FINAL ENGINEERING REPORT

SOIL VAPOR EXTRACTION AND GROUNDWATER RECOVERY AND TREATMENT SYSTEM
REYNOLDS CAN PLANT SITE
FULTON, NEW YORK

Submitted To:

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
Division of Hazardous Waste Remediation
50 Wolf Road
Albany, New York 12233-7010

Prepared For:

MILLER BREWING COMPANY
3939 West Highland Boulevard
Milwaukee, Wisconsin 53201-0482

Prepared By:

EARTH TECH ENGINEERS OF NEW YORK, P.C.
c\o CT Corporation System
1633 Broadway
New York, New York 10019

PROJECT NO. 10977

NOVEMBER 1997

TABLE OF CONTENTS

Main\wpdocs\miller\asbuilt.rpt

TABLE OF CONTENTS (CONTINUED)

TABLE OF CONTENTS (CONTINUED)

TABLE OF CONTENTS (CONTINUED)

TABLE OF CONTENTS (CONTINUED)

LIST OF TABLES

TABLE OF CONTENTS (CONTINUED)

LIST OF FIGURES

SECTION 1
INTRODUCTION

1.1 Background

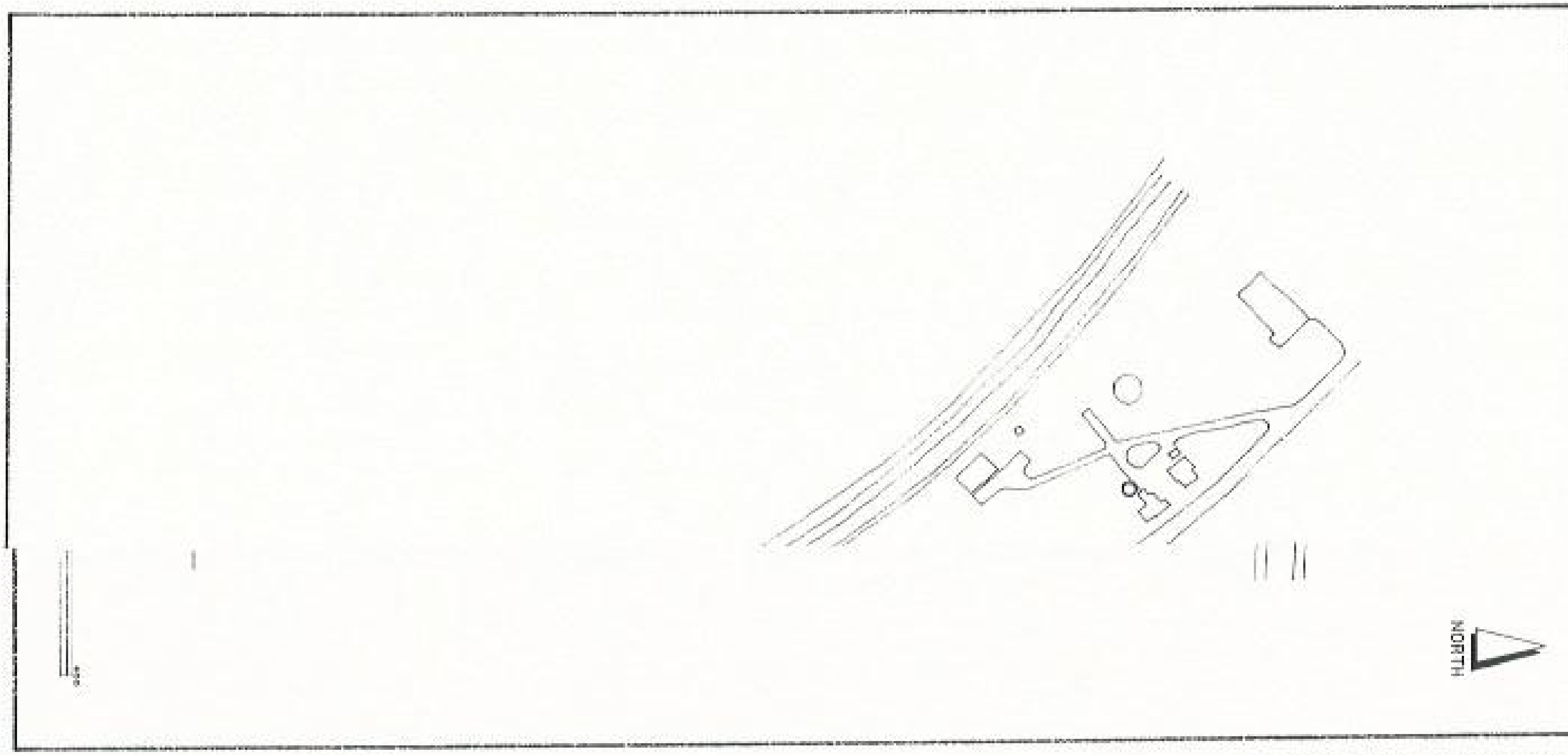
Earth Tech Engineers of New York, P.C. (Earth Tech) was retained by Miller Brewing Company (Miller) to provide design, construction and operation services to implement the selected remedial system for the Reynolds Can Plant Site located in the Town of Volney, New York. Figure 1-1 presents a site location map. Previous remedial investigations identified volatile organic contamination present in subsurface soils and groundwater. Interim Remedial Measures (IRM) were conducted which included remediation of contaminated soils associated with the Northern Operable Unit, installation of a 20 gallon per minute (gpm) groundwater recovery and treatment system as well as installation and operation of a one million gallon per day air stripping treatment system at the nearby City of Fulton municipal well field. Figure 1-2 presents an overall site plan.

The findings of the remedial investigation/feasibility study (RI/FS) revealed that one additional source area required remediation in the area of four underground storage tanks (USTs) previously used as part of the Reynolds Can Plant industrial wastewater treatment system. The hydrogeological investigations revealed two groundwater contaminant plumes identified as the Northern Operable Unit and Southern Operable Unit that require remediation.

The feasibility study selected the remedial action for the Reynolds Can Plant to include source remediation in the Southern Operable Unit using soil vapor extraction and a groundwater collection and treatment system that will provide hydraulic control of the groundwater contaminant plumes and effectively treat the recovered groundwater for discharge to a surface water body. The proposed remedial action was accepted by the New York State Department of Environmental Conservation (NYSDEC) and a Record of Decision (ROD) was developed for the selected remedial action.

In May 1995, a Remedial Design Report was prepared that presented the basis of design for the Proposed Remedial Action Plan issued by NYSDEC. This Remedial Design Report was used to develop technical specifications for solicitation of a design/build contractor to be responsible for detailed engineering design and specification, construction, and operation of the final remedial system.

In July 1995, Miller solicited bids from pre-qualified design/build contractors for design installation and operation, monitoring, and maintenance of the remedial system. In August 1995, Earth Tech was selected as the design/build/operate contractor.



ENVIRONMENTAL / CONSULTING ENGINEERS

53 HADDONFIELD ROAD, SUITE 316
CHERRY HILL, NEW JERSEY 08002

EARTH TECH

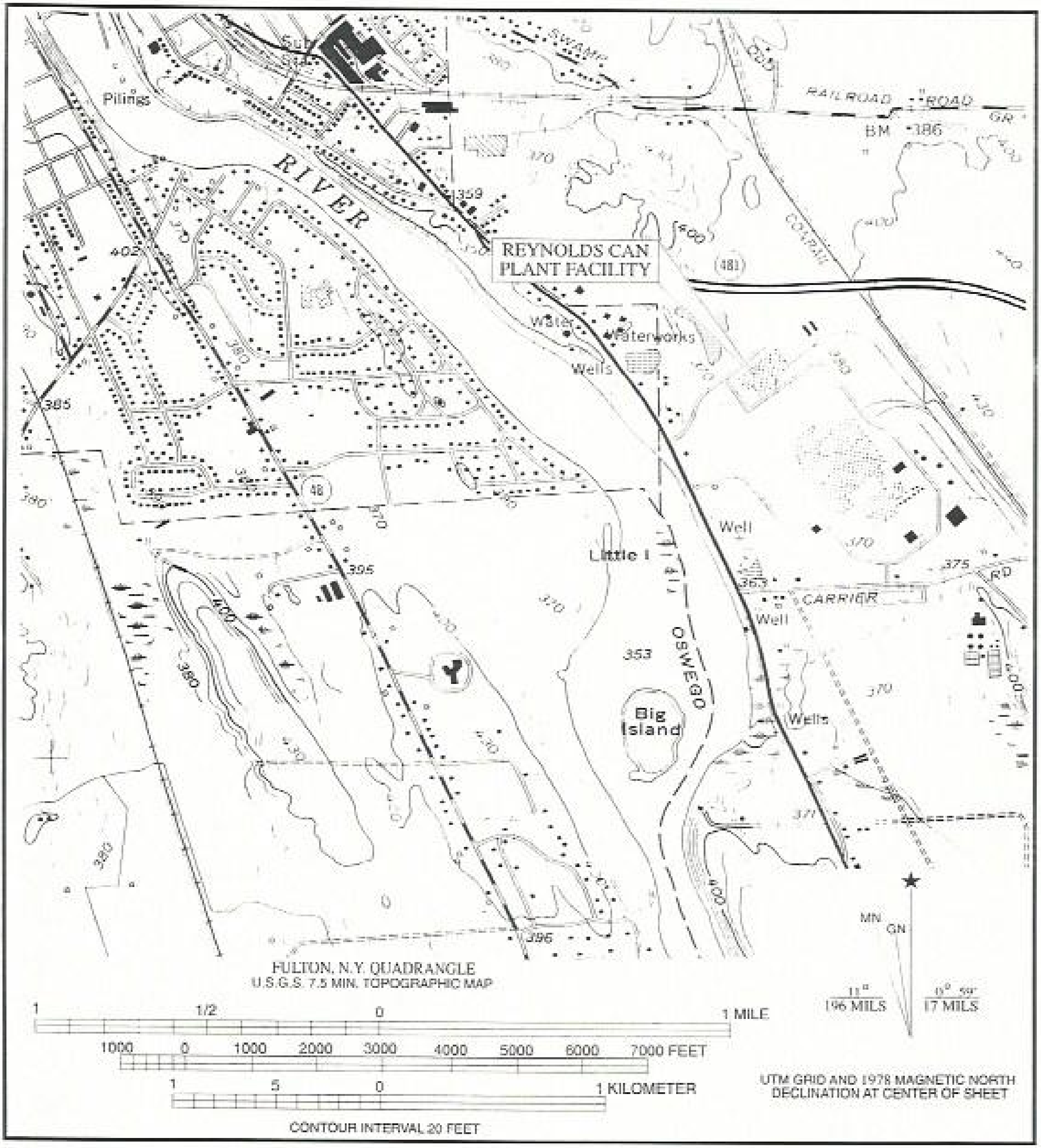
PROJECT:

FINAL ENGINEERING REPORT
REYNOLDS CAN PLANT SITE
FULTON, NEW YORK

CLIENT:

MILLER BREWING COMPANY
3939 W. Highland Boulevard
Milwaukee, Wisconsin 53201-0482

TITLE:	SITE PLAN
DATE:	8/29/95
SCALE:	1" = 300'
PROJECT NO.	957961
FIGURE NO.	1-2



53 HADDONFIELD ROAD, SUITE 316
CHERRY HILL, NEW JERSEY 08002

ENVIRONMENTAL/CONSULTING ENGINEERS

EARTH TECH

PROJECT:

REYNOLDS CAN PLANT REMEDIATION

REYNOLDS CAN PLANT FACILITY
Fulton, New York

TITLE: SITE LOCATION MAP	
SCALE: NOTED	DATE: 10/15/97
PROJECT NO. 957961	FIGURE NO. 1-1

In September 1995, Earth Tech submitted a Remedial Design Report Addendum that presented the selected remedial system for implementation at the Reynolds Can Plant and described alternatives to be incorporated into the detailed engineering design of the remedial action system. These alternatives were developed within the requirements of the ROD to enhance the effectiveness of the overall approach to design, installation and operation of the remedial system.

In November 1995, NYSDEC and Miller signed an order of consent to design, build and operate the selected remedial alternative for soil and groundwater contamination at the Reynolds Can Plant. A design submittal was prepared to comply with the submission required to obtain NYSDEC approval to implement the selected remedial action. The order of consent is included as Appendix A.

1.2 Design Submittals

The engineering design of the remedial system was developed in four submittals. The 100% design submittal, dated August 1996, consisted of the following:

Volume I - Design Report
Volume II - Technical Specifications
Volume III - Design Drawings
Volume IV - Health and Safety Plan
Volume V - Construction Quality Assurance Plan

The detailed engineering design submittals were reviewed by NYSDEC and approved in correspondence, dated 7 August 1996.

1.3 System Construction

The remedial system construction activities were initiated on 22 April 1996 and were completed on 12 February 1997. The start-up operation period was conducted to demonstrate consistent conformance with the performance goals of the system design. The start-up period was initiated on 26 February 1997 and continued for six months until 29 August 1997. Upon demonstration that the system performed to the required specification, continued operation, maintenance and monitoring (OM&M) of the remedial system has been performed by Earth Tech.

1.4 Final Engineering Report

This final engineering report presents the as-built remedial system construction, identifies any variations implemented to the approved remedial design and certifies that the Remedial Design was implemented and all construction activities were completed in accordance with the NYSDEC-approved Remedial Design.

SECTION 2
PROCESS TREATMENT BUILDING

The Process Treatment Building is located on the northern side of the Miller Brewing property line directly adjacent to the Reynolds Can Plant Property. This location was selected to allow access through the Miller Brewing property thereby minimizing potential impact to the Reynolds Can Plant property. The dimensions of the building are 80 feet by 40 feet with an eave height of 18 feet.

2.1 Concrete Slab and Foundation

The Process Treatment Building was constructed on a concrete slab and foundation. Based upon classification and analysis of soil samples collected from geotechnical borings advanced in the vicinity of the proposed treatment building, it was determined that the building could be supported on a spread footing foundation with a design net bearing pressure of two tons per square foot (TSF). The top of the exterior footings are located at a depth of four feet below finished outside grade for protection from frost, while interior footings are located just below the floor slab. The report prepared outlining the results of the geotechnical investigation is included as Appendix B.

A six inch thick concrete pad was constructed for the interior of the building to support the identified process equipment as well as any future process equipment which may be required as part of the remedial system. The concrete slab was constructed as a containment pad with a six inch curb in the event there is a leak or discharge. The concrete slab is sloped to a common sump located near the center of the building. The water-tight sump will contain any spills and leaks and allow pumping of the contained liquids back into the equalization tank for treatment.

2.2 Pre-Engineered Building

A pre-engineered prefabricated metal building was constructed to house the process treatment equipment. This pre-engineered building was constructed to comply with applicable state and local building codes. The building design took into account potential snow loads, wind loads and other unique considerations for this geographical area. The pre-engineered building includes a control room which houses the control panels as well as providing an office area for maintaining records. A rest room is included, as well as health and safety requirements such as an emergency eye wash and shower station.

This submittal includes as-built information for the pre-engineered building including elevations, layout plans and fabrication information. It should be noted that local zoning ordinances required a variance for the construction of the Process Treatment Building since it was located within 25 feet of the Reynolds Can Plant property boundary. Earth Tech received local zoning board approval to allow a reduced setback of 15 feet.

2.3 Mechanical

The mechanical systems include the Process Treatment Building heating, ventilation and air conditioning (HVAC) systems, water supply and sanitary sewer service. The Process Treatment Building is heated using propane fueled unit heaters supported from the ceiling of the structure. The process area is maintained at warehouse temperatures while a separate unit heater has been installed for the control room and rest room. Sanitary sewer lines were accessed and tapped into from the Miller Brewing property. All mechanical installations comply with local code requirements. The detailed mechanical specifications for the Process Treatment Building are presented in the as-built submittal.

2.4 Electrical Provisions

The Process Treatment Building mechanical and electrical requirements are supplied by a 480/277 volt service which is obtained through the electrical service of the process equipment. The electrical service components of the Process Treatment Building are obtained through a subpanel which include lighting and receptacle service within the process equipment area as well as lighting and electrical service within the control room and rest room. The detailed electrical specifications of the Process Treatment Building and treatment equipment are presented in the as-built submittal.

SECTION 3
GROUNDWATER RECOVERY SYSTEM

The groundwater recovery wells were installed at locations identified in the design documents to maintain hydraulic control of the contaminant plumes while resulting in maximum contaminant mass removal. The recovery well layout was selected based upon groundwater modelling and capture zone analysis conducted as part of the initial remedial design. The groundwater recovery system includes the following major components:

- Recovery Well Layout
- Recovery Well Construction
- Recovery Well Development
- Recovery Well Vault Construction
- Recovery Well Pumps
- Underground Storage Tank Recovery System

3.1 Recovery Well Layout

The Remedial Design Report presented a recovery well network that was designed through capture analysis to capture the two contaminant plumes (Northern and Southern Operable Units) identified on the site. Nine recovery wells were installed to capture the Northern Operable Unit contaminant plume. These recovery wells are located in the northern portion of the property to capture contaminants present from the former spill containment tank area, northern drum storage area and area east of the Taylor property. Recovery wells RW-10, RW-11 and RW-12 have been installed near the Taylor property boundary and act as an interceptor barrier for any contaminants potentially migrating off site. New recovery wells RW-1, RW-2 and RW-3 were installed in the immediate areas of the recovery wells that operated under the IRM while the existing recovery wells were properly abandoned. The locations of the recovery wells were identified as the optimum locations to fulfill the overall objectives of the recovery system. Recovery wells RW-4 and RW-13 were also installed in the Northern Operable Unit.

Four recovery wells are utilized to provide hydraulic control and remediation of the Southern Operable Unit. Previously existing monitor wells located inside the Reynolds Can Plant Building (renumbered as RW-6 and RW-7) were replaced to serve as dual extraction wells, utilized both as groundwater recovery wells and soil vapor extraction wells in the immediate area of the underground storage tank (UST) recovery system. Recovery wells RW-8 and RW-9 have been installed west of the Plant building in the Southern Operable Unit.

3.2 Recovery Well Construction

Recovery well construction design was based upon a preliminary soil boring program conducted at the recovery well locations. The purpose of this program was to define soil conditions in the vicinity of the proposed recovery wells and establish the optimum screen length, screen slot size, and filter pack for each recovery well. These details were determined based upon soil boring lithology and sieve analysis.

Five pilot hole soil borings (PHRW-2, PHRW-4, PHRW-8, PHRW-11, and PHRW-13) were drilled across the site. The pilot hole soil boring locations were selected to provide subsurface lithology in the immediate area of selected recovery well locations. PHRW-2 was advanced approximately 15 feet from future RW-2 to provide subsurface characterization for recovery wells RW-2 and RW-5. PHRW-4 was advanced approximately 25 feet south of future RW-4 to provide subsurface characterization for recovery wells RW-3, RW-4 and RW-5. PHRW-8 was advanced between RW-8 and RW-9 to provide subsurface characterization for recovery wells RW-8 and RW-9. PHRW-11 was advanced approximately 15 feet from future RW-11 to provide subsurface characterization for recovery wells RW-10, RW-11, and RW-12. PHRW-13 was advanced between RW-1 and RW-13 to provide subsurface characterization for recovery wells RW-1 and RW-13.

All soil borings were sampled continuously utilizing 2-foot split spoon samplers. The borings were advanced until till was encountered. All soil samples collected were classified for lithology by the project geologist. At least two soil samples per soil boring were collected for sieve analysis from the intended depth of the screened sections for the recovery wells in the immediate area of the pilot hole soil boring.

