North Shore University Hospital

Addendum To The Preliminary Site Assessment Work Plan

100 – 150 Community Drive
Great Neck, NY

June 2009

Environmental Resources Management
40 Marcus Drive, Suite 200
Melville, New York 11747

ADDENDUM TO THE PRELIMINARY SITE ASSESSMENT WORK PLAN

100-150 Community Drive
Great Neck, NY

June 2009

0084265.03

Prepared for:

North Shore University Hospital
145 Community Drive
Great Neck, NY 11021

Prepared by:

Environmental Resources Management
40 Marcus Drive, Suite 200
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SECTION 1

1.0 INTRODUCTION

Environmental Resources Management (ERM) is submitting this Addendum Work Plan (WP) to update the procedures and schedule for the installation and sampling of a Lloyd aquifer well to be installed on the Fresh Meadows Country Club (FMCC). The Preliminary Site Assessment (PSA) Work Plan for the 100-150 Community Drive site included installation of three Lloyd aquifer monitoring wells. Based on the outputs of updated groundwater flow and transport simulations of Freon 22 contamination in the Lloyd aquifer, North Shore University Hospital and ERM recommended to the New York State Department of Environmental Conservation (NYSDEC) that a Lloyd well, be installed on the FMCC to provide additional data to verify the transport model and more precisely determine the concentration of Freon 22 between the site and well N-12802. Through a more accurately determination of the Freon 22 mass in this portion of the Lloyd aquifer, the need for and feasibility of remedial strategies can be evaluated. This Addendum WP has been prepared in accordance with the:

- specifications set forth in the New York State Department of Environmental Conservation (NYSDEC) Order on Consent, Index No: D1-0500-06-12, and
- the NYSDEC approved Preliminary Site Assessment Work Plan for 100-150 Community Drive, Great Neck, New York dated September, 2007.

This Addendum WP updates the well installation task in the PSA to reflect requirements of both the NYSDEC and the FMCC. The Addendum WP also presents the overall anticipated project schedule for installation of the Lloyd well on the FMCC, which will be carried out in parallel with monitoring wells being installed on the FMCC on behalf of Lockheed Martin Corporation (LMC). Field activities associated with this work plan will be conducted in accordance with the already approved Health and Safety Plan (HASP) and the Community Air Monitoring Plan provided in the September, 2007, PSA Work Plan. Finally, key project team members and their corresponding responsibilities in the project are identified.

1.1 PURPOSE AND OBJECTIVES

Installation of the Lloyd well is required to verify groundwater modeling results and more accurately determine the mass of Freon 22 in the groundwater plume in the vicinity of the Site.

1.1.1 *Site Setting*

The Site is located in the Village of Great Neck in Nassau County, New York. Land usage in this portion of Great Neck includes both commercial and residential properties. The study area is approximately bounded by Community Drive to the east, Route 25A to the north, Allen Drive to the west, and Fresh Meadow Country Club to the south. Nassau County identifies the property as Section 2, Block 358, Lot 49.

1.1.2 *Site History*

Air conditioning at 100-150 Community Drive was once supplied by an open-loop groundwater system that used Freon 22 as a refrigerant. This system operated from about 1967 to 1993, and initially consisted of a Magothy Aquifer supply well (N-8255) and a Lloyd Aquifer diffusion well (N-8375D). The Magothy well was replaced in 1969 by a Lloyd supply well (N-8456) because of fouling of the discharge well screen.

Freon 22 has been detected in public supply well N-12802 located on Community Drive south of the 100-150 Community Drive building. Sampling of the wells at 100-150 Community Drive did not detect Freon 22 in the former Magothy supply well (N-8255), however, Freon 22 was detected in groundwater samples collected from N-8456 (Lloyd replacement supply well) and N-8375D (diffusion well) Freon 22. No other contaminants were detected in these wells.

Groundwater modeling studies of the Lloyd Aquifer beneath 100 -150 Community Drive have been carried out to determine if 100-150 Community Drive could be a source of the Freon 22 detected in public supply well N-12802. The modeling studies were performed by Camp Dresser McKee (CDM) using the Nassau County regional groundwater model (2003 Update Version). Freon 22 transport was modeled using a range of assumed release dates and durations. Freon 22 mass loading rates were also assigned so that the magnitude of simulated concentrations at supply well N-12802, N-8375D and N-8456 was consistent with observed concentrations. A map of the modeled plume (updated through 2007) is presented on Figure 1. This figure shows the 100-200 microgram per liter (µg/L) contour of Freon 22 in the Lloyd Aquifer in August, 2008.

1.1.3 *Site Hydrogeology*

The upper surface of the Lloyd aquifer ranges in depth from 100 feet below land surface on the north shore to more than 1,500 feet on the south shore. Aquifer thickness increases southward from 50 feet to about 500 feet. Transmissivity ranges from 1,500 to 19,000 feet squared per day. All recharge (35 to 40 million gallons per day) and nearly all discharge is through the overlying confining unit (Raritan Clay). The potentiometric-surface configuration of the Lloyd aquifer at any given time is dependent upon the balance between recharge, discharge, and pumping (both in the Lloyd itself and the overlying Magothy aquifer). In the western third of the Island (where the Site is located), heavy pumpage from the Lloyd and overlying aquifers has created localized depressions in the potentimetric surface (USGS; 1986).

The December, 2005, CDM report titled "Lloyd Aquifer Groundwater Flow and Freon 22 Transport Analysis" uses historic fluid level data collected from various sources to simulate flow direction in the Lloyd aquifer in this region of Nassau County. The report states " flow direction in the Lloyd Aquifer in this region of Long Island is quite variable over time due to changes in pumping at production wells in the area. When either well N-1618 or N-12802 was pumping, a southerly flow direction from 100-150 Community Drive towards these wells was simulated. This was especially the case in the mid to late 1980s when the pumping from N-1618 was the greatest. When neither well was pumping, the simulated Lloyd flow direction was typically westerly to northerly in the vicinity of the 100–150 Community Drive Property".

SECTION 2

2.0 *SCOPE OF WORK*

The Scope of Work, presented herein is based on the recommendations presented in the 2008 Revised Groundwater Modeling Report, the ERM document entitled "Preliminary Site Assessment Work Plan 100-150 Community Drive," dated September, 2007, and approved by the NYSDEC, and discussions with the NYSDEC.

2.1 *OFF-SITE MONITORING WELL INSTALLATION*

To confirm the concentration of Freon 22 present in groundwater between 100-150 Community Drive and public supply well N-12802, a well, completed in the Lloyd aquifer will be installed and sampled. The location for installation of this well was selected based on CDM's groundwater modeling results provided in their December 16, 2008, report. The well installation is required to:

- provide a downgradient calibration point for the groundwater model to verify the modeling results, and
- to provide accurate concentration data on which to evaluate the mass of Freon 22 in the aquifer and assess the implementablity of potential remedial scenarios for the Freon 22 contamination thought to exist between 100-150 Community Drive and the supply well.

2.2 *OFF-SITE MONITORING WELL INSTALLATION*

One groundwater monitoring well will be installed at the Fresh Meadows Country Club located at 255 Lakeville Road, Lake Success, New York 11020. The proposed location of the monitoring well is depicted on Figure 2. The monitoring well will be completed in the Lloyd aquifer approximately 500-feet below grade surface (ft bgs). The completed monitoring well will be composed of 6-inch diameter carbon steel casing and slotted stainless steel Vee-wire type screen. A Barber type drill rig will be used to drill and install 16" carbon steel casing to approximately 200-250 ft bgs. A Failing F10 mud rotary drill rig will then be used to drill and install a 15-inch diameter mud borehole through the 16-inch diameter casing to set a 10-inch diameter steel casing into the Raritan clay (appropriate grouting will occur to secure the 10-inch casing into the Raritan clay unit). This dual casing method is being utilized in the construction of the well to prevent the migration of groundwater between the Magothy Aquifer and the Lloyd Aquifer. After the grout sets, the Failing F10 mud rotary drill rig will be used to advance a 9.5-inch diameter borehole through the 10-inch steel casing. Groundwater samples will be collected every 10-feet in the Lloyd Aquifer (estimated thickness 100-feet) using a hydropunch to profile the Freon 22 concentration within the aquifer. Samples will be sent for laboratory analysis on an expedited (24-hours) turn-around, and in consultation with the NYSDEC the zone to be screened will be identified based on the analytical results. A 6-inch monitoring well will then be constructed and shown on Figure 3, with the screen set in the zone exhibiting the highest Freon 22 concentration. If a very narrow zone of Freon 22 contamination is defined during the hydropunch sampling, ERM will consult with the NYSDEC regarding reducing the length of the well screen.

At the completion of monitoring well installation, the well will be developed following the protocols presented in Appendix A.

The applicable standard operating procedures that will be employed during this activity are summarized below and presented in Appendix A.

Section	Standard Operating Procedure
A.1	SOP 1 Water Level Measurement Procedure
A.2	SOP 2 Monitoring Well Construction
A.3	SOP 3 Monitoring Well Development
A.5	SOP 5 Groundwater pH And Temperature
A.6	SOP 6 Measurement Of Groundwater Specific Conductance
A.7	SOP 7 Measurement Of Groundwater Turbidity
A.8	SOP 8 Measurement Of Groundwater Dissolved Oxygen
A.9	SOP 9 Equipment Decontamination

2.2.1 *Subtask 2A: Underground Utility Markouts*

ERM's Health and Safety policy requires that underground utility markouts be performed at the areas to be investigated prior to finalization of sampling locations, and/or any intrusive field investigation is undertaken. As part of this survey, the Underground Utilities Protection Organization (UFPO) will be contacted as required by law. Drilling will only be performed at a safe distance from all utilities. Prior to installation of the borehole, the drilling location will be hand cleared to a depth of 4-feet to confirm that there are no underground structures beneath the drilling site.

2.2.2 *Subtask 2B: Site Access*

Site access to the Fresh Meadows Country Club is being requested/negotiated for the well installation. The NYSDEC has also directed LMC to install well(s) at a different location on the golf course.

ERM is working with LMC's consultant Arcadis to coordinate the well installations and minimize disruptions/impacts to play at the course. To the extent possible, all drilling equipment including casing, drilling rods, etc., will be staged on-Site prior to the start of the well installations. Where possible, the same drilling equipment, water supply and waste handling and supply equipment will be used by both ERM and Arcadis. Access to the drill site will be from the north through a gate installed north of the 16th tee to the access road for 100 to 225 Community Drive. Any equipment not brought onto the golf course before the start of drilling will be brought in as needed, at the beginning of the work day (0700 hours). The work day will run from 0700 hours until darkness or to a maximum of 10 hours per weekday.

2.2.3 *Subtask 2C: Site Preparation/Activities*

The proposed drill site will be cleared, grubbed and leveled. Where possible, existing large trees will not be cut, however, some removal of saplings (possible from five to six young trees) may be necessary to ensure safe operating conditions. The surface of the drill site will be covered using either stone or crushed recycled concrete aggregate (RCA). The drilling equipment will be brought in and staged. The site will be fenced with erosion control measures placed outside the working area.

