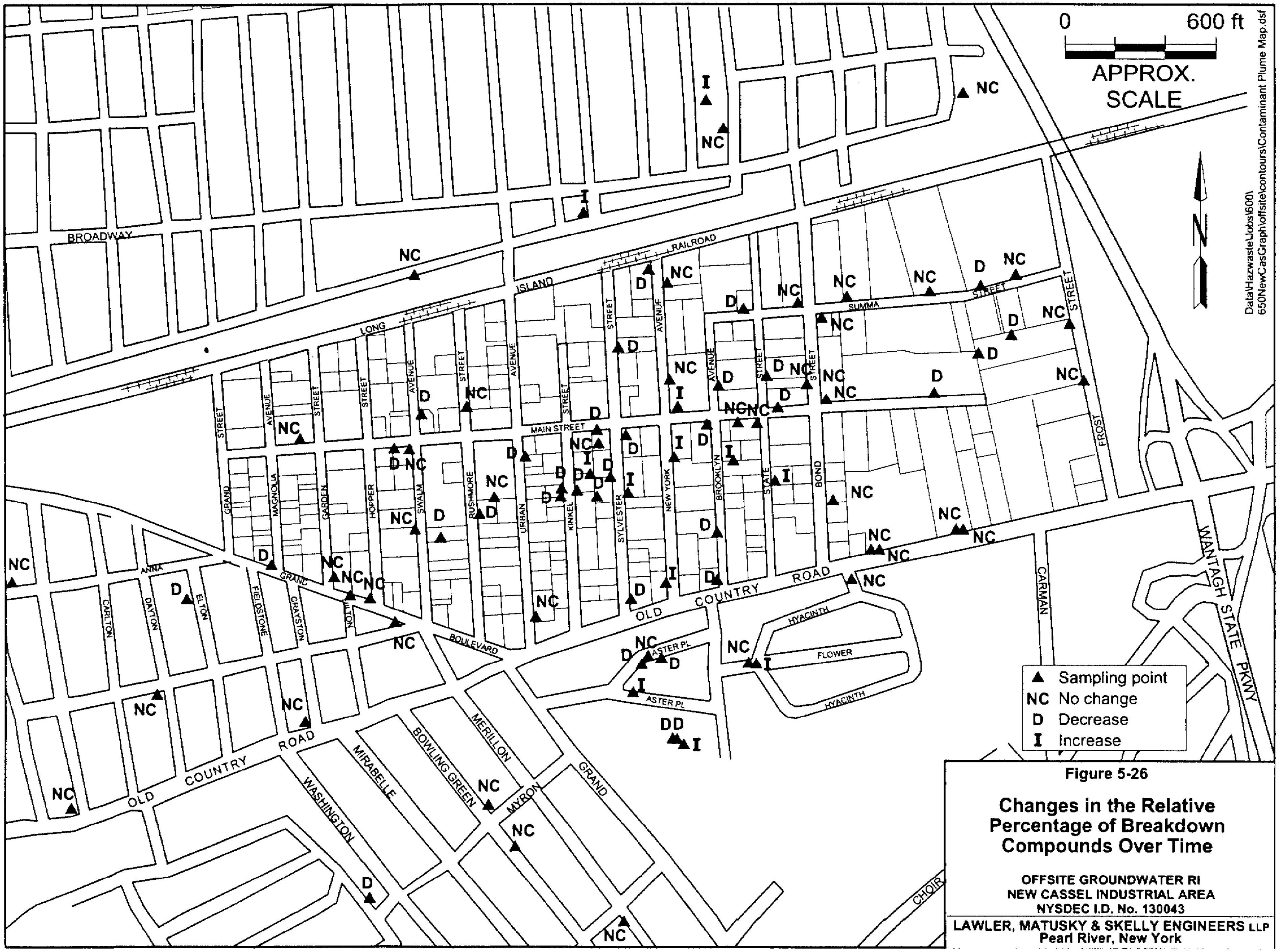


Figure 5-26

Changes in the Relative Percentage of Breakdown Compounds Over Time

OFFSITE GROUNDWATER RI
NEW CASSEL INDUSTRIAL AREA
NYSDEC I.D. No. 130043

LAWLER, MATUSKY & SKELLY ENGINEERS LLP
Pearl River, New York

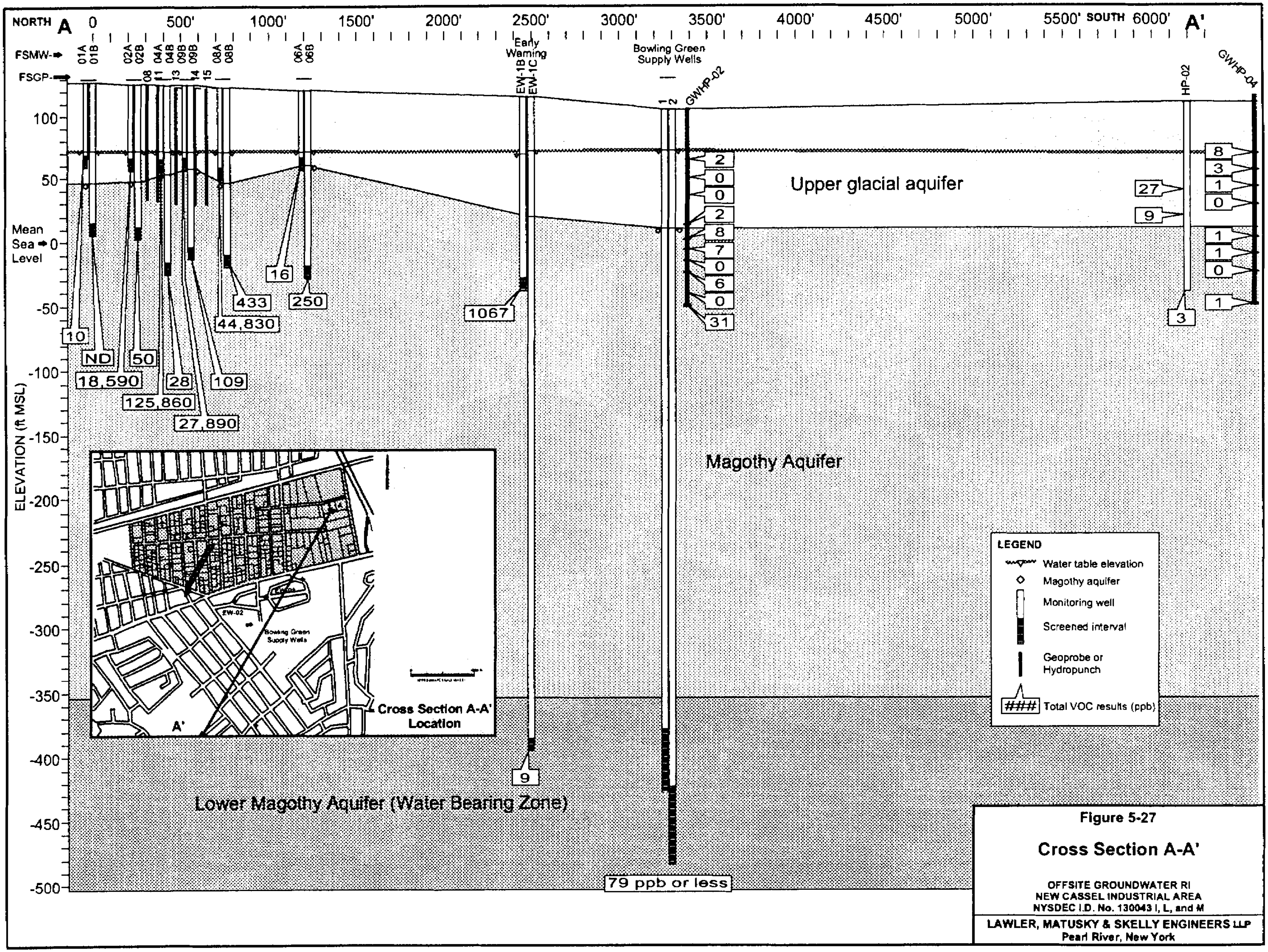


Figure 5-27

Cross Section A-A'