Using methods described in a standard reference (Driscoll, *Groundwater and Wells*, Second Edition, 1989), the 40 percent (%) retained grain size and the 70% retained grain size were determined from the sieve analysis. These factors were utilized to select the appropriate recovery well slot and filter pack sizes that would maximize well efficiency while minimizing siltation of the well. Based upon the sieve analysis and borehole lithology, recovery well construction recommendations were determined. Earth Tech submitted the recommended recovery well construction details to NYSDEC for approval prior to initiating recovery well construction.

Two soil samples were collected at PHRW-2 for particle size analysis. Both samples were collected from the fine sand above till. The analysis conducted on sands near the top of the productive zone indicated that the appropriate well construction would be use of 15-slot screen and a Morie #00 filter pack, and the analysis conducted on sands near the base of the productive zone indicated that the appropriate well construction would be use of 30-slot screen and a Morie #1 filter pack. The lithology indicated that the sand zone was approximately ten feet thick; therefore, Morie #0 sand pack and ten feet of 20-slot screen were used to construct RW-2.

Two soil samples were collected at PHRW-4 for particle size analysis. Both soil samples were collected from the sand zone above till. Both analyses indicated that the appropriate well construction would be use of 15-slot screen and a Morie #00 filter pack. The lithology indicated that the productive sand zone was approximately 10 feet thick and fine sands were encountered 15 feet above till; therefore, Morie #00 sand pack and 15 feet of 15-slot screen were used to construct recovery wells RW-3, RW-4, and RW-5.

Three soil samples were collected at PHRW-8 for particle size analysis. Two soil samples were collected from the sand zone above silt overlying the till, and one soil sample was collected from a silt zone located on top of the till. The analyses conducted in the sand zone indicated that the optimal well construction would be use of 20-slot screen and a Morie #0 filter pack, and that use of 30-slot screen and Morie #1 sand is optimal for the coarser zone. The analysis conducted in the silty zone above till indicated that appropriate construction would be use of 15-slot screen and a Morie #00 filter pack. The lithology indicated that the productive sand zone is approximately 15 feet thick, with a coarser zone near the middle; therefore, 15 feet of 20-slot screen and Morie #0 sand were used to construct recovery wells RW-8 and RW-9.

Two soil samples were collected at PHRW-11 for particle size analysis. Both soil samples were collected from the sand zone above till. The analysis conducted in the fine sand indicated that the appropriate well construction will be use of 20-slot screen and a Morie #0 filter pack. The analysis conducted in the coarser sand indicated that the appropriate well construction was 30-slot screen and a Morie #1 filter pack. Use of 20-slot screen and Morie #0 sand pack was recommended. The lithology indicated that the sand zone is approximately four feet thick. Local lithologic logs of nearby monitor wells indicated that the productive zone would be thicker north of PHRW-11 (toward RW-11 and RW-12) and thinner south of PHRW-11 (toward RW-10); therefore, five feet of screen in recovery well RW-10 and ten feet of screen in recovery wells RW-11 and RW-12 were used to construct these recovery wells.

Two soil samples were collected at PHRW-13 for particle size analysis. One soil sample was collected from the sand zone above till, and the other sample was collected from the top of the till. The analysis conducted in the fine sand indicated that the appropriate well construction was 20-slot screen and a Morie #0 filter pack, and the analysis conducted in the upper till indicated that use of 30-slot or 50-slot screen and a Morie #1 or #2 filter pack was appropriate. However, the recovery from split spoons advanced in the till was generally dry, indicating that the till is not transmissive; therefore, wells were not screened in the till. The lithology indicated that the sand zone was approximately 10 to 15 feet thick; therefore, Morie #0 filter pack and 15 feet of 20-slot screen were used to construct recovery wells RW-1 and RW-13.

No particle size analyses were conducted when MW-58S (future RW-6) and MW-59S (future RW-7) were installed by others. The boring logs indicated that these wells were screened in a very fine silty sand zone and till was not encountered. The wells were constructed with 10-slot screen and #0 filter pack in the saturated zone (~24.5′ to 34.5′) and 20-slot screen and #1 filter pack in the unsaturated zone. Both wells had a five foot section of riser below the screen, which was probably intended as a sump for potential DNAPL recovery. The use of coarser material and larger slots in the unsaturated zone was appropriate based upon the intended use of these wells for dual recovery of fluid and vapor. The filter pack was appropriately sized; however, review of literature provided by the Morie Company indicated the slot sizes were not optimally matched with the filter pack. Recommendations were presented and approved for construction of recovery wells RW-6 and RW-7 with two feet of riser at the base, 20-slot screen and #0 filter pack from approximately 35 feet below ground surface (bgs) to the water table (~25'), and 30-slot screen and #1 filter pack from the water table to approximately 10 feet bgs.

Based upon borehole lithology as determined during the soil boring program, screen lengths were altered from the original design in recovery wells RW-1, RW-3, RW-4, RW-5, RW-8, RW-11, RW-12, and RW-13. These alterations were justified by the presence of fine-grained formations above the recommended screened section and the necessity of avoiding siltation of the wells.

The soil boring program provided the required data to select screen intervals, screen length and sand pack. These field observations and analysis allowed each individual recovery well to be constructed in order to optimize the recovery of the contaminated aquifer.

The recovery well construction techniques included:

- sand pack consisted of imported clean silica sand, appropriately sized for the formation within the screened interval;

- sand was placed in a manner as to avoid any gaps or bridges within the sand pack.

- wells were developed using an appropriate combination of surging and pumping to produce a clear, sediment-free discharge.

During well development, sampling of the recovered groundwater and monitoring of the flow rate was conducted at each well to establish initial groundwater characteristics for each recovery well. Temperature, conductivity, and pH was measured and recorded in the field. Subsequent to well development, well samples were collected and submitted for the following analyses: Total Dissolved Solids, Total Suspended Solids, Turbidity, Alkalinity, Hardness, Chloride, Sulfate, Iron, Calcium, Magnesium, Manganese, Sodium, Potassium, and Iron Bacteria. This information was used to determine aquifer inorganic parameter quality and the potential impact to well maintenance requirements. Specific capacity testing was conducted to establish the optimum recovery well flow rates for each recovery well.

Based upon the observed field conditions of each recovery well, field adjustments were made as needed in recovery well construction in order to optimize the effectiveness of each recovery well in capturing the contaminant plume. Detailed drawings of recovery well construction are included with the as-built submittal. Table 3-1 presents a summary of recovery well construction.

TABLE 3-1

SUMMARY OF RECOVERY WELL CONSTRUCTION
FORMER MILLER BREWING; FULTON, NEW YORK

LOCATION	SOIL BORING	SPECIFICATION SCREEN LENGTH (feet)	RECOMMENDED SCREEN LENGTH (feet)	SLOT SIZE	FILTER PACK SIZE
RW-1	PHRW-13	25	15	20	Morie #0
RW-2	PHRW-2	10	10	20	Morie #0
RW-3	PHRW-4	15	15	15	Morie #00
RW-4	PHRW-4	15	15	15	Morie #00
RW-5	PHRW-2 PHRW-4	15	15	15	Morie #00
RW-6	Not Applicable	25	25	30 (-10-25') 20 (-25-35')	Morie #1 (-10-25') Morie #0 (-25-35')
RW-7	Not Applicable	25	25	30 (-10-25') 20 (-25-35')	Morie #1 (-10-25') Morie #0 (-25-35')
RW-8	PHRW-8	20	15	20	Morie #0
RW-9	PHRW-8	15	15	20	Morie #0
RW-10	PHRW-11	5	5	20	Morie #0
RW-11	PHRW-11	10	10	20	Morie #0
RW-12	PHRW-11	15	10	20	Morie #0
RW-13	PHRW-13	25	15	20	Morie #0

3.3 Recovery Well Development

Earth Tech performed additional development of selected recovery wells which were installed at the subject property as part of the Reynolds Can Plant Remediation project. Additional development techniques which included jetting and surge and block methods were conducted to attempt to improve recovery well flow rates and establish aquifer yields. Additional well development was performed at recovery wells RW-1, RW-2, RW-3, RW-4, RW-8, RW-9, RW-10, RW-11, RW-12 and RW-13. Well development began on 16 September 1996 and continued through 24 September 1996.

Additional well development in each of the wells initially consisted of jetting with a high pressure stream of water. The jet stream of water was generated by pumping a large volume of water through a section of two inch Schedule 40 PVC pipe with numerous one-eighth (⅛) inch holes drilled around the circumference. A pressure gauge was attached to an one and one-half inch poly supply line to monitor the pressure of the water jets. The jetting device was lowered to the bottom of each well screen and was slowly lifted up and down so as not to damage the well screen. The silt which was removed from the sand pack placed around the well screen was forced to the surface by the introduction of potable water at the bottom of the well. As the silt reached the surface of the well riser, it was discharged to a holding tank positioned adjacent to the well. The silt was allowed to settle in the holding tank and the clear water was pumped back through the one and one-half inch supply line to the jetting device.

The amount of silt and fine sand generated during well development was monitored during the jetting process. When the water which was being discharged to the holding tank from the well became very turbid, the jetting process was halted and a submersible well pump was inserted in the well to pump out the standing water. After the pumped water began to clear, the jetting device was reinstalled in the well. This process continued until there was a noticeable decrease in the amount of silt and fine sand produced.

After it was determined that the amount of silt and fine sand generated during the jetting process decreased, the surge and block technique was employed. In this technique, a solid metal plug with a diameter only slightly smaller then that of the inner diameter of the well was lowered to the bottom of the well using steel rods. After the plug reached the bottom of the well it was raised and lowered quickly along the length of the well screen. As the plug was raised a vacuum within the well was created, and when the plug was lowered, water beneath the plug was forced out through the well screen into the surrounding formation. It is this pressure and vacuum which loosened any silt or fine sand particles remaining in the sand pack placed around the well screen.

This procedure was performed for a period of up to 15 minutes, at which time the plug and associated piping were removed from the well. A submersible well pump was then installed in the well, and the standing water within the well was pumped into a holding tank. Pumping of the well continued until either the water began to clear or the well went dry. At that time the plug was reinserted into the well and the process continued until no visible silt or fine sand was present in the collected water.