As described above, two drilling rigs will be used to install the well. The first rig will be a dual rotary Barber Industries Model D24. This rig will install 16-inch diameter casing to a depth of approximately 225-feet below land surface. After installation of the 16-inch diameter casing, the Barber Rig will demobilize from the site.

The second drilling rig to be used for the Lloyd well installation will be a Failing F10 mud rotary rig. This rig will be used to drill a borehole for installation of a 10-inch diameter casing into the Raritan Clay unit and then drill a 9.5-inch borehole into the Lloyd aquifer, collect the hydropunch samples and complete the well. The well will be completed with a 3-foot concrete pad securing an 8-inch protective steel casing with a 3-foot stick to ensure that the well can be found in the wooded area after the drilling project is completed. After completion, the well will be developed by pumping and air lifting (Appendix A.3).

2.2.4 *Subtask 2D: Groundwater Sampling*

Approximately two weeks following well development activities, groundwater samples will be collected from the newly installed well, and from the existing Lloyd wells (N-8456 and N-8375D). Each groundwater sample will be analyzed for TCL VOCs including Freon 11, Freon 12, Freon 21, Freon 22, Freon 113, Freon 123a and Total Freon using USEPA SW-846 Method 8260. The laboratory will be responsible for achieving a detection limit of 0.5 ppb. Tentatively identified compounds (the ten highest concentrations) will also be reported.

It is anticipated that USEPA low-flow well sampling techniques will be utilized. Prior to well purging, an inflatable packer will be lowered into the well and inflated to isolate the screen zone from the standing water column. Groundwater will then be purged from the screen zone. Well purging will continue until the turbidity of the recovered well water is less than 50 Nephelometric Turbidity Units (NTUs), and the pH, conductivity and temperature measurements of the purge water have stabilized within 10% for a minimum of three consecutive measurements. Groundwater will be purged into a tank for later treatment and disposal.

Section	Standard Operating Procedure
A.1	SOP 1 Water Level Measurement Procedure
A.4	SOP 4 Groundwater Sampling
A.5	SOP 5 Groundwater pH And Temperature
A.6	SOP 6 Measurement Of Groundwater Specific Conductance
A.7	SOP 7 Measurement Of Groundwater Turbidity
A.8	SOP 8 Measurement Of Groundwater Dissolved Oxygen
A.9	SOP 9 Equipment Decontamination

The applicable standard operating procedures that will be employed during this activity are summarized below and presented in Appendix A.

2.2.5 *Subtask 2E: Site Survey*

At the conclusion of field activities, a New York State-licensed surveyor will survey the newly installed monitoring well. The elevations of all monitoring well casings will be established to within +/- 0.01 feet based on the NGVD 86 datum. A notch will be placed in all interior casings to provide the reference point from which to collect future groundwater elevation measurements.

All surveyor collected latitude, longitude and elevation data will be provided to ERM in an ASCII file and imported into the project database.

2.2.6 *Subtask 2F: Management of Investigative Derived Wastes*

The following section describes the general protocol for handling and disposal of solid and liquid investigative derived waste (IDW) generated during the implementation of the remedial investigation (RI). Waste generated during the investigation is expected to consist of trash (boxes, paper, etc.), drill cuttings, decontamination wash water, groundwater monitoring well purge water, and used protective clothing.

The following guidance documents and regulations may be relied upon to guide the management, staging, storage and disposal of RI-generated IDW:

- NYSDEC's TAGM #4032 on " Disposal of Drill Cuttings" {November 21, 1989};
- NYSDEC's RCRA TAGM #3028 on " Contained-In Criteria for Environmental Media" {November 30, 1992};
- 40 C. F. R. Part 262 (Standards Applicable to Generators of Hazardous Waste);
- 40 C. F. R. Part 263 (Standards Applicable to Transporters of Hazardous Waste;
- 40 C. F. R. Part 264 (Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities); and
- 40 C. F. R. Part 268 (Land Disposal Restrictions).

Accordingly, handling and disposal will be as follows:

- Because the Lloyd well is being installed in a wooded, undeveloped area, cuttings from the unsaturated zone will not be contaminated and therefore will be left on site.
- Cuttings from installation of the surface casing below the water table will be collected and stored in 55-gallons drums or a roll-off (access permitting)
- Liquids generated from installation of the surface casing below the water table, mud rotary drilling, equipment decontamination, groundwater well development/purging will be collected in 55-gallon drums at the point of generation. The collected water will be transported and stored in a FRAC tank (if quantity requires) that will be staged off-Site. The water will be sampled and disposed of accordingly.
- Used protective clothing and equipment that is suspected to be contaminated with hazardous waste will be placed in plastic bags, and packed in 55-gallon ring-top drums.
- All drums will be labeled according to the borehole/well number. The drilling subcontractor shall move the drums to the staging area at the direction of ERM's Hydrogeologist.

- ERM will procure waste transport and disposal subcontractor services to properly dispose of all IDW in accordance with all local, State and Federal regulations.
- Non-contaminated trash, debris and protective clothing will be placed in a trash dumpster and disposed of by a local garbage hauler.

2.2.7 Subtask 2G: Site Restoration

The drilling site area will be restored after drilling is completed. The stone or crushed RCA will remain in place. The remainder of the site will be regarded, the fence removed and annual rye grass seed applied to reduce run-off. After germination of the seed, the erosion control devices will be removed. If there are impacts to the access road, these will be repaired and access gate removed.

2.2.8 Subtask 2I: Report

Upon completion of the WP, the data will be transmitted in the next scheduled monthly progress report. The progress report will include a summary of the work performed, the analytical data collected during the sampling events, and evaluation of the data and recommendations for proceeding with the PSA. The Final Site Investigation Report will include the above and recommendations for additional investigative activities necessary to fill any remaining data gaps.

SECTION 3

3.0 SCHEDULE

The monitoring well installation schedule, including milestones is presented in Figure 4.

The timeline outlined in the attached schedule begins upon the signing of an access agreement with the FMCC and the acceptance by the NYSDEC of the well installation method. ERM will endeavor to adhere to the schedule at all times, but there are several critical path items related to execution of the fieldwork (i.e. drilling site access, completion of the LMC well and various logistical issues). As such, it may be necessary to modify and revise the schedule.

SECTION 4

4.0 PROJECT STAFFING PLAN

Staffing for the 100-150 Community Drive Off-Site Monitoring Well Installation will be from ERM's Melville, New York, Office.

While all personnel involved in an investigation and in the generation of data are implicitly a part of the overall project management and QA program, certain members of the Project Team have specifically designated responsibilities. Project Team members with specific management and QA roles in the WP are the NYSDEC Project Manager (NYSDEC PM), the ERM Project Director (PD), the ERM Project Manager (PM), the ERM Field Team Leader (FTL) and the ERM QA/QC Officer. In the following sections, the roles and responsibilities of key personnel are identified. Professional profiles of key staff members are presented in Appendix D.

4.1 ERM PROJECT DIRECTOR

The ERM PD, Dr. Gregory Shkuda, Ph. D., will report to the ERM PIC. Dr. Shkuda will oversee the ERM PM, and be responsible for all technical aspects of the project including the overall quality of the project and project deliverables for ERM. Dr. Shkuda has extensive experience with the management and coordination of multi-disciplinary RI/FS and remedial projects in New York State. Dr. Shkuda will report to the ERM Principal-in-Charge – Ernest Rossano (ERM PIC).

4.2 ERM PROJECT MANAGER

The ERM PM, Ms. Nicole Repetti, will report to the ERM PD and the ERM PIC. Ms. Repetti will oversee the ERM QA/QC Officer and the ERM FTL, field investigation staff, and any subcontractors. Ms. Repetti will also be responsible for all technical aspects of the project for ERM. This includes scheduling, communicating to the ERM PIC and the ERM PD, technical development and review of all field activities, subcontracting, and the overall quality of the project and project deliverables for ERM.
Ms. Repetti will be the primary contact between ERM and NYSDEC, as directed by the ERM PD. Ms. Repetti has extensive experience in the management and coordination of multi-disciplinary RI/FS and remedial projects in New York State.

4.3 ERM QA/QC OFFICER

The QA/QC Officer, Mr. Andrew Coenen, will report to the ERM PM and the ERM PD. Mr. Coenen will be responsible for interface with the analytical laboratory, and will prepare the Data Usability Report. Mr. Coenen will have overall responsibility for QA/QC review of all analytical data generated during the field investigation, data validation and qualification of analytical results in terms of data usability. Mr. Coenen has extensive analytical laboratory experience and experience in the validation of analytical data.

4.4 ERM FIELD TEAM LEADER

The FTL, Ms. Karen Pickering will report to the ERM PM and the ERM PD. Ms. Pickering will be responsible for the day-to-day management and coordination of ERM field staff and subcontractors. Ms. Pickering will be responsible for the implementation and quality of the field activities. Ms. Pickering has extensive environmental field investigation/subcontractor oversight experience in New York State.

4.5 PROJECT HEALTH AND SAFETY COORDINATOR

Mr. Ernie Rossano, will be the Project Health and Safety Coordinator. Mr. Rossano will report to the ERM PM and the ERM PD. Mr. Rossano has extensive experience as a Project Health and Safety Coordinator for multi-disciplinary RI/FS and remedial projects in New York State. Mr. Rossano's experience includes the preparation and implementation of site-specific health and safety plans, field oversight, and field health and safety audits.

SECTION 5

5.0 REFERENCES

ERM, Feb. 2006, Comment Letter. RE: CDM Draft Memorandum – Lloyd Aquifer Groundwater Flow and Freon-22 Transport Analysis, December 16, 2005,

ERM 2005, Freon Investigation Report, 4000 Lakeville Road, New Hyde Park, NY and 145 Community Drive, Great Neck , NY. August 2005

CDM, August 2008, Groundwater Modeling at 100-150 Community Drive, Manhasset, NY

Garber Murray., 1986, Geohydrology of the Lloyd Aquifer, Long Island, New York, USGS Water-Resources Investigation Report 85-4159