OFFSITE GROUNDWATER RI
NEW CASSEL INDUSTRIAL AREA
NYSDEC I.D. No. 130043 I, L, and M

LAWLER, MATUSKY & SKELLY ENGINEERS LLP
Pearl River, New York

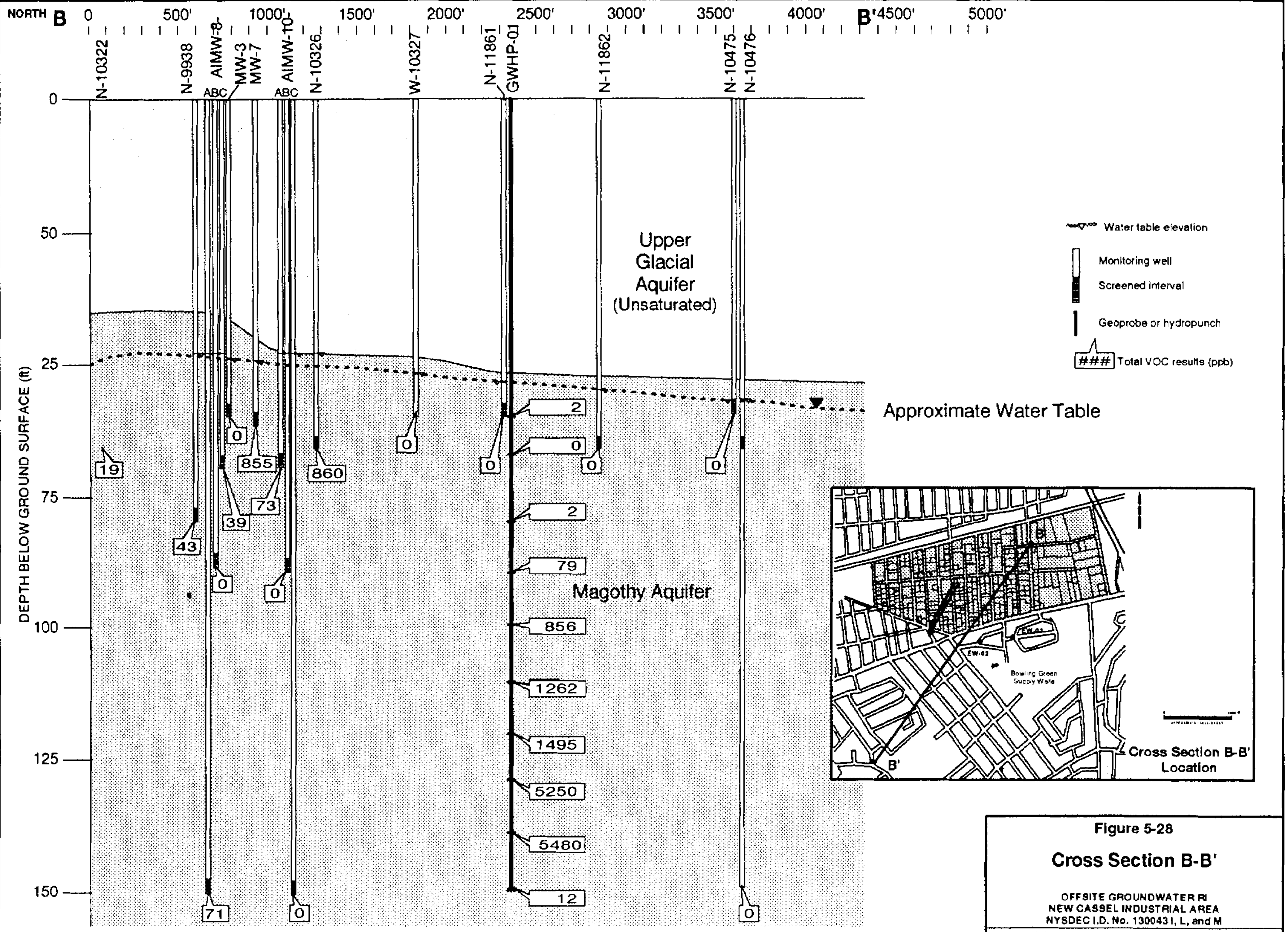


Figure 5-28

Cross Section B-B'