Upon completion of the addition well development, each well was pumped using a ten (10) gallon per minute (gpm) submersible pump to establish resultant yields. A summary of the new yields as compared to what was observed after the initial development is included in Table 3-2.

Review of the results indicated that the additional development resulted in increased yields in seven of the 10 recovery wells. Yields in recovery wells RW-2, RW-8 and RW-12 increased to the range of the modelled flow rates calculated during the RI/FS. Earth Tech conducted additional well efficiency tests using a variable speed pump to simulate actual operating conditions. These tests were conducted on the low yielding recovery wells to establish sustainable yields for recovery well pump design. Based upon the results of these tests, redesign of these recovery well pumps was conducted.

Since redesign of the recovery well pumps was required, NYSDEC approval was obtained for the newly specified recovery pumps. These recovery well pumps and control panels were obtained and installed at selected recovery wells with reduced yields upon receipt of NYSDEC concurrence.

3.4 Recovery Well Vault Construction

The recovery wells are housed within concrete recovery well vaults installed below grade. These vaults are placed on a gravel bed four feet below ground surface. The vaults contain a steel manhole and cover in order to protect the well from the elements. The well risers are cut off approximately six inches above the top of the gravel layer. The vaults contain junction boxes for the sensors, motor controllers and power lines associated with the recovery well system. Each wellhead is capped within the vault and the vaults include steel rungs for easy access. As-built drawings of the recovery well vaults are included in the as-built submittal.

3.5 Recovery Well Pumps

Recovery well pumps have been designed to maintain optimum recovery flow rate based upon groundwater elevation in each recovery well. The recovery wells are equipped with submersible pumps that have been sized according to expected yields and calculated head requirements. The recovery well pumps in RW-2, RW-8 and RW-12 are Grundfos Model pumps with capacities of up to 25 gpm at a total dynamic head (TDH) of 122 feet. Recovery well pumps installed in RW-1, RW-3, RW-4, RW-5, RW-6, RW-7, RW-9, RW-10, RW-11 and RW-13 were retrofitted with alternative pump heads to provide lower flow rates at the same TDH. All recovery well pumps were installed approximately three feet from the bottom of the recovery wells. The submersible pumps were attached to specified diameter hoses using pitless adaptors connected to the side of the well riser. The pitless adaptors are located within the recovery well vaults for access. The pumps have been suspended at the specified depths in the wells using steel cable.

Table 3-2

Recovery Well Development Summary
Miller Brewing Site
Volney, New York

Well #	Original Time Developed	Original Pumping Rate	Additional Time Developed	New Pumping Rate	Modelled Pumping Rate
RW-1	6 hours	<1 gpm	7 hours	<1 gpm	7 gpm
RW-2	4 hours	10 gpm	2 hours	12 gpm	2 gpm
RW-3	8 hours	1 gpm	10 hours	2 gpm	2 gpm
RW-4	8 hours	4.5 gpm	6 hours	4.5 gpm	10 gpm
RW-5	8 hours	5 gpm	none	5 gpm	10 gpm
RW-6	8 hours	1.5 gpm	none	1.5 gpm	10 gpm
RW-7	8 hours	1.5 gpm	none	1.5 gpm	10 gpm
RW-8	5 hours	10 gpm	2 hours	18 gpm	10 gpm
RW-9	14 hours	<1 gpm	8 hours	2 gpm	10 gpm
RW-10	4 hours	1 gpm	8 hours	1 gpm	15 gpm
RW-11	4 hours	1 gpm	8 hours	3 gpm	15 gpm
RW-12	4 hours	5 gpm	2 hours	14 gpm	15 gpm
RW-13	4 hours	1 gpm	8 hours	3 gpm	7 gpm

Variable speed motors are utilized to control the recovery flow rates based upon monitored groundwater elevation. The variable speed controllers are housed within the recovery well vaults for recovery wells RW-5, RW-10, RW-11 and RW-12. The controllers are housed in aboveground panels for recovery wells RW-1, RW-2, RW-3, RW-4, RW-6, RW-7, RW-8, RW-9 and RW-13. These controllers were mounted in aboveground units due to perched groundwater buildup in the recovery well vaults. The variable speed motors are controlled by a water elevation sensor to maintain the desired preset groundwater elevation in the well.

Recovery wells RW-6 and RW-7 were constructed separately since these wells are dual extraction wells. The dual extraction wells were constructed similarly to the other recovery wells; however, the housing was constructed with a sealed environment at the well head to allow for the required retrofitting for application of vacuum extraction. Separate details have been provided for construction of these recovery wells with the as-built submittal.

3.6 Underground Storage Tank Recovery System

The UST recovery system was constructed to recover perched groundwater and floating product present in the area of the former USTs. The USTs were being used as recovery points for floating product on a periodic basis in this immediate area. The dewatering of this area is required to ensure effective SVE system operation.

At the initiation of construction activities, two of the three USTs located in the southern operable unit were perforated and fitted with sumps for groundwater and floating product recovery. The third UST located in this area was accessed, perforated and fitted with a sump during the recovery well installation task. Submersible pumps with level switch controllers were installed in the UST sumps and piped to combine with the dual extraction well recovery lines. The UST recovery lines as well as the dual extraction recovery lines were constructed with secondary containment due to the potential presence of non-aqueous phase liquid (NAPL) in the recovered water. Submersible pumps with 10 gpm capacity at the required TDH have been installed to ensure the recovery system will dewater this area. Details of the UST recovery system are included with the as-built submittal.

SECTION 4
SOIL VAPOR EXTRACTION SYSTEM

The injection/withdrawal soil vapor extraction (SVE) system was installed to remediate soil contamination in the Southern Operable Unit. The area requiring remediation is complicated by the presence of four underground storage tanks (USTs) located in the area of contamination. Two previously existing monitor wells in this area were converted to dual extraction wells (RW-6 and RW-7). Six additional SVE wells were installed in strategic accessible locations. The SVE well locations, well construction details and underground piping runs are included with the as-built submittal. The injection/withdrawal system includes an extraction blower and injection blower in order to provide the required vacuum and injection air flow.

The SVE extraction well system installation included the following major components:

- SVE Well Layout
- SVE Well Construction
- Dual Extraction Well Construction

4.1 SVE Well Layout

Six SVE wells were installed in the immediate area surrounding the pre-existing USTs present in the southern operable unit area. The number of SVE wells and their locations were determined based upon previous remedial investigation data and a pilot study that was conducted at the site. The six SVE wells were installed to allow application of air flow across the delineated contaminated soil zone. Due to the tight constraints associated with the SVE system, SVE well locations were adjusted in the field to ensure the locations were accessible for piping runs and did not interfere with operations conducted in the building.

The installed SVE wells are manifolded to allow for use as withdrawal or injection wells. This design allows for operation flexibility over the SVE system.

4.2 SVE Well Construction

The SVE wells were installed based upon the vertical extent of contamination identified during previous investigations. The depth of the individual SVE wells was defined based upon the depth to the water table at each location. The SVE well screens were installed to account for the cone of depression anticipated to occur due to the recovery wells being installed in this area. The lowering of the groundwater elevation will expose additional soils for treatment using the soil vapor extraction system.

All SVE wells have been constructed as indicated on the SVE well construction details included with the as-built submittal. The SVE wells consist of two-inch Schedule 40 PVC screen (20 slot) and riser placed inside an eight-inch boring. The annular space around the screen is filled with coarse filter pack. The filter pack extends above the screen. Above the filter pack, the annular space has been filled with a cement-bentonite grout to the surface. The piping for the extraction wells passes through a well seal and connects to a PVC tee fitting which is connected to the vapor extraction piping leading to the treatment system.

4.3 Dual Extraction Wells

Recovery wells RW-6 and RW-7 have been retrofitted as dual extraction wells. These wells have been fitted with a sealing well head to allow for vacuum to be applied. The extracted air is directed through the riser using pitless adaptors to the vapor extraction recovery piping. These wells have both groundwater recovery and soil vapor extraction recovery piping runs installed in the trench extending from the USTs area to the Process Treatment Building. Details of the dual extraction wells are included in the as-built submittal.

4.4 SVE Piping Design

The six SVE wells are piped separately to the treatment system building allowing for control of the operation of each individual well. This system allows for total control of each individual SVE well including use of all wells as either withdrawal or injection. This approach also allows for air flow and pressure measurements to be collected from each well, as well as collection of individual air samples. Detailed locations of these piping runs and trench cross-sections are provided with the as-built submittal. Based upon the operating results of the system, well parameters are altered to ensure that the entire soil volume receives adequate treatment. The selected SVE system provides for maximum flexibility in the operation of the system optimizing the overall remediation of the contaminated soils.

SECTION 5
RECOVERY SYSTEM PIPING AND MANIFOLD

All outdoor piping including conduit for the recovery and treatment system, has been placed in underground trenches to prevent damage to piping due to freezing of the lines in cold weather. Groundwater recovery piping, soil vapor extraction piping, UST sump piping and discharge line piping are illustrated in the final as-built drawings. The piping routes were selected to minimize the required piping runs and potential disturbance to any future operations to be conducted at the Reynolds facility. The underground piping system was specified in the Division 2 Site Work of the project specification and includes the following major components:

- Recovery Line Trenching
- Discharge Line Trenching
- Manifold Details

5.1 Recovery Line Trenching

All of the recovery well and soil vapor extraction piping was installed in underground trenching. Eight of the recovery wells located in the Northern Operable Unit are manifolded within the air stripper building located at the facility. Check valves have been installed in the recovery well lines prior to the manifold and in the recovery well pumps to prevent potential backflow. The manifolded lines are then directed through underground trenching to the Process Treatment Building. There is one main trench which runs east to west from recovery well RW-4 to the air stripper building. An additional trench runs west to east from recovery wells RW-10, RW-11 and RW-12 to the air stripper building. A third trench runs north to south from recovery well RW-13 to the air stripper building. The manifolded line is a four inch diameter pipe installed in trenching running from the air stripper building to the Process Treatment Building in the southeast direction across the Reynolds property. The other five recovery wells and soil vapor extraction recovery lines are located in this main trench leading to the Process Treatment Building.