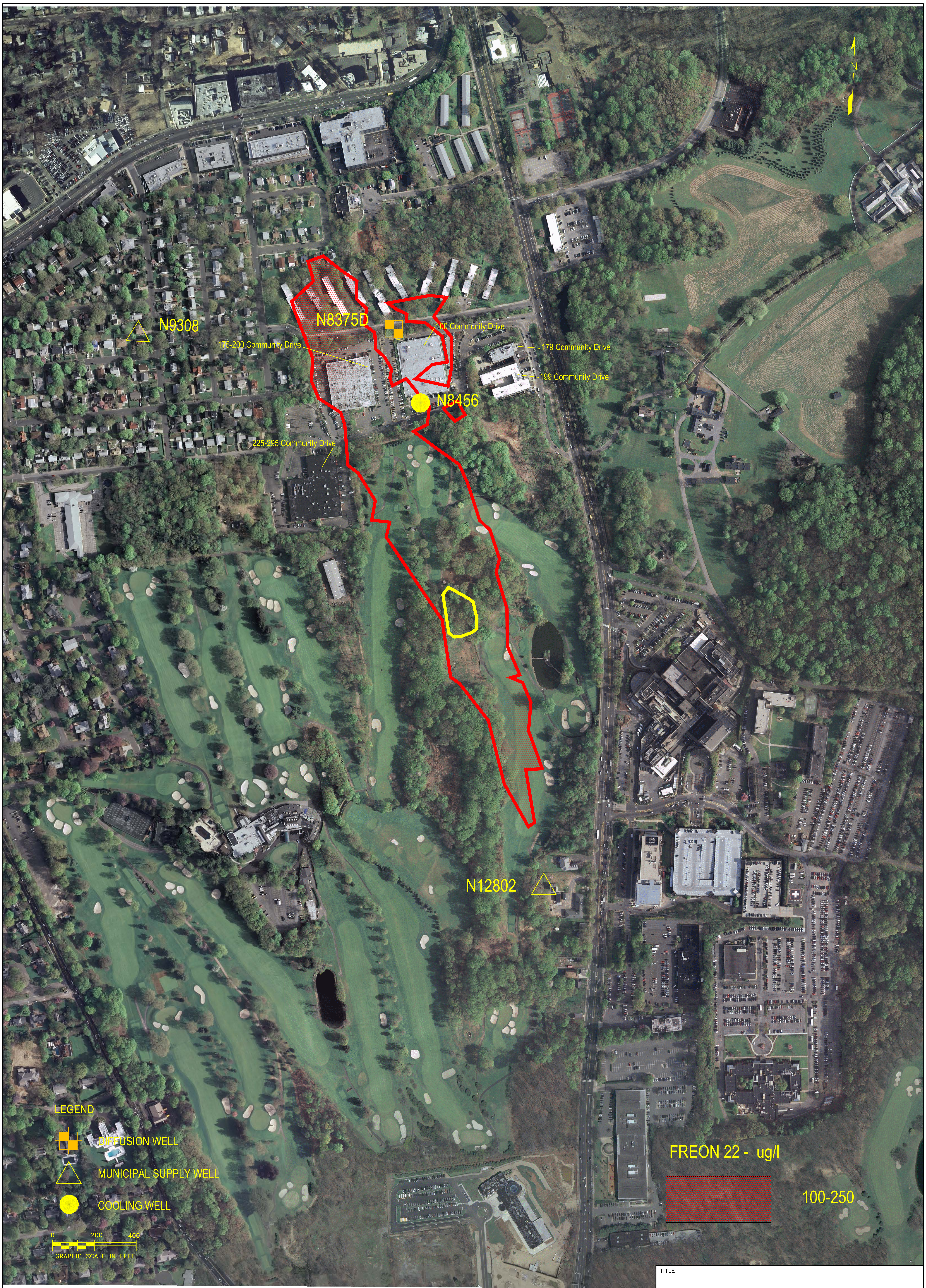
NYSDEC, 1989. Division Technical and Administrative Guidance Memorandum (TAGM): Disposal of Drill Cuttings. Division of Hazardous Waste Remediation. HWR-94-4032. 21 November 1989.

NYSDEC, 1991. New York State Water Classifications – 6 NYCRR 701. 2 August, 1991

NYSDEC, 1992. Division Technical and Administrative Guidance Memorandum (TAGM): "Contained-In" Criteria For Environmental Media. Division of Hazardous Substance Regulation. HWR-92-3028. 30 November 1992.

NYSDEC, 1998. New York State Groundwater Quality Standards – 6 NYCRR 703 (12 March 1998) and Division of Water Technical and Operational Guidance Series (1.1.1) – Ambient Water Quality Standards and Guidance Values, (June 1998), Errata Sheet (January 1999), and Addenda (April 2000).

FIGURES



TITLE

SIMULATED PLUME CONFIGURATION
AUGUST 2008
100 – 200 ug/l CONTOUR

PREPARED FOR

North Shore University Hospital

ERM Environmental Resources Management

SCALE	FIGURE
GRAPHIC	1
DATE 4/15/09	

DRAWN:	JOB NO.:	FILE NAME:
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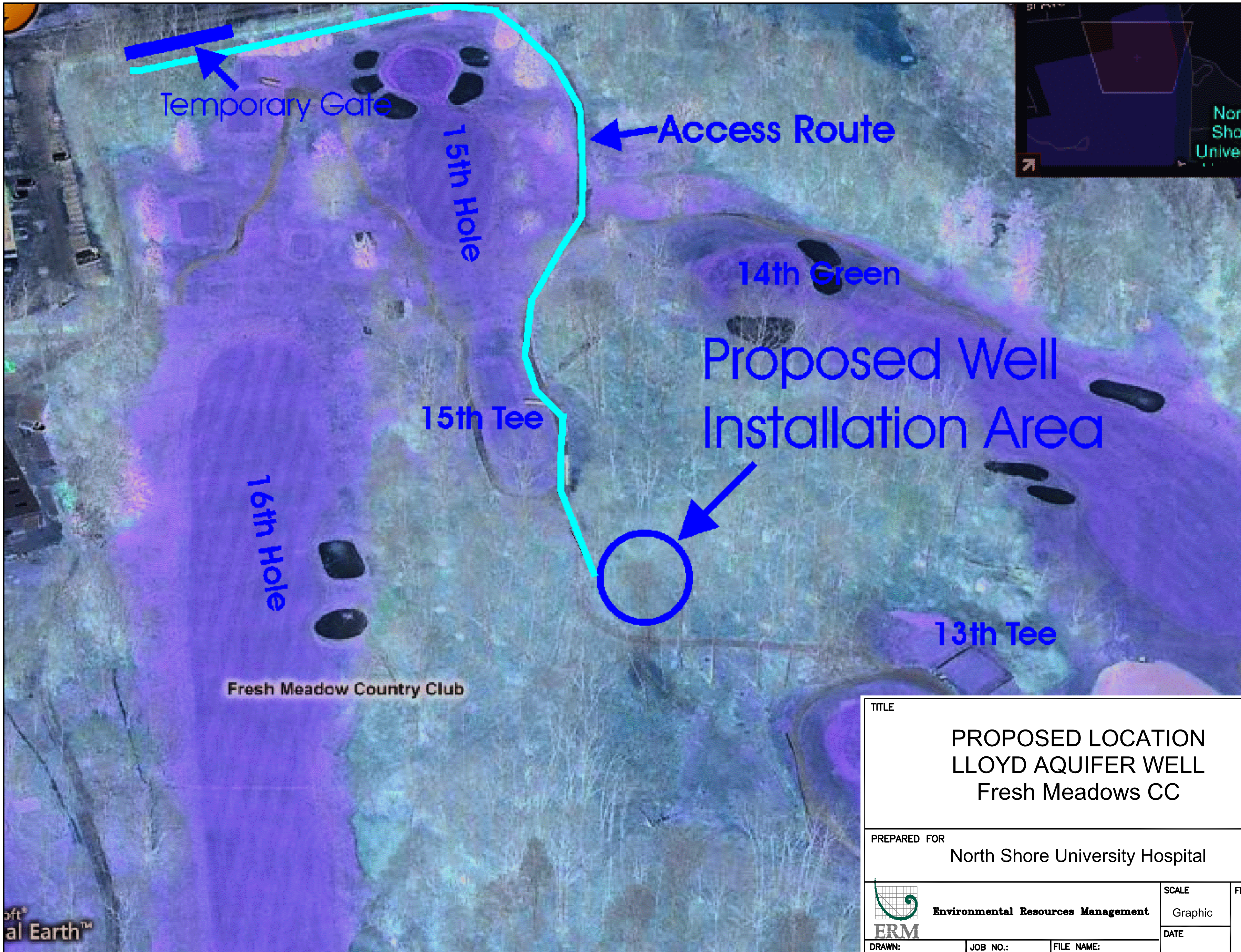

TITLE

PROPOSED LOCATION
LLOYD AQUIFER WELL
Fresh Meadows CC

PREPARED FOR
North Shore University Hospital

Environmental Resources Management
ERM

DRAWN:	JOB NO.:	FILE NAME:	SCALE	DATE	FIGURE
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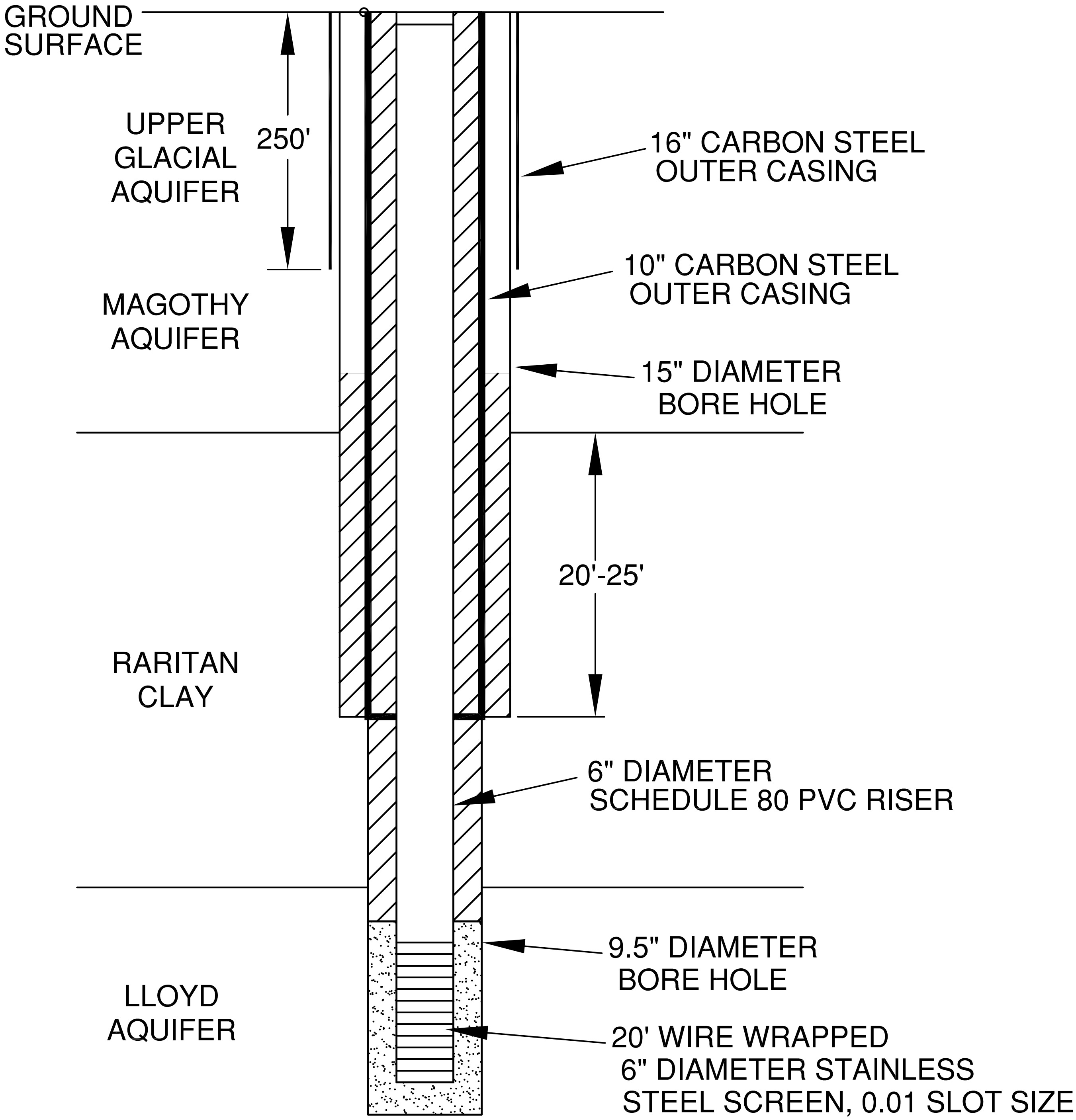