OFFSITE GROUNDWATER RI
NEW CASSEL INDUSTRIAL AREA
NYSDEC I.D. No. 130043 I, L, and M

LAWLER, MATUSKY & SKELLY ENGINEERS LLP
Pearl River, New York

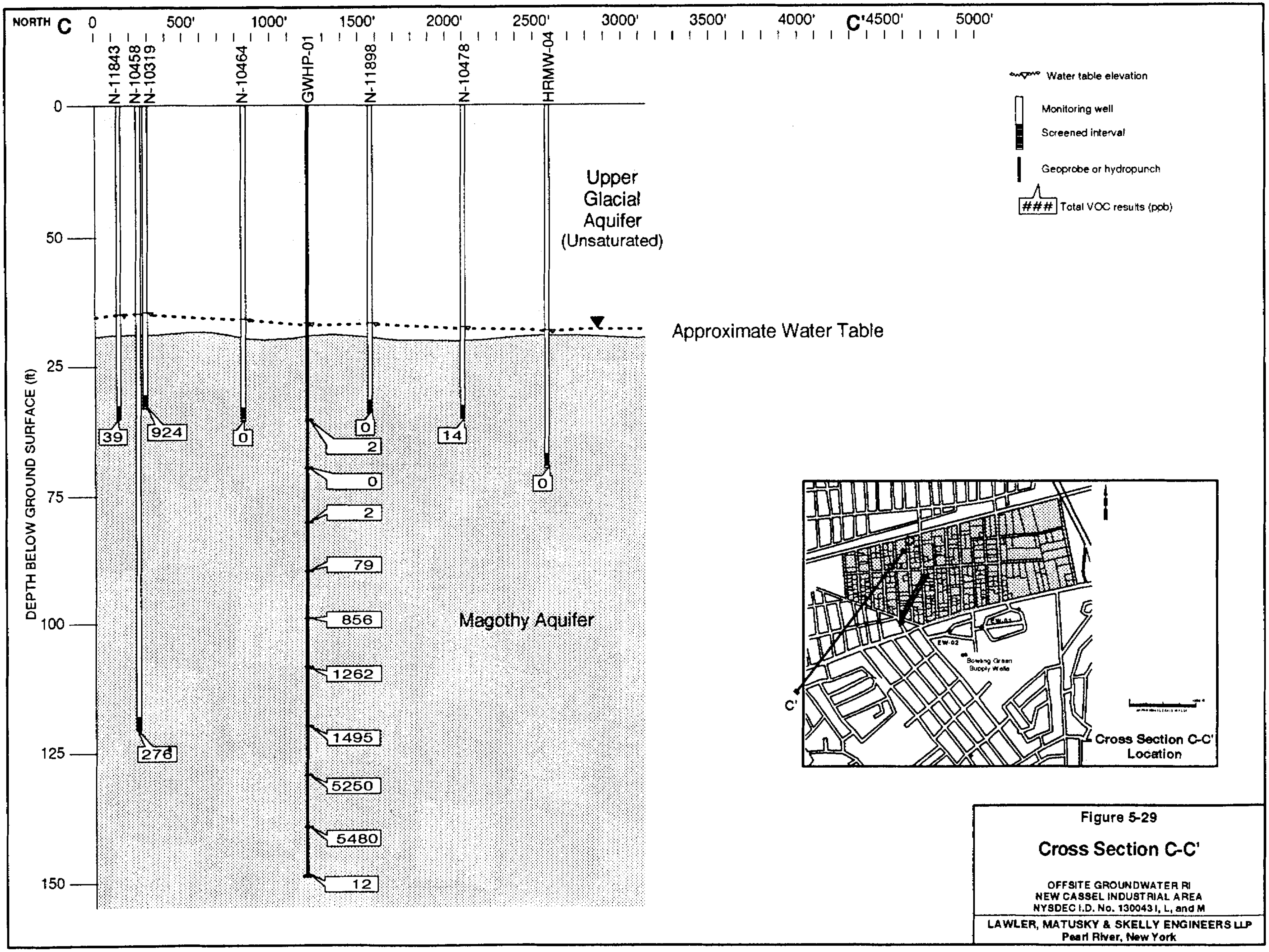


Figure 5-29

Cross Section C-C'