The piping trenches are approximately six feet deep and are lined with six-inches of sandy fill. The piping was placed on top of this sandy bedding. All piping has been installed at a minimum of four feet below grade to ensure the piping is located below the frost line for this region. Trenching follows the contours of the ground surface to maintain a constant upper pipe depth of four feet below grade.

The groundwater recovery piping for RW-6, RW-7 and the three UST sump pumps includes secondary containment due to the potential for NAPLs to be present in these recovery lines. Exposed recovery piping of RW-6, RW-7 and the UST recovery system includes heat tracing to prevent freezing in unheated areas of the Reynolds Can Plant.

Electrical supply lines to the sensors and pumps located in each well were run approximately six inches above the water lines. All disturbed areas have been backfilled and restored to their original condition. Details of trench construction are included with the as-built submittal.

5.2 Discharge Pipeline Trenching

The discharge line was installed in trenching that runs from the northwest corner of the Process Treatment Building west-southeast to the drainage culvert just east of Route 57. This line was installed as a force line which is pumped by a discharge pump from the effluent holding tank located within the Process Treatment Building. This pipeline has been installed to handle the maximum design flow (220 gpm). The pipeline from the Process Treatment Building runs to a manhole which discharges into the existing stormwater culvert just prior to crossing under County Route 57 to the Oswego River. This trench was installed similarly to the recovery well trenching; however, the pipe installed is six inches in diameter to accommodate the total system effluent flow. Details of the discharge pipeline are included with the as-built drawing submittal.

5.3 Manifold Details

The groundwater recovery and soil vapor extraction lines enter the Process Treatment Building through a common vault located within the Process Treatment Building. The recovery lines contain an electronic flow meter, ball valve, sampling port and an additional ball valve. The electronic flow meter supplies data on each well to the programmable logic controller (PLC). The ball valves allow for manual control of flow and provide ease of maintenance of the flow meters and sampling ports. The sampling ports are utilized to collect samples for analysis from each recovery well. Details of the manifold systems are included with the as-built submittal.

SECTION 6
TREATMENT PROCESS

6.1 Groundwater Treatment System

The groundwater treatment system process units are located inside the Process Treatment Building. The process units were installed based upon the approved remedial design. The volatile organics are removed from the water by using air stripping and activated carbon technologies.

The groundwater treatment system was installed based upon a maximum flow of 220 gpm and an average flow of 110 gpm. The actual recovery flow rate was determined during the startup period to be a monthly average of 64 gpm and a maximum monthly average flow of 72 gpm. The treatment system was constructed to meet the substantive requirements of the SPDES Permit.

The groundwater treatment system was installed with air stripping as the primary treatment and liquid phase activated carbon as the secondary treatment system. During the initial startup period of the groundwater treatment system, water samples from the influent and effluent of the air stripper and the liquid phase activated carbon system were collected and analyzed to establish air stripper removal rates, air stripper effluent quality and the liquid phase activated carbon effluent quality.

During the start-up period the overall treatment system effectively removed the recovered contaminants. An equipment layout plan within the Process Treatment Building illustrating the installed treatment system equipment is included with the as-built submittal.

The following subsections present descriptions of the installed process equipment for the groundwater recovery and treatment system.

6.1.1 Oil/Water Separator

The recovered groundwater from RW-6 and RW-7 and the UST recovery system is manifolded and directed to the oil/water separator with demulsifying system. The oil/water separator is designed to treat a maximum flow of 60 gpm. The actual flow realized from recovery wells (RW-6 and RW-7) is significantly less than anticipated (< 1gpm). This system provides for chemical addition for pH adjustment, physical separation of the resultant oils through a coalescing plate-type oil/water separator and final pH neutralization prior to combining with the other groundwater recovery flows. Recovered oil is directed to a separate holding vessel for off site disposal. The oil/water separator system includes an effluent tank that allows for pumping of the treated groundwater directly to the equalization tank.

6.1.2 Equalization Tank

The combined recovered groundwater and oil/water separator effluent is pumped to an equalization tank. This equalization tank provides equalization of flows and allows continuous operation of the groundwater recovery system with batch operation of the groundwater treatment system. The equalization tank is a 5,500 gallon HDPE tank that has provided a detention time of 1.4 hours at the average influent flow rate of 64 gpm.

6.1.3 Filtration System

The equalized recovered groundwater is pumped through a filtration system to remove silt and suspended solids. Four silt filters have been placed in parallel and in series to remove particulates greater than 10 microns. The filter units have been installed with hydraulic capacities at the maximum flow rate to allow bypassing one parallel train, if required. During initial recovery well installation, groundwater samples were collected and analyzed to establish particle size distribution of the suspended solids present in the recovered groundwater. Based upon this data, 25 micron and 10 micron filters have been installed in series to remove fines from the influent groundwater. The pre-filtration system has effectively removed fines recovered in the groundwater.

6.1.4 Sequestering System

Previous investigations and operation of the interim air stripper system revealed inorganic constituents of the recovered groundwater have the potential to adversely affect the overall efficiency of the treatment system. Concentrations of soluble magnesium and hardness have been detected at concentrations of concern. Based upon the previous experience with the interim air stripper and detected concentrations of inorganic constituents in the monitor wells, a sequestering agent system was installed.

The sequestering agent feed system is used to chemically treat the recovered groundwater prior to treatment with the air stripper. The sequestering system has been installed to sequester inorganic components within the recovered groundwater that may adversely affect the performance of the treatment system components. The sequestering system pumps the sequestering agent at a pre-determined flow rate. A chemical feed pump injects the sequestering agent from an aboveground storage vessel into the influent pipe just prior to the equalization tank. The detention time in the equalization tank ensures the sequestering agent is thoroughly in solution prior to entering the air stripper.

During the startup study, Earth Tech identified the optimum dosage (10 mg/L) for addition of sequestering agent (Diversey - GW 4040 - Acrylic Acid Polymer/Terpolymer Blend). The sequestering agent has effectively sequestered inorganic components of the groundwater stream to prevent interference with the operating systems.

6.1.5 Air Stripper

The influent groundwater is treated for volatile organics using a low profile tray air stripper. This type air stripper was installed due to its low profile, ease of maintenance and performance record relative to similar groundwater recovery and treatment applications. The air stripper has been designed to provide up to 99% removal of volatile organics with the exception of ketone components. The low profile air stripper installed for this system was the Shallow Tray Model 4124. This model can handle flows up to 300 gpm with a maximum of four trays. This skid mounted unit includes the stripper feed pump, blower and discharge pump. The air stripper blower has been designed to provide 2400 cfm at 38 inches of water. The air is drawn through the air stripper under vacuum and the offgas is directed through the inline heater and vapor phase activated carbon units. The air stripper water effluent is directed to liquid phase activated carbon for polishing and secondary treatment. The installed air stripper has effectively removed greater than 99% of the volatile organic components from the groundwater stream.

6.1.6 Vapor Phase Activated Carbon

The off gas from the air stripper and the soil vapor extraction system is directed to a vapor phase activated carbon system capable of treating the air flow and contaminants associated with the combined air stream. An in-line heater (Gaumer Model IPH-36) is also included to provide temperature control of the air stream to minimize condensation from forming in the vapor phase units; thereby, optimizing removal efficiency. The vapor phase activated carbon unit selected for the system consists of two Carbonaire (GPC-70) 10,000 pound units which are operated in series. These units were installed based upon the system flow rate and expected off gas contamination mass loadings. The vapor phase activated carbon system is designed to allow operation in series and with piping and valving to allow either unit to be operated in the lead or lag series position. Check valves have been installed in the piping system to eliminate potential bypassing of the vapor phase activated carbon system.

Due to the reduced flow realized by the recovery system, the vapor phase activated carbon system did not require change-out during the startup period (February through August 1997). Based upon the loadings to the system, breakthrough of the primary vapor phase activated carbon unit is anticipated after approximately six months of operation. The actual changeout event will be determined based upon vapor phase sampling results. Carbon change-outs will be conducted by the carbon vendor using on site service capabilities. The spent carbon is removed using a vacuum system and fresh activated carbon installed directly into the evacuated carbon vessel. This change-out procedure minimizes the required time to complete carbon change-outs. The spent activated carbon will be regenerated at an approved off site facility.

6.1.7 Liquid Phase Activated Carbon

The treatment system has been designed for the air stripper effluent to be pumped through a liquid phase activated carbon system. The liquid phase activated carbon provides polishing treatment of the air stripper effluent to ensure permit compliance is maintained if the air stripper performance is impeded and the liquid phase activated carbon also provides secondary treatment of the air stripper effluent due to compounds which are not readily removed with air stripping technology.

During initial recovery well installation, groundwater samples were collected and analyzed to establish the expected ketone components and concentrations in the recovered groundwater that required treatment. The sampling revealed ketones were not present in recovery wells. The liquid phase activated carbon units selected for this system consist of two Carbonaire (PC-50) 10,000 lb units which operate in series. These units were selected based upon the system flow rate and expected contaminant mass loadings. The liquid phase activated carbon system is designed with piping and valving to allow either unit to be operated in the lead or lag series position. Check valves have been installed in the piping to ensure no accidental bypass of the treatment units.

Based upon the results of the start-up study, the liquid phase activated carbon system is the optimum system for treatment of the resultant air stripper effluent stream. This was based upon the resultant components and concentrations of the air stripper effluent, carbon usage rates under actual operating conditions and effluent quality. The study revealed that the activated carbon units will provide the required polishing for the air stripper effluent. However, an alternative investigation will need to be conducted to evaluate applicability of the UST recovery system recovered water.