LEGEND

CEMENT BENTONITE GROUT

GRAVEL PACK

TITLE

PROPOSED WELL CONSTRUCTION DIAGRAM

PREPARED FOR

North Shore University Hospital

ERM Environmental Resources Management

SCALE	FIGURE
NONE	3
DATE	
3/2/07	

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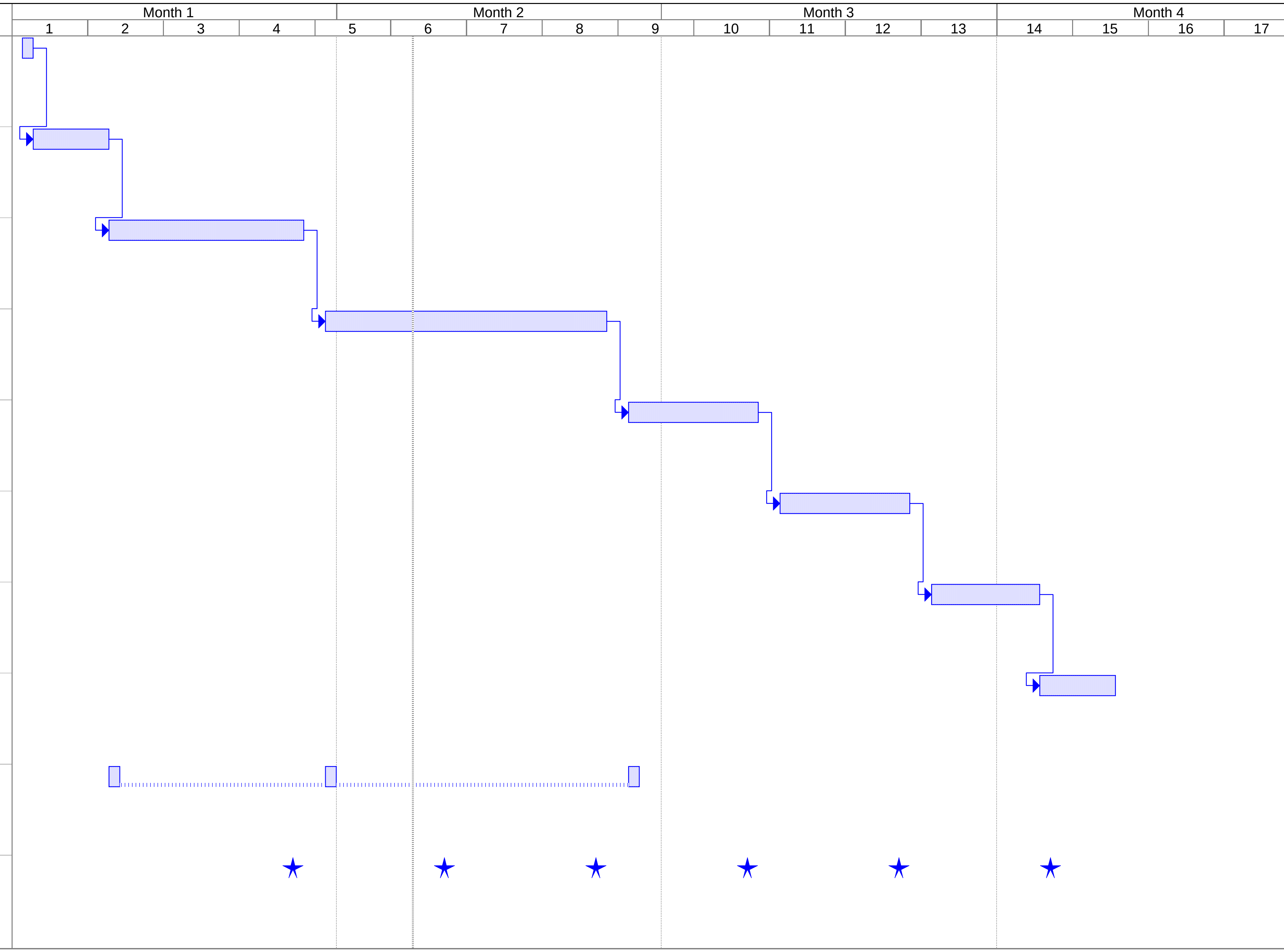
EG/EMF	0030777	0030777-01-001

FIGURE 4 - LLOYD WELL INSTALLATION SCHEDULE
FRESH MEADOWS COUNTRY CLUB

ID	Task Name	Start	Finish	Duration
1	Mobilization	Mon 8/3/09	Mon 8/3/09	1 day
2	Site Preparation	Tue 8/4/09	Mon 8/10/09	5 days
3	Barber Rig Casing to 250'	Tue 8/11/09	Fri 8/28/09	14 days
4	10" Casing to Raritan Clay	Mon 8/31/09	Fri 9/25/09	20 days
5	6" Borehole through Raritan Clay	Mon 9/28/09	Fri 10/9/09	10 days
6	Hydropunch Sampling	Mon 10/12/09	Fri 10/23/09	10 days
7	6" Well Construction	Mon 10/26/09	Wed 11/4/09	8 days
8	Well Development	Thu 11/5/09	Wed 11/11/09	5 days
9	Decontamination	Tue 8/11/09	Mon 9/28/09	3 days
10	**IDW Handling**	**Fri 8/28/09**	**Fri 11/6/09**	**51 days**



Project: Lloyd Well Installation
Date: Tue 9/8/09

Task
Split
Progress
Milestone
Summary
Project Summary
External Tasks
External Milestone
Deadline

APPENDIX A

APPENDIX A
STANDARD OPERATING PROCEDURES (SOPS)

100-150 Community Drive
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June 2009

0084265.03

Prepared for:

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APPENDIX A
STANDARD OPERATING PROCEDURES (SOPS)

Section	Standard Operating Procedure
A.1	SOP 1 Water Level Measurement Procedure
A.2	SOP 2 Monitoring Well Construction
A.3	SOP 3 Monitoring Well Development
A.4	SOP 4 Groundwater Sampling (Conventional & Low-Flow)
A.5	SOP 5 Groundwater pH And Temperature
A.6	SOP 6 Measurement Of Groundwater Specific Conductance
A.7	SOP 7 Measurement Of Groundwater Turbidity
A.8	SOP 8 Measurement Of Groundwater Dissolved Oxygen
A.9	SOP 9 Equipment Decontamination

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A.0 STANDARD OPERATING PROCEDURES

A.1 SOP 1: WATER LEVEL MEASUREMENT PROCEDURE

Groundwater elevation measurements are to be obtained using the following general procedures whenever depth to groundwater or groundwater elevation data is required. This may include activities such as soil borings, groundwater monitoring well installation/development, groundwater monitoring well sampling, and/or synoptic groundwater level measurements. The measurements will be collected concurrent with the groundwater sampling event and the water levels will be obtained prior to well evacuation and sample collection. The static water level will be measured to the nearest 0.01 foot.

(1) Clean all water-level measuring equipment using appropriate decontamination procedures.

(2) Remove locking well cap, note weather, time of day, and date, etc. in field notebook, or on an appropriate form.

(3) Remove well casing cap.

(4) Monitor headspace of well with a PID to determine presence of VOCs, and record in field notebook.

(5) Lower water level measuring device into well until the water surface is encountered.

(6) Measure distance from water surface to reference measuring point on well casing, and record in field notebook.

    <u>NOTE</u>: if water level measurement is from either the top of protective steel casing, top of riser pipe, from ground surface, or some other position on the wellhead.

(7) Measure total depth of well and record in field notebook or on log form.

(8) Remove all downhole equipment; replace well casing cap and locking steel caps.

(9) Calculate elevation of water:

    Ew = E - D
    Where
    Ew = Elevation of Water
    E = Elevation at point of measurement
    D = Depth to Water

A.2 SOP 2: MONITORING WELL CONSTRUCTION

The groundwater monitoring well will be installed and constructed according to NYSDEC requirements. The monitoring well installation, drilling, construction, development, testing and sampling will be overseen by a qualified Hydrogeologist who will maintain detailed records (e.g., soil boring logs, screening data, field observations, odors, pumping rate/yield during development) at each well.

A.2.1 Source of Water

All water used during drilling and/or steam-cleaning operations shall be from a potable source and so designated in writing. ERM's drilling subcontractor will obtain all permits from the local water purveyor and any other concerned authorities, and provision of any required back-flow prevention devices.

A.2.2 Monitoring Well Borehole Construction

To facilitate the installation of the Lloyd well, a 16-inch diameter carbon steel casing will first be installed through the unsaturated zone, Upper Glacial aquifer and into the Magothy aquifer to a depth of approximately 250-feet using a dual rotary drilling method. Cuttings will be removed from the inside of this casing during installation. Installation of this surface casing is to reduce frictional losses, which would occur during drilling through the Upper Glacial aquifer to install a casing into the Raritan clay to isolate the borehole from contaminants potentially present in the Upper Glacial and Magothy aquifers.

A 15-inch diameter borehole will be drilled inside the 16-inch casing, the borehole advanced approximately 20 to 25-feet into the clay, and a 10-inch diameter casing grouted in place in the clay. As indicated above, this casing will isolate the borehole that will be advanced into the Lloyd aquifer from contaminants potentially present in the Upper Glacial and Mogothy aquifers. Cuttings from inside this casing will be removed and the water inside the casing screened for volatile organic compounds (VOCs) after the grout has cured. The Lloyd borehole will also be advanced using mud rotary drilling. The Lloyd well boring will be 9.5 inches in diameter to allow construction of a 6-inch diameter Lloyd well. The exact depth of the Lloyd well will be based on hydropunch groundwater samples that will be collected every 10-feet through the thickness of the Lloyd aquifer.

Each borehole will be advanced to the prescribed completion depth below grade. The drilling subcontractor shall verify by measurement that the borehole is open, and drill cuttings have been removed from the borehole prior to assembly of the well string.

Cuttings generated from the construction of the boreholes will be contained in New York State Department of Transportation (NYSDOT)-approved 55-gallon ring-top drums. The drums will be appropriately labeled.

A.2.3 Well Construction Materials

The Lloyd well will be constructed of 6-inch diameter (nominal) carbon steel casing and a stainless steel screen 20-feet in length having slot openings of 0.010-inches.

ERM's Hydrogeologist shall inspect all well materials for dents, cracks, grease, etc. and to ensure that the materials are in accordance with the specifications. Any materials found to be defective shall be rejected by ERM's Hydrogeologist and replaced by the drilling subcontractor. All well casing and screen shall be steam cleaned prior to well construction.