OFFSITE GROUNDWATER RI
NEW CASSEL INDUSTRIAL AREA
NYSDEC I.D. No. 130043 I, L, and M

LAWLER, MATUSKY & SKELLY ENGINEERS LLP
Pearl River, New York

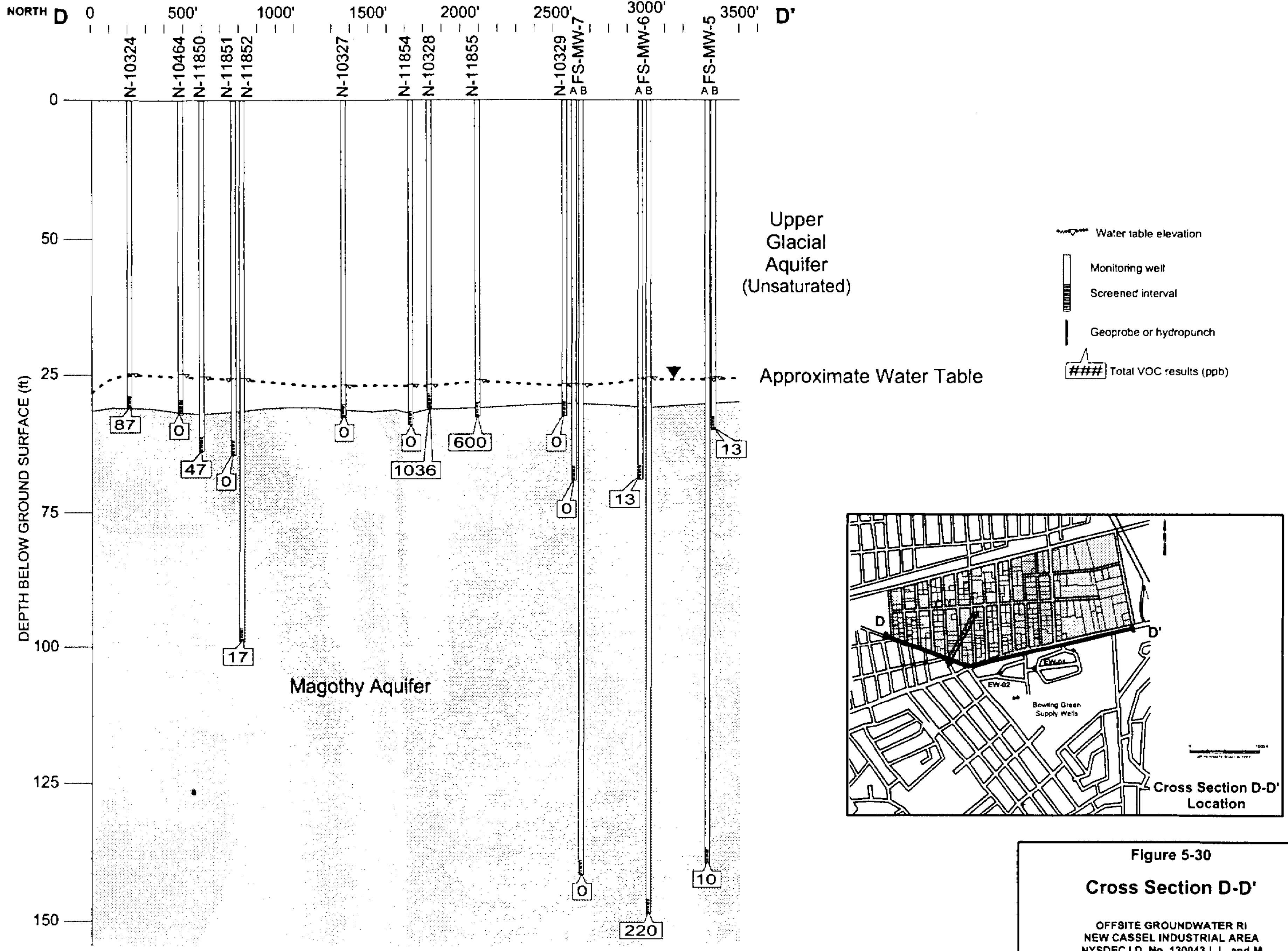


Figure 5-30

Cross Section D-D'

OFFSITE GROUNDWATER RI
NEW CASSEL INDUSTRIAL AREA
NYSDEC I.D. No. 130043 I, L, and M

LAWLER, MATUSKY & SKELLY ENGINEERS LLP
Pearl River, New York

CHAPTER 6

SUMMARY AND CONCLUSIONS

6.1 FIELD INVESTIGATION

The off-site groundwater RI for the NCIA was performed to further characterize the nature and extent of the known groundwater contamination discovered during the previous investigations associated with this site. The field investigation included two phases; the first phase of the RI included two rounds of groundwater monitoring well sampling, and the construction and sampling of 4 new shallow monitoring wells at off-site locations. The second phase of the RI included a third round of monitoring well sampling, and the completion of four hydropunch-sampling locations.

A total of 49 groundwater samples were collected from 49 monitoring wells during the first round of sampling (May 1999) including 41 existing wells, the four new shallow monitoring wells, and the four Bowling Green early warning wells. The NYSDEC contract laboratory analyzed each of these groundwater samples for VOCs.

During the second round of sampling in August 1999 a total of 49 groundwater samples were collected from same subset of wells as the first sampling round in April 1999. The NYSDEC contract laboratory also analyzed each of these groundwater samples for VOCs.

The third round of monitoring well sampling (January 2000) included a 24 well subset of the first and second round monitoring wells. Each of these wells were analyzed for VOCs and a number of other physical and chemical parameters to assist in the MNA evaluation.

A total of 39 groundwater samples were collected from four separate off-site hydropunch groundwater sampling locations. These samples were collected beginning at the watertable and continuing to a total depth of 150-ft. below the ground surface at 10-foot sampling intervals. Each of these samples were analyzed by the NYSDEC contract laboratory for VOCs.