Due to the efficient removal of volatile organics by the air stripper, the liquid phase activated carbon units did not require change-out during the startup study. Liquid phase activated carbon change-outs will be conducted by the carbon vendor using on site service capabilities. The spent carbon is removed using a vacuum system and new activated carbon installed directly into the evacuated carbon vessel. This change-out procedure will minimize the required time to complete carbon change-outs. The spent activated carbon is then regenerated at an approved off site facility.

6.1.8 Effluent Holding Tank

The recovery and treatment system includes an effluent holding tank. The effluent holding tank is constructed of HDPE and provides a collection system to be used for potential required backwashing of the liquid phase activated carbon system and as a holding tank for discharge of the effluent to the discharge pipe. The effluent holding tank is 5,500 gallons in volume and provides approximately 1.4 hours of detention time at the average system flow rate. A discharge pump is included with the holding tank to pump the effluent to the discharge pipe which discharges the effluent to the Oswego River. The discharge pump installed provides a maximum flow of 220 gpm at the specified head to the discharge pipeline.

A separate backwash pump system has also been installed to provide backwashing of the liquid phase activated carbon using the treated effluent, if needed. The backwash pump is capable of discharging 400 gpm through each liquid phase carbon system as required to adequately backwash the system. The resultant backwash water is directed to the equalization tank and filtration system for reprocessing through the treatment system.

During the startup study, the liquid activated carbon system was backwashed on 7 April 1997 due to scaling. The backwash system effectively operated and provided reduced head loss through the liquid activated carbon system.

6.2 SVE System

The selected soil vapor extraction (SVE) system installed to remediate soil contamination in the Southern Operable Unit is an injection/withdrawal system. The area requiring remediation is complicated by the presence of four USTs located between the dual extraction recovery wells. Recovery wells RW-6 and RW-7 are used as dual extraction wells while six additional SVE wells were installed throughout the contaminated zone.

The injection/withdrawal SVE system was installed due to the following reasons:

- Injection/withdrawal SVE systems installed with a site cap promote lateral air flows between injection and withdrawal wells. Vacuum-only systems will draw air that travels laterally in the upper part of the vadose zone, not along the capillary fringe. The capillary fringe zone is typically the area with the highest concentration of contaminants. Injection/withdrawal systems provide air to subsurface soil through the injection wells. Air travels laterally from the injection well to the extraction well.

- All multi-well systems have nodes of little or no air flow between wells. Additionally, at this facility, the USTs will block air flow for much of the impacted soils. Optimum air flow control is maintained in injection/withdrawal systems due to the fact that air flows from the injection well to the withdrawal well. By switching wells between injection and withdrawal, air flows can be adjusted throughout the contaminated soil zones.

- By using pressurized injection, the pressure gradient differential is split between pressure and vacuum, decreasing the potential to breakthrough a well seal causing short-circuiting of air.

A SVE system drawing showing the major components of the installed injection/withdrawal system is included with the as-built drawings. The injection/withdrawal system includes an extraction blower and injection blower that provide the required vacuum and injection air flow. The injection blower is a positive displacement blower capable of applying 200 cfm at two and one-half pounds per square inch (psi). The withdrawal blower is a positive displacement blower capable of applying a flow of 200 cfm at five inches of mercury. A condensate trap has been included to collect moisture that will be extracted in the off gas. The collected condensate is pumped to the oil/water separator for treatment.

The off gas from the withdrawal blower is directed to the air stripper off gas line prior to the in-line heater of the vapor phase treatment prior to discharging through the common system stack. This piping configuration is presented in the as-built submittal.

SECTION 7

INSTRUMENTATION AND PROCESS CONTROL

The remedial system is controlled by an Allen Bradley SLC-5/03 Programmable Logic Controller (PLC) specifically designed for the components of the installed remedial system. The PLC provides sufficient computing power to control the current installed system and potential future upgrades or additions to the current system. The PLC has the ability to operate the groundwater recovery and treatment system and the SVE system independently. The PLC has on/off control of pumps and blowers and monitors flow rates in the system from a network of sensors. The instrumentation and process control system of the remedial system includes the following major components:

- SVE System Process Control
- Groundwater Recovery and Treatment System Process Control

Process and Instrumentation Design plans have been included with the as-built drawings illustrating the various process instrumentation and controls associated with the remedial system.

7.1 SVE Process Control

Instrumentation has been designed with the SVE system to provide on/off control of all system components as well as measurement of system parameters. Sensors have been installed to allow monitoring of pressure and air flow in the various vapor lines. The SVE system is controlled automatically by the same PLC as the groundwater recovery system to provide automatic shutdown of the entire system under identified fault conditions. The instrumentation design of the SVE system includes the following major components:

- Air Flow Controls
- Pressure and Vacuum Gauges
- Air Flow Meters
- Pressure Switches
- Sample Ports

7.1.1 Air Flow Controls

Air flow control of the SVE system is based upon the initial start-up study findings which has identified optimum air flow for the system. The optimum air flow for the system was identified and adjusted manually as necessary based upon monitoring results. Individual control of each SVE vent is adjusted manually as necessary to optimize the system. Air flow is measured in each SVE vent line to allow maximum flexibility operation of the system.

7.1.2 Pressure and Vacuum Gauges

Pressure and vacuum gauges have been installed in appropriate locations to allow adequate monitoring of the injection and withdrawal system. The gauges are designed to provide appropriate measurement of the anticipated pressure and vacuum ranges within each measured pipeline.

7.1.3 Air Flow Meters

Each injection/withdrawal line contains access ports to allow air flow monitoring. Air velocity is manually measured across the pipe. This enables monitoring of all air flow through the SVE system.

7.1.4 Pressure Switches

Pressure and vacuum switches have been included in the design to prevent damage to treatment units and/or maintain acceptable system operating conditions. Pressure switches are located on lines where the potential for excessive pressure build-up exists. Such a condition indicates a potential problem that must be addressed by the operator.

7.1.5 Sample Ports

Sample ports have been installed in each recovery line and the discharge of the withdrawal blower. These sample ports are designed to allow collection of gas samples for analysis to monitor the overall performance of the SVE system.

7.2 Groundwater Recovery and Treatment System Process Control

The instrumentation for the groundwater recovery and treatment system is controlled and monitored through the PLC. In case of automatic shutdown, the groundwater recovery and treatment system requires manual restart before operation may resume. The instrumentation of the groundwater recovery and treatment system includes the following major components:

- Air Flow Controls
- Pressure Gauges and Switches

- Level Switches
- Sampling Ports

7.2.1 Air Flow Controls

Air flow control of the groundwater recovery and treatment system is applied by the air stripper blower which pulls air through the air stripper and discharges this air to the in-line heater and vapor phase activated carbon units. This blower applies the required flow rate necessary to volatilize the contaminants in the water stream and the blower has the capacity to discharge the contaminated air stream through the vapor phase activated carbon units. In addition, the discharge from the SVE blower is directed to combine with the air stripper off gas prior to entering the in-line heater and vapor phase activated carbon units. Automated flow control check valves have been incorporated to prevent potential backflow of these air streams. The PLC system allows a time delay shutdown of the air stripper blower to ensure proper treatment of the water flow being processed through the air stripper occurs during any shutdown.

7.2.2 Pressure Gauges and Switches

Pressure gauges have been installed on the outlet of every pump in the system. All gauges have been sized for the appropriate pressure range associated with each pump. Pressure switches have been installed in tandem, with all pressure gauges. A pressure switch is located immediately upstream of the liquid phase activated carbon unit and the filtration unit to allow shutdown if excessive pressure build-up occurs. All pressure switches have been set to an acceptable pressure in order to protect downstream units.

7.2.3 Flow Meters

The groundwater recovery and treatment system has been fully equipped with flow meters. The flow meters are capable of supplying an electronic signal to the PLC. The PLC then converts the signal into a flow rate and maintains a totalized flow for that stream. All flow meters have been installed in the correct housing to ensure accuracy of the flow rate. Totalizers have been included with all flow meters to allow continuous monitoring of all system flows.

7.2.4 Level Switches

All tanks and sumps are equipped with level switches. Three switches have been installed in the equalization tank and the effluent holding tank. These switches in each tank designate low level, high level and high alarm level. The low and high level switches perform on/off manipulation of the downstream pump. The high alarm switch locks out the preceding pump or pumps and signals a fault alarm that shuts down the required components of the system.

7.2.5 Sampling Ports

Water sampling ports have been installed before and after all treatment units in the groundwater recovery and treatment system. Air sampling ports have been installed in the vapor phase treatment system to allow collection of gases, for analysis, to monitor the effectiveness of the system.

SECTION 8
REMEDIAL SYSTEM OPERATION

Upon completion of construction of the remedial system, a start-up operation period was conducted to demonstrate consistent conformance with the performance goals of the design. This start-up period was conducted for a total of six months (February - August 1997). Upon completion of the startup study, continued operation, maintenance, and monitoring (OM&M) of the remedial system has been performed. This section presents a summary of the monitoring performed at start-up to demonstrate the effectiveness of the Reynolds Can Plant remedial system as well as the continued operation, maintenance and monitoring requirements.

A complete O&M Plan has been developed and is included with this Final Engineering Report submittal as a separate stand-alone document. The O&M Plan includes detailed maintenance and monitoring procedures and conforms with the requirements of the NYSDEC guidance memorandum for operation and maintenance programs at remediated sites.

A Contingency Plan has been developed and is included with this Final Engineering Report submittal as a separate stand-alone document. The Contingency Plan outlines the procedures to be conducted if the remedial system fails to achieve any of the remediation goals of the ROD.

8.1 Groundwater Recovery System

The groundwater recovery system has been installed and is operating at the Reynolds Can Plant site to mitigate off-site migration of overburden groundwater contamination from the Northern and Southern Operable Unit groundwater plumes. A discussion of the pertinent operational requirements, as well as the monitoring activities conducted during the start-up period and to be continued during the post start-up period, are presented below.