A.2.4 Monitoring Well Construction Procedures

A.2.4.1 Well Assembly and Screen Placement

Once the well casing is assembled in the borehole, the well will be suspended in a manner such that the screen is set approximately one (1) foot above the bottom of the borehole.

A.2.4.2 Well Screen Sand Packs

A #2 Morie sand pack, will be placed into the annular space to a minimum height of 3 to 5 feet (minimum 20% of the screen length) above the top of the well screen. Following placement of the Morie # 2 grade sand pack, a Morie #00 sand pack will be placed into the annular space to a minimum thickness of 1-foot above the Morie # 2 well screen sand pack. During the installation of the sand pack, the sand shall be tamped down using a weighted tape measure to minimize the potential for bridging, and to ensure the proper placement and thickness of the sand.

A.2.4.3 Annular Seal

Upon completing the placement of the sand packs, a minimum 2-foot thick bentonite seal will be tremied into placed in the annular space above the sand pack. During the installation of the seal, a weighted steel tape will be used to ensure the proper placement and thickness of the seal.

The remainder of the annular space will be grouted using a cement/bentonite grout (95% cement/5% bentonite) emplaced by tremie method.

A.2.5 Well Completions At Grade

The 6-inch diameter carbon steel riser will extend from the top of the screen to approximately 4-inches below ground surface. A permanent mark will be made at the top of the well casing to provide a reference point from which to make future water level measurements.

The well will be fitted with a 12-inch flush-mounted steel well vault secured in a surface seal to adequately protect the casing. A locking cap will be provided with one (1) to two (2) inches clearance between the top of the well cap and the bottom of the locking cap of the protective casing when in the locked position.

The well will have a concrete surface seal that will secure the protective casing in place. The surface seal will extend below the frost depth (a minimum of 24 inches) to prevent potential well damage. The top of the seal will be constructed by pouring concrete into a pre-built form with a minimum of 2-foot long sides. The seal will be finished with a sloping surface to prevent surface runoff from ponding and entering the well vault.

A.3 SOP 3: MONITORING WELL DEVELOPMENT

The well will be developed by submersible pump or air-lift method to ensure the removal of any drilling fluids and to restore the hydraulic properties of the surrounding formation. All wells will be developed no sooner than twenty-four hours after installation, to allow the cement/bentonite grout to set. At no time will water be introduced into the well during well development procedures.

If submersible pumps are used during development, the pump will be decontaminated to the satisfaction of the ERM Hydrogeologist, and new lengths of dedicated polyethylene hose will be used as a discharge line. If an air-lift assembly is used during well development, the air source will be oil-less type compressor outfitted with appropriate oil trap and/or filters, and new lengths of dedicated polyethylene hose will be used as a discharge line. Additionally, the airlift assembly will be configured in a manner such that the air discharge will remain within the discharge and not come in contact with the well. The adequacy of the airlift assembly to fulfill the aforementioned conditions and effectively develop the monitoring well will be subject to the approval of the ERM Hydrogeologist or the Field Team Leader (FTL).

The well will be developed to remove at a minimum, the volume of water introduced during drilling, and the point that the turbidity of the recovered well water is less than 50 NTUs. Additionally, well development monitoring will be supplemented by measurement of the development water for pH, conductivity, ORP and temperature that will be within 10% for a minimum of three consecutive measurements before development is considered complete. The ERM Hydrogeologist will be responsible for collection of NTU, pH, conductivity, ORP, and temperature measurements after each well volume is removed from the well. At a minimum, the volume of water introduced during drilling will be removed during development of each well.

Well development water will be handled in accordance with the Management of Investigative Derived Waste described in Section 2.2.6. Wells will not be sampled for a minimum of one (1) week following development. Analytical results of the samples collected from the groundwater well will determine the ultimate disposition of the development water.

A.4 SOP 4: GROUNDWATER SAMPLING

Groundwater sampling will be performed using USEPA low-flow well purging/sample collection techniques. The low-flow groundwater purging/sampling technique employs the use of a flow-through cell equipped with probes and a meter for measuring groundwater quality parameters such as pH, temperature, specific conductivity, and dissolved oxygen. One example of this equipment is the Horiba U-22 Flow-Through Cell and the specific manufacturer's calibration and operation instructions should be followed. In the event that low-flow purging/sampling cannot be performed and conventional procedures must be employed, SOPs 5 though 8 are presented to describe operating procedures for the measurement of pH, temperature, turbidity, specific conductivity and dissolved oxygen using standard hand-held meters.

A.4.1 General Procedures

The following procedure will be used for all monitoring well groundwater sampling:

- Clean all water-level measuring equipment using appropriate decontamination procedures.

- Wear appropriate health and safety equipment as outlined in the HASP. In addition, samplers will don new sampling gloves at each individual well prior to sampling.
- Visually examine the exterior of the monitoring well for signs of damage or tampering and record in the field logbook.
- Unlock well cap.
- Take and record in field logbook PID readings.
- Measure the static water level in the well with a decontaminated steel tape or electronic water level indicator.

A.4.2 Low-Flow Sampling

The low-flow sampling procedure is intended to facilitate the collection of minimum-turbidity groundwater monitoring well samples.

A.4.2.1 Sample Equipment

- Adjustable-rate, positive displacement pumps (e.g., centrifugal, submersible or bladder pumps constructed of stainless-steel or Teflon®). The selected pump must be specifically designed for low-flow rates (i.e., use of a high volume pump that is adjusted down to a low flow setting is not permitted).
- Tubing: Tubing used in purging and sampling each well must be dedicated to that well. Once properly located, moving the pump in the well should be avoided. Consequently, the same tubing should be used for purging and sampling. Teflon® and Teflon®-lined polyethylene tubing must be used to collect samples for organic analysis.
- Electronic water level measuring device, 0.01-foot accuracy.
- Flow measurement supplies (e.g., graduated cylinder and stop watch).
- Power or air source (generator, compressed air tank, etc.).
- In-line purge criteria parameter monitoring instruments - pH, turbidity, specific conductance, temperature, and dissolved oxygen.
- Decontamination supplies.
- Logbook and field forms.
- Sample bottles.
- Sample preservation supplies (as specified by the analytical methods).

- Sample tags or labels, chain of custody forms.
- Well construction data, location map, field data from last sampling event.

A.4.2.2 Sample Procedure

1) Sound the well to determine the total depth and assess if there is any sand/sediment in the well. Insert packer and riser into well and locate packer just above the top of the well screen. Inflate packer assembly and measure depth to the packer to ensure that it is place properly.
2) Lower pump, safety cable, tubing, and electrical lines very slowly through the packer riser tube into the screened zone to a depth corresponding to the center of the screened zone. Lowering the pump quickly, or even at a moderate rate, will result in disturbing sediment in the well. This is one of the most important steps in low flow sampling at the Site.
3) Measure the water level again inside the riser tube with the pump in well before starting the pump. Start pumping the well at 100 to 500 milliliters per minute. Ideally, the pump rate should cause little or no water level drawdown in the well (less than 0.3 foot and the water level should stabilize).
    - Measure and record the depth to water in the riser tube and pumping rate every 3 to 5 minutes (or as appropriate) during pumping. If purging continues for more than 30 minutes, readings will be recorded at approximately 10-minute intervals. However, once stabilization is indicated, a minimum of 3 consecutive readings at 3 to 5 minute intervals will be recorded prior to sample collection.
    - Care should be taken not to cause pump suction to be broken or entrainment of air in the sample. Do not allow the groundwater level to go below the pump intake.
    - Pumping rates should, if needed, be reduced to the minimum capabilities of the pump to minimize drawdown and/or to ensure stabilization of indicator parameters.
4) During purging, measure and record the field indicator parameters using the in-line meter (turbidity, temperature, specific conductance, pH, Eh, and dissolved oxygen) every 3 to 5 minutes (or as appropriate). If purging continues for more than 30 minutes, readings will be recorded at approximately 10-minute intervals. However, once stabilization is indicated, a minimum of 3 consecutive readings at 3 to 5 minute intervals will be recorded prior to sample collection.

- The well is considered stabilized and ready for sample collection once all the field indicator parameter values remain within 10 percent for 3 consecutive readings.
- If drawdown in the well is measured at 1 foot or more, continue to low flow purge until a minimum of the equivalent volume of 1 well casing volume is removed. Using the flow equation to calculate the volume of purge water. Then collect the groundwater sample.

5) Before sampling, either disconnect the in-line cell or use a by pass assembly to collect groundwater samples before the in-line cell. All sample containers should be filled by allowing the pump discharge to flow gently down the inside of the container with minimal turbulence.
6) Samples requiring pH adjustments will have their pH checked to ensure that the proper pH has been obtained. For VOC samples, this will necessitate the collection of a test sample to determine the amount of preservative that needs to be added to the sample container prior to sampling.
7) Label the samples using waterproof labels, or apply clear tape over the paper labels. Place all samples in a cooler as described in the QAPP with bagged ice or frozen cold packs and maintain at 4°C for delivery to the laboratory.
8) Do not use ice for packing material; melting will cause bottle contact and possible breakage.
9) Measure and record well depth. Take final water quality reading using low flow cell.
10) Secure the well.

A.5 SOP 5: GROUNDWATER PH AND TEMPERATURE

(1) Immerse the tip of the electrode in water overnight. If this is not possible due to field conditions, immerse the electrode tip in water for at least an hour before use.

(2) Rinse the electrode with demineralized water.

(3) Immerse the electrode in pH 7 buffer solution.

(4) Adjust the temperature compensator to the proper temperature.

(5) Adjust the pH meter to read 7.0.

(6) Remove the electrode from the buffer and rinse with demineralized water.

(7) Collect a groundwater sample using a bailer (or from the pump discharge line in the case of the vertical profile wells) and pour a small amount of this sample into an extra sample jar, which will not be used to store chemically analyzed samples.

(8) Immerse the electrode into the extra sample jar. Do not immerse the electrode into a sample that will be chemically analyzed.

(9) Read and record the pH of the solution, after adjusting the temperature compensator to the sample temperature (obtained during measurement of specific conductance or from a standard scientific thermometer).

(10) Rinse the electrodes with demineralized water.

(11) Keep the electrode immersed in demineralized water when not in use.

(12) All results are to be recorded in the Field Notebook.

A.6 SOP 6: MEASUREMENT OF GROUNDWATER SPECIFIC CONDUCTANCE

(1) Immerse the electrode in water overnight. If this is not possible due to field conditions, immerse the electrode for at least an hour before use.

(2) Collect a groundwater sample using a bailer (or from the pump discharge line in the case of the well purging activities) and pour a small amount of this sample into an extra sample jar, which will not be used to store chemically analyzed samples.

(3) Rinse the cell with one or more portions of the sample to be tested.

(4) Immerse the electrode in the sample and measure the temperature. Do not immerse the electrode into a sample, which will be chemically analyzed.

(5) Adjust the temperature setting to the sample temperature.

(6) Immerse the electrode in the sample and measure the conductivity. Do not immerse the electrode into a sample, which will be chemically analyzed.

(7) Record the results in the Field Notebook.