6.2 DATA INTERPRETATION

The groundwater contamination problem associated with the NCIA was first discovered in 1985 (NCDOH 1986). Since that time several extensive sampling efforts have been conducted at the NCIA to determine the sources and extent of this contamination (Table 5-1). A major portion of the effort of this off-site groundwater RI has been to compile and interpret the historical data to determine the fate and transport of the contaminants as they relate to off-site locations.

6.2.1 Area of Historically Impacted Groundwater

The area of historically impacted groundwater is shown on Figures 5-5 to 5-8. Overall this set of figures shows the maximum area of impacted groundwater since it was prepared using the highest noted concentration of total VOCs over the years. The inferred isoconcentration contours are based on a logarithmic scale beginning a 100 µg/l and progressing through 1,000 µg/l. This contouring resulted in three individual plume areas over the three depth intervals examined with the exception of the deepest depth level (125 to 200 ft below the ground surface) where only two apparent plume areas were found.

The eastern most plume is located west of Frost Street and south of Summa Avenue with its source area centered about the Frost Street sites (#1-30-043I, M, and L) (Figure 5-5). The nature and extent of the contamination in this area has been relatively well defined during the RI at these sites and this plume area exhibits the highest concentrations associated with the NCIA (LMS 1999). The primary contaminant of concern in this plume area is PCE and it's associated breakdown products. The total VOC concentrations in the shallow groundwater in this area exceeded 10,000 µg/l at four sampling locations in the shallow groundwater, the very high concentrations suggest that DNAPL is present in this vicinity. The shallow groundwater contamination associated with this plume area extends just south of Old Country Road (Figure 5-5). The axis of the plume is generally in the direction of the flow direction found for the shallow groundwater.

The total VOC concentration increases with depth in the eastern plume and reaches it's highest concentrations at the 65 to 99 ft. interval with the highest single measurement of over 100,000 µg/l at the center of this plume area (Figure 5-6). It is believed that the extremely high concentrations noted in the area are the result of NAPL within the fine-grained matrix of the transition zone between the UGA and Magothy Aquifer. The maximum extent of this plume is slightly smaller than the noted plume in the shallow groundwater. At the deeper depth intervals (100-124 ft and 125 to 200 ft below the ground surface) the contaminant concentrations decrease on-site (north of Old Country Road) as it appears that the plume has not migrated vertically downward in this area (Figure 5-7 and 5-8). It is not known whether this is a function of the time required to migrate to this depth or whether the fine-grained nature of the material at this depth is preventing downward migration. The planned active groundwater remediation at the Frost Street sites should facilitate source removal and limit the further potential for downward migration on the site. At the deeper depths off-site, the eastern plume and the central plume are co-mingled. Generally the highest total VOC concentrations (TVOC > 1000 μg/l) are located south of Old Country Road just north of the Bowling Green wellfield. At the deeper depths the data is somewhat limited, the hydropunch data collected during the installation of the early warning wells indicate that beyond 150 feet the contaminant concentrations drop off rapidly.

The second plume area is located in the central section of the industrial area with the most highly concentrated area south of Main Street (Figure 5-5). The source area of this plume appears to be the Arkwin Industries site (#1-30-043D), and the Tishcon Corporation sites (#1-30-043V and E). The noted contamination north of Main Street is attributable to the Tishcon Corporation site (#1-30-043C) and the delisted Metpar Steel site (#1-30-043G). The former LAKA site (1-30-043K) is also located within the western portion of this plume area. In this plume area the primary contaminant of concern is 1,1,1-TCA and its breakdown products. Significant concentrations of TCE and PCE were also found at certain sampling locations especially at the deeper depths off-site. The total VOC concentrations in the shallow groundwater in this area exceeded 10,000 μg/l at three sampling locations and exceeded 1,000 μg/l at two locations in the shallow groundwater (Figure 5-5). The highest concentrations are located directly downgradient of the Tishcon Corporation site (#1-30-043E) and the very high concentrations suggest that NAPL is present in this vicinity. The high concentrations found on-site suggest that the on-site areas will continue to act as a source of contamination to the off-site groundwater. The planned active remedial measures on-site should serve to reduce the mass of contaminants available as a source for the off-site contamination. The shallow off-site groundwater contamination associated with this plume area extends south of Old Country Road to just north of the Bowling Green wellfield (Figure 5-5).

Since this plume area extends into the vicinity of the Bowling Green wellfield the contaminant distribution with depth is critical. Both of the deeper depth intervals (Figure 5-7 and 5-8) indicate that a large relatively highly concentrated plume (TVOC> 1,000 µg/l) exists south of Old Country Road. The hydropunch sampling location completed on Myron (GWHP-01) (Figure 5-4) indicates that total VOC concentrations range from 856 to 5,480 µg/l between 100 and 140 ft below the ground surface, at these depths the primary contaminant of concern is TCE and 1,1-DCE. An additional groundwater hydropunch sampling location (GWHP-02) was completed in this area. This hydropunch was located directly downgradient of the Bowling Green wells within Basin 51. This hydropunch sampling location exhibited significantly lower concentrations at the deeper depths that GWHP-01. Total VOC concentrations at this location ranged from ND to 8 µg/l between 100 and 140 ft. The highest total VOC concentration found at this location was 31 µg/l in the deepest sample that was collected. Previous sampling conducted during the installation of the Bowling Green early warning wells indicate that at the two early warning well location the total VOC concentrations tend to decrease below 150 ft below the ground surface.