8.1.1 Recovery System Operation

The basis for construction of the groundwater recovery system is presented in Section 3. As discussed, collection of contaminated groundwater in the Northern and Southern Operable Unit groundwater plumes is effected through continuous pumping of the 13 groundwater recovery wells (i.e. nine wells in the Northern Operable Unit groundwater plume and four wells in the Southern Operable Unit groundwater plume). The recovery wells are comprised of six inch diameter wells with stainless steel screens and Schedule 80 PVC riser pipes fitted with submersible pumps. The well pumping rate is maintained through a programmable logic controller (PLC) that regulates flows from the pumping wells by adjusting the variable speed pump motors based upon relative groundwater elevations, which are measured via pressure transducers at the bottom of each recovery well. The groundwater recovery system during the startup period resulted in an average total recovery flow of 64 gpm.

A summary of the average recovery flows from each recovery well to the treatment system for the six month start-up period is presented in Table 8-1. Appendix C presents a complete summary of monthly recovery well flows from each recovery well operated during the startup period. The PLC system provided totalizer flows for each recovery well allowing continuous monitoring of flow rates over time.

During the six month startup period, approximately 16 MGD of groundwater was recovered and treated by the groundwater recovery and treatment system. The average daily flow of the recovery system over this period was 64 gpm. This average flow is lower than designed due to lower recovery flow rates realized in individual recovery wells. These reduced flow rates were indicative of the aquifer characteristics in the area of each recovery well. High variability was realized in the yield of each recovery well across the site ranging from 0.11 gpm to 20.41 gpm.

8.1.2 Recovery System Monitoring

Monitoring of the groundwater recovery system was conducted throughout the startup period to evaluate the effectiveness of the system in recovering the contaminated groundwater in the Northern and Southern Operable Unit groundwater plumes. Due to the limited operating period of the recovery system to date, an initial evaluation has been conducted to establish the effectiveness of the current operating system to recover the contaminant plumes. This evaluation will continue ongoing throughout the long term operating period as the continued operation of the recovery system continues to impact overall groundwater quality at the site.

Monitor wells on site and on the City of Fulton property are currently sampled on an alternating monthly schedule. The data from the analysis of the samples collected at these wells prior to and during operation of the recovery system will be used to assess the impact to water quality immediately upgradient of and within the cone of influence of municipal wells M-2/K-2 and K-1.

Sampling at monitor well locations to supplement the Early-Warning Network sampling locations were performed to monitor the effectiveness of the remedial system. The supplemental monitor well sampling locations are listed in Table 8-2. The data collected at these wells, in addition to the Early-Warning Network monitoring well data, was used to assess the effectiveness of the groundwater recovery system. Water level monitoring at the monitoring and recovery wells, and recovery well flow rate monitoring, also generated data to aid in this assessment.

The sampling and water level monitoring tasks were performed on a frequent basis during the start-up period to allow evaluation of the recovery system's affect on the contaminated aquifer. The frequency of the data collection tasks decreased after the start-up period was concluded. The monitor well locations where water level data were collected are listed in Table 8-3. The frequency of water level monitoring, the frequency of sampling (during the start-up and post start-up periods), and the analytical methods are presented in Table 8-4.

TABLE 8-1
MILLER GROUNDWATER TREATMENT SYSTEM
SUMMARY OF RECOVERY WELL FLOWS

WELL ID	FEBRUARY 1997 TO AUGUST 1997
RW-1	0.10 gpm
RW-2	20.41 gpm
RW-3	0.26 gpm
RW-4	1.36 gpm
RW-5	2.30 gpm
RW-6	0.11 gpm
RW-7	0.69 gpm
RW-8	18.64 gpm
RW-9	0.75 gpm
RW-10	0.54 gpm
RW-11	1.70 gpm
RW-12	13.92 gpm
RW-13	1.01 gpm
Total Recovered	15,957,500 gallons

TABLE 8-2

MILLER BREWING COMPANY
REYNOLDS CAN PLANT SITE REMEDIATION

SUPPLEMENTAL MONITOR WELL SAMPLING LOCATIONS
DURING START-UP PERIOD

EVEN MONTHS	ODD MONTHS
MW-36S*	MW-32D
MW-37I*	MW-33S
MW-38S*	MW-35D
MW-47S*	MW-62I*
MW-48S*	MW-63I*

CITY OF FULTON WTF EARLY WARNING MONITOR WELL
SAMPLING LOCATIONS

EVEN MONTHS	ODD MONTHS
MW-8I	MW-10I
MW-8D	MW-13D
MW-9D	MW-14D
MW-17D	MW-15D
MW-31I	MW-21S
MW-38S	MW-25S
MW-51I	MW-25D
MW-51D	MW-46S
MW-53I	MW-46D
MW-54I	MW-49I
MW-56D	MW-49D
MW-60D	MW-50I
MW-61D	MW-60I

NOTE: Unless Otherwise designated, the samples will be analyzed for USEPA Methods 601/602 plus xylenes.

* - USEPA Method 624

TABLE 8-3

MILLER BREWING COMPANY
WATER LEVEL MONITORING POINTS
FOR EACH RECOVERY WELL

RW-1	RW-2	RW-3	RW-4	RW-5	RW-6 & RW-7
MW-7D	MW-11S	MW-1S	MW-38S	MW-6S	MW-36S
MW-8I	MW-11D	MW-1D	MW-38D	MW-6I	MW-36D
MW-8D	MW-12S	MW-2S	MW-62S	MW-6D	MW-47S
MW-16D	MW-12D	MW-2D	MW-63S		MW-48S
MW-17D	MW-16D	MW-3S			
MW-19D		MW-3D			
MW-20D		MW-4S			
MW-41S		MW-4D			
MW-61D					
RW-8	**RW-9**	**RW-10**	**RW-11**	**RW-12**	**RW-13**
MW-37S	MW-12S	MW-21S	T-2	MW-14S	MW-15D
MW-37I	MW-12D	MW-21D	T-3	MW-14D	MW-51I
MW-37D	MW-53S	MW-33S	MW-34D	MW-18S	MW-51D
MW-39S	MW-53I			MW-55D	MW-56D
MW-39I					
MW-40S					
MW-54S					
MW-54I					
MW-54D					

TABLE 8-4

MILLER BREWING COMPANY
REYNOLDS CAN PLANT SITE REMEDIATION

GROUNDWATER RECOVERY SYSTEM MONITORING PROGRAM
START-UP PERIOD

Location	Parameter(s)	Frequency
Water Quality Monitoring		
Early Warning Monitoring Wells	EPA Method 601/602, plus xylenes	Alternating Monthly (See Table 8-1)
Municipal Wells (K-1, K-2 & M-2)	EPA Method 502.2	Monthly
Supplemental Monitoring Wells	EPA Method 601/602, plus xylenes (all wells) 624 (select wells)	Alternating Monthly (See Table 8-1)
Recovery Wells (Except RW-6, RW-7, RW-8 & RW-9)	EPA Method 601/602 plus xylenes	Bi-weekly
RW-6 & RW-7	EPA Method 624, Oil & Grease	Bi-weekly
RW-8 & RW-9	EPA Method 624	Bi-weekly
WTF Influent & Effluent*	EPA Method 502.2	Weekly
Water Level Monitoring		
Recovery Wells	Water Level Elevation	Weekly
Monitoring Wells (See Table 8-2)	Water Level Elevation	Weekly
Flow Rate Monitoring		
Recovery Wells	Flow Rate (gpm)	Daily

* Effluent monitoring was conducted for 24 consecutive "compliant" weeks as per the substantive requirements of the SPDES permit.

TABLE 8-4 (Continued)

MILLER BREWING COMPANY
REYNOLDS CAN PLANT SITE REMEDIATION

GROUNDWATER RECOVERY SYSTEM MONITORING PROGRAM
POST START-UP PERIOD

Location	Parameter(s)	Frequency
Water Quality Monitoring		
Supplemental Monitoring Wells	EPA Method 601/602, plus xylenes, EPA Method 624 (select wells), Eh, pH, Temperature, Turbidity, Specific Conductivity	Semi-annually
Recovery Wells (Except RW-6, RW-7, RW-8 & RW-9)	EPA Method 601/602, plus xylenes, Eh, pH, Temperature, Turbidity, Specific Conductivity	Semi-annually
RW-6 & RW-7	EPA Method 624, plus xylenes, Eh, pH, Temperature, Turbidity, Specific Conductivity	Semi-annually
RW-8 & RW-9	EPA Method 624, plus xylenes, Eh, pH, Temperature, Turbidity, Specific Conductivity	Semi-annually
Early Warning Monitoring Wells	EPA Method 601/602, plus xylenes	Alternating Monthly (See Table 8-1)
Municipal Wells (K-1, K-2 & M-2)	EPA Method 502.2	Monthly
WTF Influent & Effluent*	EPA Method 502.2	Monthly
Water Level Monitoring		
Early Warning Monitoring Wells	Water Level Elevation	Monthly
Supplemental Monitoring Wells	Water Level Elevation	Monthly
Recovery Wells	Water Level Elevation	Monthly
Flow Rate Monitoring		
Recovery Wells	Flow Rate (gpm)	Daily

* Effluent monitoring was conducted for 24 consecutive "compliant" weeks as per the substantive requirements of the SPDES permit.

The samples were analyzed for the parameters on the USEPA Methods 601/602 lists, plus xylenes. In addition, select monitoring wells (Table 8-2) were analyzed for the compounds on the USEPA Method 624 list due to the potential for ketone compounds to be present. Groundwater flow rates were monitored through the PLC system by metering the discharge lines from each pumping well. The daily production rates were continuously recorded by the PLC system.

During the start-up period, groundwater elevations were recorded on a weekly basis at each of the monitoring well locations identified in Table 8-3 to monitor the transient effects of pumping and to verify the effectiveness of the collection system in meeting the performance goals for drawdown and plume containment. These data was used to conduct capture analysis as part of this remedial performance evaluations (Section 9). After the start-up period, the water levels are being collected on a semi-annual basis, and the data will be summarized as part of the annual monitoring report to be submitted to NYSDEC.