A.7 SOP 7: MEASUREMENT OF GROUNDWATER TURBIDITY

(1) Ensure that the sample cell (sample vials) is clean, with no dust and lint on the inside or outside surface.

(2) Ensure that instrument has been standardized recently and span control has not been changed.

(3) Range calibration of instrument is performed at the factory, but it should be checked from time to time against fresh formalin turbidity standard dilutions.

(4) Check the mechanical zero setting while instrument is off.

(5) Turn on the power and press the battery check switch and verify the battery check range. The needle should be in the battery check area. If battery was not recharged before use, switch to a charged instrument. The battery pack should be charged on a daily basis.

(6) Select the range that will exceed the expected turbidity of the sample under test and press the appropriate range switch.

(7) Place the focusing template into the cell holder and adjust the zero control for a reading of zero NTU. Remove the focusing template.

Note: If the instrument will be used in the 100 range, place the cell riser into the cell holder before inserting the test sample. When using the 1 and 10 ranges, the cell riser must not be used.

(8) Collect a groundwater sample using a bailer (or from the pump discharge line in the case of the vertical profile wells) and pour a small amount of this sample into an extra sample jar, which will not be used to store chemically analyzed samples.

(9) Fill a clean sample cell to the marked line with the sample to be measured and place it into the cell holder. Use the white dot on the sample cell to orient the cell in the same position each time. Cover the sample cell with the light shield and allow the meter to stabilize. Read the turbidity of the sample.

Notes:
The sample size for all turbidity measurements should be 18 ml. Use the line on the sample cell as a level indicator. Variation in sample volume can affect the accuracy of the determinations. When measuring the lower range (0 - 10 and 0 - 1 NTU), air bubbles in the sample will cause false high readings - before covering the cell with the light shield, observe the sample in its cell. A five-minute wait period can eliminate air bubbles from the sample and thereafter a valid reading can be taken.

(10) Record the results in the Field Notebook.

A.8 SOP 8: MEASUREMENT OF GROUNDWATER DISSOLVED OXYGEN

The dissolved oxygen (DO) meter will be properly calibrated prior to each sampling event.

Calibration Procedure

(1) Prepare the DO meter with a thin Teflon membrane stretched over the sensor.

(2) Perform a battery check.

(3) Set mode switch to operate and the operation switch to zero, and zero the instrument.

(4) Take a temperature measurement and determine the calibration value from the manufacturers table for the appropriate atmospheric pressure.

(5) Select the desired range and adjust the instrument to an appropriate calibration value (determined in the preceding step).

(6) Place the probe in a water sample with a known dissolved oxygen level and read mg/L-dissolved oxygen.

(7) Record temperature and dissolved oxygen calibration information on the equipment calibration and maintenance log for that instrument.

Operating Procedure

(1) Calibrate the dissolved oxygen meter.

(2) Perform the battery check.

(3) Immerse the electrode in water overnight. If this is not possible due to field conditions, immerse the electrode for at least an hour before use.

(4) Collect a groundwater sample using a bailer and pour a small amount of this sample into an extra sample jar, which will not be used to store chemically analyzed samples.

(5) Rinse the cell with one or more portions of the sample to be tested.

(6) Set mode switch to operate and the operation switch to the desired range.

(7) Immerse the probe in the water sample.

(8) Take a temperature and adjust the temperature compensator to the sample temperature (obtained during measurement of specific conductance or from a standard scientific thermometer).

(9) Switch the dissolved oxygen content measurement and allow reading to stabilize.

(10) Record the results in the Field Notebook.

(11) Repeat procedure and record a second reading. Average the results and record the average.

(12) Rinse the probe with distilled water and replace protective cover on probe with a small amount of distilled water to keep the probe membrane wet.

A.9 SOP 9: EQUIPMENT DECONTAMINATION

In order to minimize the potential for cross-contamination, non-dedicated drilling and sampling equipment shall be properly decontaminated prior to and after each use.

General Procedures

Heavy equipment will be decontaminated in a designated area. Sampling equipment and probes will be decontaminated in an area covered by plastic near the sampling location. Wash water used in the decontamination process will be collected and drummed for off-Site disposal. Disposable sampling equipment will be properly disposed of in dry containers.

Well casing and screen shall either be delivered to the Site, pre-cleaned and sealed in plastic, or be steam cleaned on-Site, wrapped in clean polyethylene sheeting and stored until the time of well construction.

Extraneous contamination and cross-contamination shall be controlled by wrapping the sampling equipment with aluminum foil when not in use and changing and disposing of the sampler's gloves between samples. Decontamination of sampling equipment shall be kept to a minimum in the field, and wherever possible, dedicated sampling equipment shall be used. Personnel directly involved in equipment decontamination shall wear appropriate protective equipment.

Heavy Equipment (drill rigs, etc.)

Drilling equipment shall be decontaminated by steam cleaning prior to performance of the first boring/well installation and between all subsequent borings/well installations. This shall include all hand tools, casing, augers, drill rods and bits, tremie pipe and other related tools and equipment. The steam cleaning equipment shall be capable of generating live steam with a minimum temperature of 212 degrees Fahrenheit (°F).

Water used during drilling and/or steam cleaning operations shall be from a potable source and so designated in writing. The drilling contractor is responsible for obtaining all permits from the local potable water provider and any other concerned authorities, and provision of any required back-flow prevention devices. The equipment shall be cleaned to the satisfaction of the ERM Hydrogeologist or FTL

Non-Aqueous Sampling Equipment (trowels, knives, split-spoons, bowls, etc.)

All non-aqueous sampling equipment will be decontaminated before each use as follows:

- Laboratory-grade glassware detergent and tap water scrub to remove visual contamination;
- Generous tap water rinse;
- Distilled water rinse; and
- Air Dry.

Aqueous Sampling Equipment

Disposable bailers will be used during the groundwater investigation. In the event that field decontamination is required, decontamination procedures will be as follows:

- Laboratory-grade glassware detergent and tap water scrub to remove visual contamination;
- Generous tap water rinse;
- Distilled water rinse;
- Distilled and deionized water rinse; and
- Air dry.

The submersible sampling pumps that are placed in the borehole shall be decontaminated with an Alconox detergent rinse and by pumping approximately two gallons of potable water and two gallons of distilled water through the pump. Since dedicated new lengths of polyethylene tubing shall be used for sampling each well, the tubing shall not be decontaminated. Unless otherwise specified, the submersible pumps shall be decontaminated prior to the sampling the first well and between each subsequent well as follows:

- Potable water rinse;
- Alconox detergent and potable water scrub;
- Potable water rinse;
- Distilled water rinse; and
- Wrap in aluminum foil, shiny side facing out.

Meters and Probes

All meters and probes that are used in the field (other than those used solely for air monitoring purposes, e.g., oxygen meters, explosimeters, etc.) will be decontaminated between use as follows:

- Phosphate-free laboratory detergent solution;
- Tap water; and
- Deionized water (triple rinse).

APPENDIX B

Gregory K. Shkuda, Ph.D.

Mr. Shkuda has more than 29 years of environmental consulting experience including project direction, regulatory agency negotiation, cost and schedule control, and expert opinion/testimony in matters ranging from fate and transport of chemical contaminants to fingerprinting of environmental contaminants.

Registrations & Professional Affiliations

- American Chemical Society

Fields of Competence

- Environmental Forensics including fingerprinting of petroleum fuels/oils/PCBs/MGP waste and chlorinated hydrocarbons
- Evaluation of complex ground-water quality problems
- Analysis of biodegradation of organics in ground water
- Expert testimony on hazardous waste compliance
- Review of QA/QC plans
- Development of analytical protocols for litigation purposes
- Risk Evaluation/Communication

Education

- Ph.D. Organic Chemistry, New York University, 1976
- M.S. Organic Chemistry, New York University, 1973
- B.A. Chemistry, New York University, 1968

Publications

Jalajas, P. Gregory Shkuda, and Thomas A. Mackie. Petroleum Release Dating: A Case Study Emphasizing Site Specific Conditions. NWWA 1997 - Petroleum Hydrocarbons and Organic Chemicals in Groundwater Conference, November 12-14, 1997, Houston, Texas.

Rodgers, J.A. and G.K. Shkuda. Training and Safety Considerations in Using Self-Contained Breathing Apparatus (SCBA) and Tethered Cascade Breathing Apparatus (TCBA) in Hazardous Atmosphere at Uncontrolled Hazardous Waste Sites. Procedures of the American Chemical Society 184th Annual Meeting, Kansas City, MO, September 1982.

Geller, S., S.C. Wei, G.K. Shkuda, D.M. Marcus, and C.F. Brewer, 1980. Carbon- 13-Enriched Tetra-L-Alanine Hapten to Fab' Fragments of Antipoly (L-Alanine) Antibodies. Biochemistry 1980, 3614-3623.

Shkuda, G.K., 1976. The Decomposition of Bicyclic Diazo Compounds: A Mechanistic Study. New York University, New York.

Shkuda, G.K., Coenen, A., Morgan, R.L., and Speis, D. 2004. Analysis of Samples Containing Polychlorinated Biphenyls and Polychlorinated Naphthalenes. Remediation of Chlorinated and Recalcitrant Compounds, Fourth International Conference, Monterey, California.

Shkuda, G.K. 2005. Daubert v. Emile Fischer. Geological Society of America- 39th Annual Meeting North-Central Section. Minneapolis, Minnesota.

Shkuda, G.K., Mendes, M., Coenen, A. 2005. A Simple Twist on the Triad Approach. 1st International Conference on Challenges in Site Remediation, Chicago, Illinois, October 2005.

Shkuda, G.K., Wenczel, C., Mendes, M. and Coenen, A. 2006. Contaminant Microstratification in a Homogeneous Isotropic Aquifer System. Remediation of Chlorinated and Recalcitrant Compounds, Fifth International Conference, Monterey, California.

Shkuda, G.K., Mendes, M., Coenen, A. and Carpenter, K. 2006. A Simple Twist on the Triad Approach. Remediation of Chlorinated and Recalcitrant Compounds, Fifth International Conference, Monterey, California.

Shkuda, G.K., Wenczel, C., Mendes, M. and Coenen, A. 2006. The Impacts of Contaminant Microstratification on Remedy Selection. 1ST European Conference. on DNAPL Characterization and Remediation. Göttingen, Germany.

Shkuda, G.K., Coenen, A., Perritt, K., and Desrosiers, J. 2007. Investigation of Vapor Intrusion in Commercial Buildings in Endicott, NY. Air and Waste Management Association. Vapor Intrusion: Learning from the Challenges. Providence, Rhode Island.

Shkuda, G.K., and Rossano, E. 2007 A Holistic Approach to the Identification of Dense Non-Aqueous Liquid Contamination. Second International Conference on DNAPL: Characterization and Remediation, Niagara Falls, New York.

Shkuda, G.K., Perritt, K., Desrosiers, J and Coenen, A. 2007. Investigation of Vapor Intrusion in Commercial Buildings in Endicott, NY. Second International Conference on Challenges in Site Remediation: Site Characterization and Performance Monitoring, Niagara Falls, New York.