The final plume area is located in the western section of the industrial area and extends from the Long Island Railroad to just south of Old Country Road (Figure 5-5). The most upgradient source area for this plume appears to be the 118-130 Swalm Street site (#1-30-043P). Several other Class 2 sites including Atlas Graphics (#1-30-043B), IMC Magnetics (1-30-043A), and 299 Main Street (1-30-043S) are also located within this plume area. The primary contaminants of concern in this plume depends on location, significant concentrations of TCE, PCE, and 1,1,1-TCA area found throughout the plume. The total VOC concentrations in the shallow groundwater in this area exceeded 1,000 µg/l at six sampling locations. Three of the six are located on the 118-130 Swalm Street site while the other three are located downgradient south of Main Street. The shallow groundwater contamination associated with this plume area extends approximately 100 feet south of Old Country Road. Between Grand Boulevard and Old Country Road the plume extends over a seven block residential area (Figure 5-5). This plume area reaches its maximum apparent extent in the shallow groundwater which may indicate that this plume is representative of more recent discharges or that the contaminants were released as dissolved product and has not vertically migrated downward.

6.2.2 Area of Impacted Groundwater- 1998 to 2000

The current area of impacted groundwater based on data collected from 1998 to 2000 (Figure 5-9 to 5-12) is very similar to the area of historically impacted groundwater. Three plume areas are present including the eastern, central, and western plume and they are of generally the same aerial extend and shape. In some cases the plume area have decreased in apparent size from the historically impacted area. This is caused in some cases as a result of a lack of data in certain locations and in other locations by an actual decrease in contaminant concentrations. Over all four depth ranges examined the contaminant levels are very similar during this period of time as the historically impacted area of groundwater, and the impacted groundwater areas between 1993 to 1996.

Over the various depth ranges for the eastern plume area the plume configuration is essentially the same when comparing the historically impacted area and the data collected between 1998 to 2000 over the two shallow depths (Figures 5-5 and 5-9, Figures 5-6 and 5-10). The differences at the deeper depths (Figures 5-7 and 5-11, Figures 5-8 and 5-12) are the attributable to a lack of sampling points over the particular time period of 1998 to 2000. The data collected during 1998 to 2000 is consistent with the previous data: PCE is the primary contaminant of concern both on-site and off-site. At off-site locations significant concentrations of breakdown products were also found from 1998 to 2000. As noted in the historical data the apparent source area for this contamination are the Class 2 sites in the vicinity of the Frost Street sites.

When comparing the available data for the shallow depth (0-64 ft bgs.) for the central plume during the period 1998 to the present (Figure 5-9) against the historical data (Figure 5-5) only minor differences in the plume configurations are noted. It is believed the minor differences are attributable to the limited number of sampling points available from 1998 to the present for on-site locations within the industrial area. For the depth range between 65 to 99 ft bgs significant differences are noted between the historical data (Figure 5-5) and the current data (Figure 5-9). Although a trend toward lower total VOC concentrations in the primary source area is apparent it is not known if this trend actually exists or if it is a result of limited data from 1998 to the present. For the two deeper depths of the central plume the primary differences in the present plume configuration vs. the historical plume configuration appear to be in the lower (less than 1000 μg/l) concentration fringe areas of the plume. For example the historical data indicates that the maximum extent of the 100 to 124 ft plume area should extend 300 ft downgradient of Washington Avenue while the latest RI data indicates that this plume area extends to just north of Washington Avenue. In this case it is not known whether this indicates a decrease in concentration with time or is simply a function of the available sampling data with depth.

Comparing the various plume configurations with depth for the western plume is difficult since little actual data was historically collected downgradient of the source areas for this plume. This RI focused on the potential off-site impacts from this plume and the data indicates that this plume does not appear to extend to the deeper depths at high concentrations (greater than 1000 µg/l). During the RI, hydropunch data collected at GWHP-03 located on Fieldstone Street (Figure 5-4) indicates that the highest concentration area of this plume extends from 78 to 100 ft with total VOC concentrations ranging from 123 to 315 µg/l. At the deeper depths the concentrations appear to be decreasing with the exception of 138 to 140 ft bgs (total VOCs 134 µg/l).

6.2.3 Area of Impacted Groundwater- Prior to 1993 to 2000

The previous data collected prior to 1993 (Figure 5-13 to 5-16), 1993 to 1996 (Figure 5-17 to 5-20), and 1996 to 2000 (Figure 5-21 to 5-24) provide a means of comparing this data to the current and historically impacted areas of groundwater. For the data collected from 1993 to 1996 it is important to note that the data is somewhat limited since the investigations conducted during this period were focused toward sampling the on-site groundwater at depths less than 100 ft below the ground surface. Again overall each of the plume areas at each of the shallow and intermediate depths appear to be generally of the same shape, size and magnitude of contamination. At the deepest depths the data is limited, the available data does not indicate an increasing plume size or increasing trend in contamination. Overall in comparing the various plume configurations based on the data collected over the specified years the strongest apparent trend is that the overall plume configurations have not significantly changed when the effect of limited data for specific areas is screened out.

6.2.4 Temporal Variations in Groundwater Quality in Individual Wells

The groundwater wells included in the temporal variation analysis were selected from the database based on the number of sampling events over the time period of interest. Currently the database contains groundwater quality information for 182 wells. Of the 40 wells that were included in this temporal evaluation of total VOC concentrations, 12% exhibit an apparent increasing trend in VOC concentrations while 55% exhibit an apparent decreasing trend. The remaining wells either have historically only exhibited low levels of contamination (8% of the wells) or did not appear to have either a decreasing or increasing trend in concentration (25% of the wells).