Shkuda, G.K., and Rossano, E. 2007 Considerations in the Identification of Dense Non-Aqueous Liquid Contamination. Second European Conference on DNAPL Characterization and Remediation, Amsterdam, The Netherlands.

Shkuda, G.K., Mendes, M., Coenen, A. 2008. A Simple Twist on the Triad Approach. Triad Investigations – New Approaches and Innovative Strategies. International Conference and Training, University of Massachusetts Amherst.

Shkuda, G.K., and Rossano, E. 2008. Impacts To Remedy Selection In The Identification Of Dense Non-Aqueous Phase Liquids. Remediation of Chlorinated and Recalcitrant Compounds, Sixth International Conference, Monterey, California.

Shkuda, G.K., Mohlin, J., Mattern, M, and Gravier, P. 2008. Is The Migration Of Contaminated Soil Vapor A Larger Problem Than Anticipated? Remediation of Chlorinated and Recalcitrant Compounds, Sixth International Conference, Monterey, California.

Domaradzki, C., Frak, M., Shkuda, G.K., and Coenen, A. 2008. Design and Performance Of An Innovative Vapor Sampling Apparatus. Remediation of Chlorinated and Recalcitrant Compounds, Sixth International Conference, Monterey, California.

Key Projects

Provided litigation support regarding the sources of polychlorinated biphenyls (PCBs) and polychlorinated naphthalenes (PCNs) at former wire and cable manufacturing facility. Fingerprinting of the PCBs and PNCs was carried out to determine if the source of these materials in sediments and soil was manufacturing operations at the site or from sources up-river. Detailed PCB and PCN fingerprinting analyses were carried out to supplement standard USEPA analyses.

Directed an Investigation and Clean-up of a Site under the New York State Voluntary Clean-up Program. The property was formerly the location of a municipal solid waste incinerator. Waste materials containing polychlorinated biphenyls (PCBs) and polynuclear aromatic hydrocarbons (PAHs) were detected on the site during sampling conducted as part of a property transfer. The PCBs and PAHs were detected at depth and risk analysis demonstrated that the PCBs and PAHs could safely remain in place and only limited clean-up of metal impacted soil was necessary.

Prepared clean-up plans for two transformer reconditioning/disposal facilities. Sampling plans included "decision-tree" based sampling to determine the area and vertical extent of polychlorinated biphenyl (PCB) contamination. The sites were located in two different states and the plans also had to address differing PCB regulations at each of the venues.

Provided expert testimony for a major petroleum company regarding the identity, age, and origin of petroleum hydrocarbons detected in the subsurface at a bulk terminal facility in Texas. Gas chromatographic fingerprinting and component ratio analyses were used to demonstrate that the client was not the source of the contamination impacting a nearby park.

Provided litigation support for a petroleum company at a refinery site in California. The expert analysis involved fingerprinting of free product detected below the area of the refinery where finished gasoline was produced to determine origin, type, and age of product so that the on-site contamination could be distinguished from the product detected off-site. Various techniques were applied including high-resolution gas chromatography, biomarker and PIANO analyses and the occurrence and nature of organic lead species.

Provided expert testimony on behalf of a petroleum company regarding the origin of product detected in a former underground storage tank (UST) pit. Use of high-resolution gas chromatography allowed determination that the product was not related to the client's operations but resulted from subsequent usage of the property. The expert opinion was a key element in the summary judgment motion, which was granted by the court.

Evaluated dioxin analytical methodologies and the potential for dioxin formation from copper recovery operations at New Jersey Secondary Smelter impacting New York City.

Evaluated dioxin formation for a chemical manufacturer in Newark, New Jersey to determine the likelihood of dioxin formation and transport of putative dioxins to the Passaic River.

Evaluated on- and off-site dioxin and dibenzofuran sources and distributions at a 70-acre chemical plant in Portland, OR.

Project Director for a New York State Department of Environmental Conservation State Superfund Standby Contract. Managed Oversight of the Cleanup of Five MGP Sites throughout the State of New York. Reported on contractor clean-up activities and compliance with approved work plans. Provided air quality monitoring and reviewed final reports.

Project Manager for the investigation of the extent of MGP contamination at the former Niagara Mohawk corporate offices in Syracuse, New York. Installed a monitoring well network to define the extent of contamination. Evaluated remedial options.

Evaluated the potential presence of MGP wastes at a site just outside the limits of the Lower Falls MGP Superfund Site in Rochester New York.

Forensic evaluation of MGP impacts at Two Areas of Concern (AOC) at then MGP site in Atlantic Highlands, New Jersey. The forensic evaluation focused on determining if contamination on the AOCs was MGP derived or whether there were other sources of polynuclear aromatic hydrocarbons.

Provided litigation support at a New Jersey Superfund site. Detailed analysis of production records of chemical manufacturing, review of analytical methodologies and the fate and transport of product chemicals and by products was required for the production of an Expert Report. Assisted in critique of other experts.

Provided litigation support and expert testimony for a Potentially Responsible Party (PRPs) Group at a Superfund site in Indiana. The litigation support required detailed analysis of production records to of the PRPs and other landfill users to determine the chemical manufacturing processes used, likely products and whether unwanted by-products could be contained in waste streams. Identified hazardous substances contained in the waste streams of potential users of the disposal site to identify additional PRPs to require them to share in clean-up costs.

Directed an environmental study at a chemical plant in New Jersey, which included determination of the impacts to both ground and surface water of releases from the plant, detection, and mitigation of the impacts of non-aqueous phase liquids (NAPL) and assessment of the risk to local residences presented by the NAPL via volatilization and intrusion of the vapors into homes.

Analyzed the groundwater transport and fate, distribution, and analytical methodology used to quantify a pesticide used on Long Island. Provided expert testimony on behalf of the manufacturer to defend a toxic tort.

Provided expert testimony for the Department of Justice regarding the nature, mobility, persistence, and fate of organic and inorganic contaminants at a Superfund site in Jacksonville, Florida.

Directed the remedial investigation at a closed aircraft manufacturing facility on Long Island including negotiations with the NYSDEC regarding the scope of the investigation, evaluation of the monitoring data, supervision of Resource Conservation Recovery Act (RCRA) closure activities and coordination of cleanup activities.

Directed an RI/FS at two municipal landfills on Long Island. Was responsible for; negotiating the scopes of the work plans including assessment of risks to both human health and the environment with the New York State Department of Environmental Conservation (NYSDEC), implementing the studies, coordination of activities with the regulatory agencies (state, federal, and local), obtaining access for off-site activities with municipalities and residents. Presented the results of the RI/FS including communication of the risk assessment results at the CERCLA required public meeting. Collected ambient air monitoring data determining the concentrations of vinyl chloride being emitted from a municipal landfill and potentially impacting an adjacent elementary school.

Ernest Rossano, C.P.G.

Mr. Rossano has 20 years of varied hydrogeologic experience, including 3 years as a Project Manager for the United States Geological Survey, Water Resources Division on Long Island. His experience includes the design of monitoring well networks for volatile organics, hydrocarbons, and collection of basic hydrogeologic parameters; seismic, downhole geophysical, and sample log analysis and correlation; supervision and analysis of pump tests in confined and unconfined strata; numerical modeling of ground water flow and solute transport; and management of large scale remedial investigations and remediation.

Registrations & Professional Affiliations

- Certified Professional Geologist
- National Ground Water Association
- American Institute of Professional Geologists
- Association of Ground Water Scientists & Engineers

Fields of Competence

- Management of ground water pollution investigations
- Analysis of surface and ground water flow systems
- Surface and subsurface water quality monitoring
- In-situ permeability testing
- Infiltration testing
- Stratigraphic analysis, correlation and interpretation
- Multi-media sampling
- Tank removal and associated soils assessment
- Aquifer test analysis
- Ground water modeling
- Fate & Transport modeling
- Applied geophysics
- Municipal water supply
- Soil Vapor Extraction
- Air Sparging
- Bioventing/Biosparging
- Design & Installation of Horizontal Wells
- Construction Management
- Data Management using GIS Systems

Education

- M.S. Hydrogeology, State University of New York at Stony Brook, 1992
- B.S. Geology, Southampton College, New York, 1984

Key Projects

Comparison of major land use with the overall water quality of Long Island, New York.

Management and supervision of monitoring well network using over 1,000 wells. Correlation of data for use in USGS-published annual reports.

Stream gauging and surface water sampling on Long Island for the USGS National Stream Quality Accounting Network (NASQAN) and National Water Quality Assessment (NAWQA) programs.

Supervision of field activities including aquifer testing, test borings, well installation, recovery well construction, soil vapor and ground water sampling, and data evaluation.

Design and installation of a static hydrocarbon recovery system using 29 wells to recover over 450,000 gallons of product.

Supervision of tank removal and subsequent soils evaluation for contamination.

Design and installation of a municipal supply well yielding over 1,000 gallons per minute. Supervised all aspects of well construction and acceptance testing.

Three dimensional ground water flow model of New Jersey Coastal Plain deposits, to determine recovery well locations and rates, and feasibility of recharging treated effluent.

Pilot testing of soil vapor extraction and air sparging at several sites with varied hydrogeologic settings.

Pilot testing of bioventing and biosparging in glacial outwash deposits in New York.

Project Manager for the design, construction and operation of a 4000 scfm air sparge and 6200 scfm soil vapor extraction system consisting of 181 vertical and three horizontal sparge wells and 33 vertical and 1 horizontal soil vapor extraction wells. Provided direct construction management supervision for installation of 4 horizontal wells averaging 1100 feet in length. As project manager was responsible for construction management of above ground treatment system components.

Regional scale three-dimensional flow and solute transport model of hydrocarbons in glacial terrain in New York used to negotiate favorable cleanup criteria for the client.

Flow & transport model of a chlorinated solvent plume on Long Island, New York Constructed a model involving the movement of ground water and chlorinated solvents in highly permeable glacial sediments. This model utilized the MT3D code and site-specific decay rates to demonstrate fate and transport.

Flow & transport model of a chlorinated solvent plume in East Rutherford, New Jersey. Constructed a model involving the movement of ground water and chlorinated solvents in overburden sediments and wetland areas. This model utilized the RT3D code and site-specific decay rates to develop a Classification Exception Area and demonstrate monitored natural attenuation.

Managed a site decommissioning and remedial investigation for a large defense industry client. Investigation results indicated significant chromium contamination in soil and ground water and led to inclusion in the New York State Voluntary Cleanup Program. Sediment and surface water samples were collected from multiple locations in the East River as part of the remedial investigation. Additional investigation and remediation are pending NYSDEC review. Chosen remedial methods were excavation and in situ stabilization/reduction. As project manager was responsible for construction management aspect of implementing the remedial strategy.

Database setup and management for multiple large remedial investigation projects using GIS/Key. Database outputs include geologic and chemical cross sections, isoconcentration maps, graphs, data tables, and statistical analysis. Exports from databases have been used in ground water flow and solute transport modeling.

Management of a large ISRA project on a site contaminated with metals and chlorinated solvents. Key aspects of this project include; litigation support, active ground water remediation, off site plume delineation, ground water monitoring, data management and soil remediation.