Although this analysis contains a large degree of variability and uncertainty some general conclusions can be made. Greater than 50% of the wells appear to be decreasing in concentration. It is believed the reduction in concentrations in these wells is directly related to the changes in the disposal practices once county sewers were installed in this area. After the mid-1980's most of the industrial wastewater generated in the industrial area was directed to the newly installed sewer system rather than on-site leaching pools. Thirty-seven percent of the wells continue to exhibit significant concentrations of VOCs and of these approximately half shows an apparent increase in VOC concentrations over the years. This suggests that although the concentrations of VOCs in the groundwater appear to be decreasing in a large percentage of the wells a similar percentage of the wells have not show improvement or are increasing in concentration. This conclusion indicates that an active remedial alternative will be required to meet the remedial action objectives. Of special concern are those wells that are increasing in concentration. The 12% of wells that exhibited an increasing concentration included 5 wells. Three of the 5 wells are supply wells (N-5655, N-8956, and N-8957) including the two Bowling Green production wells (N-8956 and N-8957).

The analysis of the entire database to evaluate if the distribution of individual VOCs has changed over the years is plotted on Figure 5-26 and 5-27. This analysis compares the relative percentages of each individual compound to the total VOCs for the earliest available and latest available sampling data. This analysis did not indicate that there is a definite trend to indicate that the parent compounds are naturally degrading to their breakdown products. It is expected that if naturally occurring processes were degrading the parent chlorinated compounds the relative percentages of the parent compounds would be decreasing while the relative percentages of the breakdown products would increase. This should hold especially true for the areas downgradient away from the on-site source areas.

6.2.5 Chemical Fate and Transport

The overall contaminant distribution is related to a number of factors that are difficult to quantify for this site. In order to describe the contaminant distribution with depth a conceptual model of contaminant fate and transport at the site was developed. In developing the a conceptual model the following characteristics of the site were considered:

- Contaminant source areas and the nature of the contaminants
- Site geology
- Site hydrogeology including the influence of the Bowling Green production wells

The source areas for the on-site groundwater and off-site groundwater contamination at the NCIA is clearly attributable to the individual facilities on the New York State Registry of Inactive Hazardous Waste Disposal Sites as Class 2 sites. Sampling conducted during this investigation and previous investigations has not identified any additional sources for this contamination, including any upgradient off-site sources. The primary contaminants of concern are compounds typically known as chlorinated solvents such as 1,1,1-TCA, PCE, and TCE. In some areas compounds associated with petroleum products such as gasoline are also found but overall the contamination is specific to chlorinated solvents and their breakdown products. These chlorinated solvents were used extensively by industry for degreasing and cleaning operations. A number of industries that used large amounts of these compounds were or still are located in the industry area. Prior to this area receiving county sewer service (early to mid-1980's) the waste products from these operations were disposed of into on-site leachpools or drywells. Much of the disposal likely occurred in the 1960's to early 1980's, industrial development in the area began in the late 1950's and the area was essentially built out for industrial and commercial uses by the late 1970's. Once placed in the leachpools or drywells the wastes migrated vertically through the unsaturated zone and eventually found their way into the groundwater.

Chlorinated solvents exhibit densities greater than water and tend to sink in their pure form when released to groundwater. The solubility of the parent chlorinated compounds are 4,400 mg/l for 1,1,1-TCA, 1,100 mg/l for TCE, and 150 mg/l for PCE. As these compounds are found in several areas of the site in excess of 10 percent of their solubility limit and it is believed that non-aqueous phase liquid (NAPL) is present in the aquifer. The areas where NAPL are likely present include the eastern plume area near the Frost Street sites, the central plume area near the Tischon sites, and the western plume near the IMC Magnetics site. In an effort to contain the continuous source of contamination associated with the NAPL at these sites the selected remedial action for the individual sites includes some type of active groundwater remediation. Although these on-site remedial measures may take many years to remove the source of contamination it is believed they will significantly reduce the mass of contaminants leaving the industrial area.

The geology at the site consists of a thick sequence of stratified unconsolidated sands, silts, and gravels. Only the deeper basal portion of the Magothy Formation is currently used as a source of raw public drinking water. The remainder of the formation owing to its stratified nature with many fine-grained zones tends to confine the lower portion of the formation. The other important feature of the geology at the site that influences the contaminant fate and transport is the relationship between the watertable and the transition zone between the upper glacial sands and gravels and the Magothy Formation. It is believed that across many areas of the site the watertable is found within the transition zone and the upper glacial sands are unsaturated. This provides a mechanism for the contaminants to enter the upper zones of the Magothy Formation rather than being quickly transported horizontally in the much coarser upper glacial sands and gravels.

The site hydrogeology is typical of this area of Long Island, the groundwater flow direction in this area is to the southwest (Figure 6-1, LMS 1999, LMS 1997, LMS 1996) under a gentle gradient. This results in groundwater flow velocities ranging from .5 ft/day in the coarse-grained sands and gravels in the UGA to 0.1 ft/day in the upper portion of the Magothy Aquifer. The presence of the Bowling Green supply wells also produces a significant downward vertical gradient in the vicinity of the NCIA. The Bowling Green Estates Water District uses two production wells (Well #1 and Well #2) located south of Old Country Road. Both wells were installed in 1975 and are completed in the basal water-bearing portion of the Magothy Aquifer. Each well has a permitted capacity of 1400 gpm. Well #1 is 532.5 ft deep with a screened zone from 478 to 527.5 ft. Well #2 is 583.5 ft deep with a screened zone from 524 ft to 583.5 ft. An air stripper and carbon filters currently treat the well water; its average pumping rate is approximately 1200 gpm, with one well pumped at a time. The resultant drawdown near the wellhead during pumping is reported to be approximately 50 feet. This results in vertically downward gradient of .1 ft/ft at the wellhead that is several orders of magnitude greater than the horizontal gradient. Radially outward from the well the drawdown decreases which