Nicole M. Repetti

Ms. Repetti has over eight years of diverse experience in the environmental consulting industry and providing paralegal services to a prestigious environmental law firm. Ms. Repetti has provided assistance on various environmental site assessment projects as well as regulatory compliance reporting assignments, and has provided investigation and remediation support activities including: groundwater evaluations both in the field and on paper through contour/plume mapping and on-site sampling; groundwater, soil, soil vapor and air sampling, monitoring and soil boring logging during subsurface investigations; groundwater and soil vapor recovery/treatment plant operations; and Phase 1 (Due Diligence) environmental assessments.

Ms. Repetti has also assisted in the development and implementation of work plans and subsequent investigatory findings reports submitted to state and federal agencies for review and approval. Most recently, auditing as per the Federal Accounting Standards Board (FASB) Regulations for asset retirement obligations has been added to this repertoire of skills.

Registrations & Professional Affiliations

- 40 hr. OSHA HAZWOPER Trained
- 8 hr. OSHA Refresher, current
- 10 hr. OSHA Construction Safety & Health Trained
- First aid/CPR Certified, 2008
- ExxonMobil LPS Certified Employee
- Notary Public, Nassau County, NY

Fields of Competence

- Groundwater, Soil, Soil Vapor, and Air Sampling Techniques
- Compliance Management Systems
- Phase I, Phase II Environmental Investigations
- Due Diligence
- Tier II Reporting
- Brownfield Clean-up Program/Site Redevelopment
- Regulatory Guidance/Reporting
- Environmental Litigation Support
- Treatment System Operations

Education

- B.S. Environmental Science, SUNY Oneonta, 2000
- M.S. Environmental Studies, C.W. Post Long Island University, expected 2008
- Health Research Training Program, NYCDOH
- (Dept. of Engineering)
- Due Diligence at Dawn training, Environmental Data Resources, 2004
- Internal ERM Mergers & Acquisitions training, 2005

Key Projects

Project Manager for a Remedial Action/Redevelopment project involving a Site accepted into the New York State Brownfield Clean-up Program (BCP). The Site was formerly a lead works facility located in Brooklyn, NY and the subsurface shows exceedences of lead in soil and volatile organic compounds(VOCs) in the groundwater and sub-slab soil vapor. ERM and Ms. Repetti have been involved in the scoping of the remedial action and implementation of the supplemental design.

Project Manager for a Site Investigation project involving a Site accepted into the New York State Voluntary Clean-up Program (VCP), the precursory program to the BCP. The Site is an active manufacuturer of small metal parts using processes that include metal stamping, deburring and washing. On-Site and off-Site investigations showed exceedences of SVOCs in on-site drainage structures and VOCs in off-site groundwater and sub-slab soil vapor and indoor air. An SVE system was designed and implemented at the Site and shallow excavations will be initiated to remediate the surficial SVOC issues. A comprehensive Site Investigation and Remedial Design Report is currently being drafted and will be submitted to the NYSDEC Case Manager upon its completion.

Team member for several auditing projects prompted by the March 2005 Federal Accounting Standards Board (FASB), Financial Accounting Standard 143 (FASB Interpretation NO. 47 (FIN 47)). Projects consisted of performing site visits at several Multi-national companies to determine which of their tangible assests, upon retirement, would be subject to environmental regulatory closure requirements. A questionnaire linked to US federal and/or EU environmental regulations was developed to assist in these audits. Upon determination of the assets to include, each company set aside a reserve fund to capture these costs if they were to ever retire these assets. Annual review of these asset lists will be required.

Conduct site specific regulatory applicability analysis for international oil company. Project consists of reviewing federal, state and local regulations for portfolios of sites and determing whether they are applicable to that portfolio. If found to be applicable, action tasks are written for various individuals to maintain compliance at the facilities in each portfolio. ERM has developed a database system to organize this project, which will later be melded into the clients own compliance tracking system. ERM and myself were responsible for training users of the system during the deployment of the compliance management system.

Project Team Leader for a Soil Vapor Intrusion Study in Jamaica, NY. Activities included outdoor and sub-slab soil vapor and indoor air sampling of multiple residences to assess the off-site impacts of a former drycleaning supply warehouse. Responsible for work plan development, project implementation and continued public relations within the neighborhood. Ultimate goal of this project is to install passive venting systems in residences where sampling results exceeded regulatory guidelines. Have since participated in several other studies of the same type in multiple locations.

Participated in a Flourescent Dye Tracing Test conducted in Glen Cove, NY. Assisted in the data acquisition which led to the selection of the dye injection points, preparation of monitoring points via permanent glass bailers and continuously monitor the site for signs of the dye in down/cross gradient monitoring locations.

Provided consulting services to a confidential client regarding the drafting of their Deed Notice to accompany the property Deed on File. Former operations at the site included the manufacture of various medical apparatus (i.e. syringes, thermometers, etc.). Services included review of applicable state environmental guidelines and ensuring future implementation of these guidelines at the site via engineering controls and redevelopment restrictions.

Developed and submitted an application to the New Jersey Department of Environmental Protection (NJDEP) for Wetlands Permit. This permit would allow our client to conduct remedial measures in multiple zones of their property that the NJDEP has classified as a protected New Jersey wetland. These measures included the installation of several monitoring wells and the excavation of impacted soils in another location.

Provided Contractor-Field Oversite for the New York State Department of Environmental Conservation (NYSDEC) for a major former Manufactured Gas Plant (MGP) Remediation in Westchester, NY. The site work was conducted by a third party environmental consultant, unionized construction contractor, and various unionized labor parties (i.e. teamsters, welders, concrete/rebar specialists, heavy equipment operators, and laborer union members). Specifically provided on-site support for the NYSDEC regarding scope of work execution, liason for change order submittals, restoration oversight of highly sensitive areas along the coastline and in the Hudson River, and provided support at weekly contractor meetings.

Project Team Member for a Phase I Investigation conducted for a hotel chain with 101 locations across the United States. Played an integral role in reviewing/reporting pertainent EDR Report information, coordinating site visit information from auditors, and the Final Phase I Investigation Reports for each location.

Conducted Quarterly Groundwater Monitoring activities for various petroleum impacted sites in the 5 boroughs of New York City, Long Island and New Jersey.

On-site coordinator of subcontractors conducting product extraction with vacuum trucks and conducted air monitoring for this remedial action.

Provided support to on-site field managers on various remedial investigations and well installations providing soil boring logging and soil/groundwater sampling.

Project support for Phase I/Phase II, Remedial Investigation Reports, and Due Diligence Document reviews.

Conducted Annual and Semi-annual Compliance/Monitoring audits and subsequent reporting for New York State Department of Environmental Conservation Title V Air Facility Permit holders.

Developed and submitted SARA Title III (tier I & tier II) reports for a major contract packaging company.

Provided marketing and field support for an Environmental Construction Firm focused primarily on Wastewater Treatment Facilities. Daily activities included treatment plant effluent sampling to assure compliance with various discharge permits in place, carbon system change out documentation and waste handling procedures, and proposal and SOQ development.

Paralegal responsible for research, document production and coordination, and correspondence with NY/NJ court officials.

Andrew Coenen

Mr. Coenen has 13 years of general analytical chemistry experience, 6 years of analytical laboratory experience, and 7 years of environmental consulting experience, including analytical data validation, sampling and analysis programs, quality assurance programs, technical support, and QA oversight for fixed laboratory and field analysis. Mr. Coenen has knowledge of numerous analytical methodologies and experience in data validation of analytical data package deliverables for adherence to USEPA CLP and non-CLP, NYSDEC ASP, and NJDEP protocols. He is proficient with GIS/Key environmental management software and has operated a mobile gas chromatograph laboratory used to test soil and water samples for quick-turn volatile analysis.

Fields of Competence

- Analytical data review and validation
- Environmental database management (GIS/Key)
- Laboratory Subcontractor Management
- Analytical protocols for pollutants by USEPA methodologies
- Methods of analysis of organic and inorganic parameters
- Review and preparation of QA/QC plans
- Field analytical techniques
- Multi-Media Sampling

Education

- 8-Hour OSHA Annual Refresher Training, 1999 - current
- Rutgers University / Cook College - NJDEP Using GIS for Environmental Evaluations, October 1999
- 40-Hour OSHA [29 CFR 1910.120 (e) (2)] Health and Safety Training, 1998
- Computer Aided Drafting, 50-Hour Course, Island Drafting and Technical Institute, 1998
- Immunoassay Testing Training Program, Strategic Diagnostics Inc., 1998
- B.S. Chemistry, University of Michigan, 1991

Key Projects

Data validation for numerous projects located in New York, New Jersey, Pennsylvania, Illinois, Massachusetts, Indiana, and Wisconsin, involving evaluation of aqueous, soil, sediment, leachate and air samples analyzed by USEPA Contract Laboratory Protocols, New York State DEC Contract Laboratory and Analytical Services Protocols and SW-846 methodologies for organic, inorganic, wet chemistry parameters, TPH and various other analyses.

Reviewed sampling and laboratory chemical data for adherence to New Jersey Department of Environmental Protection protocols on numerous projects. Also constructed electronic deliverables for submission to NJDEP in required haz-deliverable format.

Database construction & management for numerous investigations utilizing GIS/Key software. Compiled field and laboratory data and generated result summary tables, contours, isopleths, contaminant plume maps, cross-sections and boring logs.

Prepared numerous Sampling and Analysis Plans (SAPs) and Quality Assurance Project Plans (QAPPs) for adherence to state and federal guidelines.

Project management and technical support for Special Analytical Services required to delineate low-level PAH contamination at a Superfund Site. This included method development and validation of a Selected Ion Monitoring (SIM) GC/MS technique.

Utilized Immunoassay test kits for field measurement of PCB contamination at the former Brooklyn Navy Yard, Brooklyn, New York. Performed data validation of all field analytical samples and off-site laboratory samples and compared off-site results to test kits.

Conducted subsurface investigations with a Geoprobe. Performed various field tests.

Supervision of tank removal and subsequent soils evaluation for contamination.

Karen L. Pickering

Ms. Karen Pickering has 1 year of experience in the field of Geology. Before ERM, Ms. Pickering worked as a Geology lab assistant, where she prepared lab work and assisted introductory students. She was also a research student at the University of Mary Washington and participated in the identification of precipitates found at Acid Mine Drainage contaminated stream in Contrary Creek, Virginia. Her research consisted of, but was not limited to

- Measuring field parameters such as pH, temperature, specific conductivity, and total alkalinity;
- Identifying elements and minerals in the stream using Inductively Couple Plasma-Optical Emission Spectrometry and X-Ray Diffraction.

Ms. Pickering presented her findings at the Summer Science Research Symposium.

Fields of Competence

- Site Assessment and Remediation

Education

- Bachelor of Science in Geology, May 2006
  University of Mary Washington, Fredericksburg, Virginia

Languages

- English, native speaker
- Spanish, beginner

Honors & Awards

Completed Summer Science Research Program identifying/evaluating the effects of Acid Mine Drainage in streams.

Key Projects

Played a significant role in Site Investigation and Remediation projects at ERM such as ExxonMobile, Invensys, Becton Dickinson, Genesco, Honeywell, and BICC.