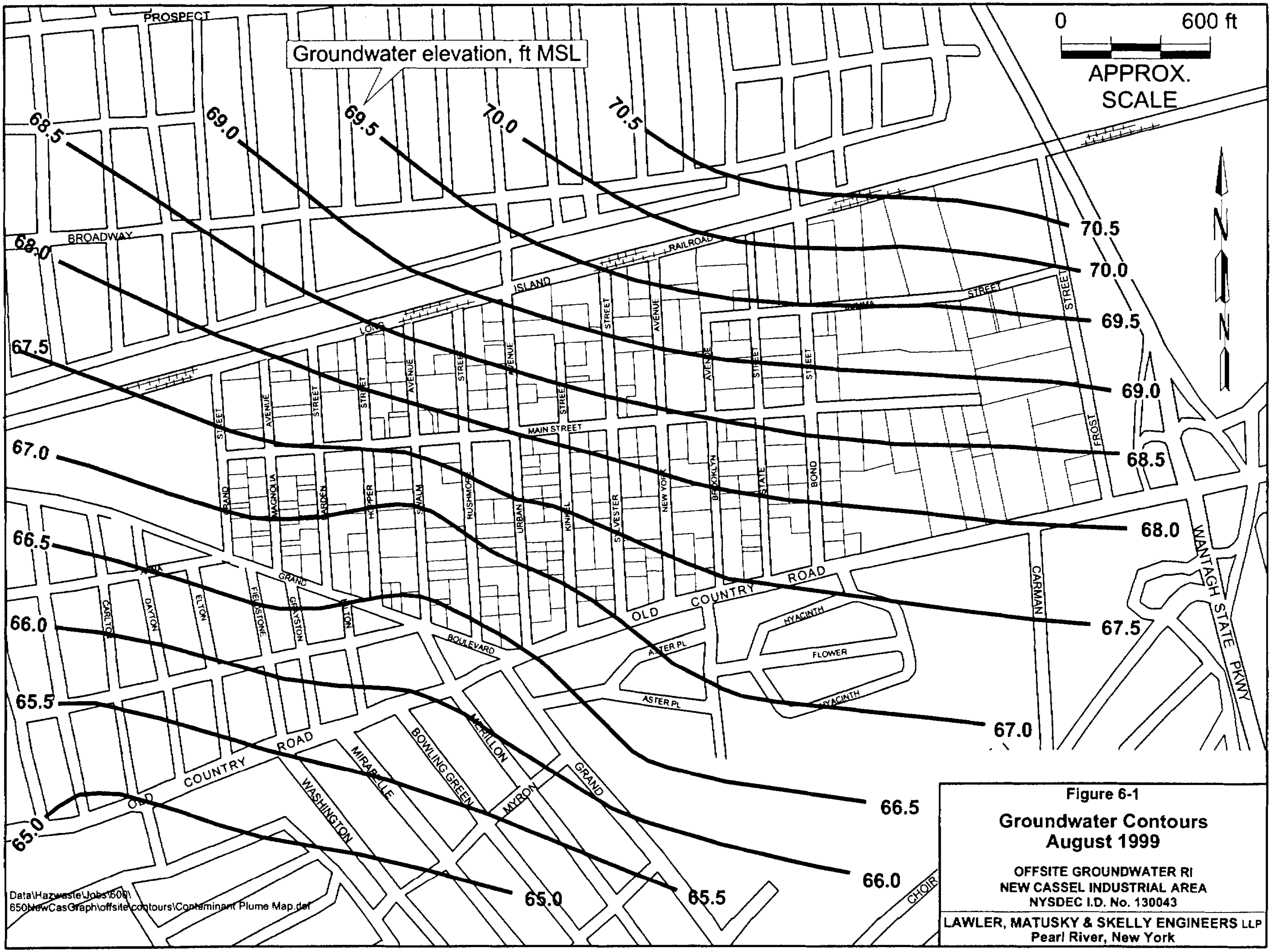


Figure 6-1

Groundwater Contours
August 1999

OFFSITE GROUNDWATER RI
NEW CASSEL INDUSTRIAL AREA
NYSDEC I.D. No. 130043

LAWLER, MATUSKY & SKELLY ENGINEERS LLP
Pearl River, New York

would tend to lower the vertical gradient. The aerial extent of the drawdown (cone of depression) caused by the Bowling Green wells likely extends under most of the eastern and central plumes. The lower values in head within the cone of depression create a significant downward vertical gradient across the confining sands, silts and clays found between the 150 and 450 foot level. This portion of the formation would appear to be the only limiting factor in preventing the migration of the contaminants to the supply wells. Due to its deep depth, the data available to describe this portion of the formation is limited. Based on the four borings which have penetrated to the basal section of the formation (the two supply wells and the two deep early warning wells) it appears that some of the clay layers are relatively thick and continuous in the vicinity of the supply wells. It is believed the hydraulic conductivity of the formation between 150 ft and 450 ft is generally low. However, it is not known if zones of higher permeability might serve as downward conduits for the contamination.

6.3 POTENTIAL EXPOSURE PATHWAYS

Currently there are no existing pathways of exposure to the groundwater within the NCIA since the groundwater is not utilized in any capacity, including as a source of drinking water. The potential for off-site exposure pathways downgradient of the NCIA through the groundwater will be addressed as part of Task 7 of this assignment and full described within the FS report (Chapter 8).

6.4 REMEDIAL ACTION OBJECTIVES

Remedial action objectives are developed for a site to determine the levels to which contaminant concentrations must be reduced to protect human health and environment. The remedial action levels for this site are based on established NYSDEC Class GA groundwater standards for each of the contaminants of concern.