Groundwater sampling during the start-up period included the collection of the combined treatment process influent. Additionally, a minimum of one round of samples was also collected from the discrete pumping wells every two weeks during the start-up period. These samples were analyzed for the USEPA Methods 601/602 volatile organics, plus xylenes, to determine the relative contribution of each pumping well to the overall VOC loading observed at the influent of the plant. Samples from recovery wells RW-6, RW-7, RW-8, and RW-9 were also analyzed for the USEPA Method 624 parameters to provide data on ketones.

After the start-up period, the groundwater monitoring program was modified to include semi-annual sampling of the designated supplemental monitoring wells on Table 8-2, semi-annual sampling at each recovery well, and alternating monthly sampling of Early-Warning Network monitoring wells. Municipal well sampling and City of Fulton WTF influent and effluent sampling will continue to be performed monthly for the parameters included on the USEPA Method 502.2 list.

Field parameters were measured by sampling personnel using portable field instruments. The remaining parameters were analyzed by an independent, NYSDOH Environmental Laboratory Approval Program (ELAP) certified analytical laboratory. Sampling from the recovery wells was performed by filling laboratory-supplied bottles at the influent line sample taps. Groundwater sampling at the monitoring well locations was performed by using dedicated bailers.

Quality Control (QC) samples that were analyzed during each semi-annual groundwater monitoring event include:

- Trip Blank
- Method Blank
- Blind Duplicate

8.2 Groundwater Treatment System

The groundwater treatment system was installed at the Reynolds Can Plant site to reduce contaminant loadings in the collected groundwater to concentrations suitable for discharge to the Oswego River. A discussion of the startup study operations as well as the maintenance and monitoring activities for the system is presented below.

8.2.1 Treatment System Operation

The groundwater treatment system startup study initiated operation on 26 February 1997. The system was initially started with 11 recovery wells in operation. Recovery wells RW-6 and RW-7 were not initiated until the oil/water separator was ready for operation. The full groundwater recovery system was in operation in May 1997. The groundwater recovery system was operated on a continuous basis while the groundwater treatment system was initially operated on a batch basis due to the reduced recovery flows and then operated continuously upon realization of the full recovery flow. The average monthly flow through the treatment system was 64 gpm. The total volume of groundwater treated over the startup study was approximately 16 MGD. Appendix D presents a summary of groundwater flows recovered and treated over the startup study.

The groundwater recovery system was shut down on three occasions. The first shutdown occurred due to an effluent sample revealing a concentration of MEK above discharge criteria. The system was restarted once the cause for the exceedance was identified and corrected. An additional shutdown was realized when an oil and grease result exceeded discharge criteria. This was realized during startup of the oil/water separator and was corrected by pumping the oil/water separator effluent into a separate holding tank for analysis prior to adding to the total system influent. Once the oil/water system was fully operational, the system was operated on a continuous basis without recurring exceedances.

An additional shutdown was realized in July 1997 due to a power failure at the Miller Brewing facility. A temporary power supply was obtained from the Reynolds Plant until a separate power line could be run from the local power company. This system was shutdown for a period from 2 July 1997 through 16 July 1997. Currently the Process Treatment Building is operating on a completely separate direct power supply from the local utility. Power failures related to the Miller Brewing Substation will not impact the remedial system in the future.

8.2.2 Treatment System Monitoring

Monitoring of the groundwater treatment system was conducted to demonstrate compliance with regulatory requirements associated with operation of the system (i.e., substantive requirements of the SPDES permit), to assist in the ongoing evaluation of the effectiveness of the system in remediating the collected groundwater, and to refine the degree and frequency of routine maintenance needs. A log of the pertinent groundwater treatment system operating variables (e.g., flow rates, air stripper exhaust pressure, upstream and downstream pressures in the filter vessels and activated carbon beds, and other general observations) was developed during the start-up period and is maintained on file in the Process Treatment Building throughout the remediation period. System operating variables are recorded in this log on a daily basis.

Treatment system performance has been demonstrated through the collection and analysis of samples at various locations within the process train. A summary of the treatment system monitoring program is presented in Table 8-5. During initial startup, the treatment system was operated on a batch basis to demonstrate that the treatment system effluent complied with the substantive requirements of the SPDES permit. The system effluent tank allowed sampling and analysis of the treated effluent prior to initial discharge to the Oswego River. Earth Tech utilized expedited turnaround of these initial samples to confirm the effectiveness of the treatment system and compliance with the substantive requirements of the SPDES permit.

During the first two weeks of start-up, daily samples for Method 624 VOCs, plus xylenes, were collected at the influent of the system to provide information on the treatment system influent quality and to allow for a comparison with the system effluent. Samples for iron, manganese, and hardness were also collected during this period. After the initial startup, the influent sample collection frequency was reduced to weekly events until the start-up demonstration period was complete. VOC samples were also collected from the stripper effluent and the final process effluent line during the start-up period at the same frequency as the process influent sampling to monitor the VOC removal efficiency of the air stripper and liquid-phase activated carbon, respectively. Samples from the oil/water separator effluent were also collected and analyzed for oil and grease during the separate start-up of this treatment unit.

As per the substantive requirements of the SPDES permit, 24 weekly samples of the effluent were collected. Following the 24 weekly samples, a monthly sampling of the treatment system effluent was performed to demonstrate compliance with the substantive requirements of the SPDES permit. Monthly sampling for VOCs at the influent of the treatment process was also conducted to provide an ongoing evaluation of the effectiveness of the system.

Due to the reduced loadings to the vapor phase activated carbon units, collection of air emission samples was based upon calculated breakthrough of the carbon units. A mass balance calculation, using the stripper influent concentrations minus the effluent concentrations, was used to estimate the VOC loading to the vapor phase activated carbon. At 80 percent of the estimated carbon capacity, monthly samples of the vapor phase activated carbon effluent were collected until breakthrough was observed. When the primary activated carbon unit is exhausted, the secondary vapor phase carbon unit will be utilized and the primary activated carbon unit will be replaced.

After the start-up period, the monthly water samples collected from the stripper effluent and final process effluent were used to determine when the liquid-phase activated carbon is nearing exhaustion (based on loading calculations). During the startup study, the air stripper effluent samples revealed essentially 100% removal of VOCs through the stripper; therefore, an ongoing monitoring program was not required for the liquid phase activated carbon units during this

TABLE 8-5
MILLER BREWING COMPANY
REYNOLDS CAN PLANT SITE REMEDIATION

TREATMENT SYSTEM MONITORING PROGRAM
START-UP PERIOD

Monitoring Activity	Location	Parameter	Frequency
Groundwater Sampling	System Influent	Iron Manganese Hardness EPA Method 624 VOCs, plus xylenes Oil and Grease	Daily until sequestering agent dosage was optimized
	Stripper Effluent	EPA Method 624 VOCs, plus xylenes	Daily*
	Final effluent	EPA Method 624 VOCs, plus xylenes Oil & Grease Iron Copper Zinc pH Temperature Turbidity Eh Specific Conductivity	Daily*
Air Monitoring	Between Primary and Secondary Units Vapor Phase System Discharge	EPA Method 601/602 plus xylenes	Based upon loading calculations

* - Reduced to weekly after first two weeks.

TABLE 8-5 (Continued)

MILLER BREWING COMPANY
REYNOLDS CAN PLANT SITE REMEDIATION

TREATMENT SYSTEM MONITORING PROGRAM
POST START-UP

Monitoring Activity	Location	Parameter	Frequency
Groundwater Sampling	System Influent	EPA Method 624 VOCs, plus xylenes	Monthly
	Stripper Effluent	EPA Method 624 VOCs, plus xylenes	Monthly
	Final Effluent*	EPA Method 624 VOCs, plus xylenes Oil & Grease	Monthly

* 24 weekly samples were collected to confirm compliance with the substantive requirements of the SPDES Permit.

period. Air monitoring of the treated discharge was conducted during the start-up period to demonstrate compliance with the emissions limits. This monitoring program consisted of collection of offgas samples from the soil vapor extraction system, stripper offgas and the vapor phase activated carbon system. Samples were collected using tedlar bags and forwarded to an analytical laboratory for analysis.

All samples collected across the treatment system were collected as single grab samples from sample ports on the appropriate process lines or tanks. Sampling was conducted in a manner such that the collected samples will be representative of normal treatment process operation. All samples were analyzed by a New York State Department of Health ELAP-certified laboratory. Table 8-6 identifies the parameters, methods, method references, detection limits, holding times, preservatives, and container specifications for analysis of the treatment system samples.

8.3 Soil Vapor Extraction System

The soil vapor extraction (SVE) system was installed at the Reynolds Can Plant site to remediate overburden soils beneath the southern portion of the Can Plant building (i.e., the Southern Operable Unit soils) to below the soil cleanup goals. A description of the operation, maintenance, and monitoring for the SVE system is presented below.

8.3.1 SVE System Operation

The SVE system was designed to operate on a continuous basis with the goal of remediating the Southern Operable Unit soils within one year. Eight SVE wells were installed to apply the required vacuum to the subsurface soils. Pumping wells RW-6 and RW-7 are dual purpose wells, serving as both vacuum extraction and groundwater recovery wells. Withdrawn air is pulled through the air/water knock-out tank and directed to the vapor phase treatment system.

8.3.2 SVE System Maintenance

SVE system maintenance consists of routine maintenance of the air/water separator discharge pump and the blower in accordance with the manufacturer's recommendations. Periodic cleaning of the air/water separator tank, particularly the entrainment separator, was necessary to remove scale build-up. In addition, the exit piping from the air/water separator tank was disconnected and the entrainment separator examined on a monthly basis. Vacuum and sample ports are routinely checked to make sure they are free of dirt and/or scale, and cleaned or replaced as necessary. Any vacuum leaks in exposed portions of the system are repaired as soon as they are detected.

8.3.3 SVE System Monitoring

Monitoring of the SVE system was conducted to assist in evaluating the effectiveness of the system in remediating the Southern Operable Unit soils, and to demonstrate conformance with air emissions limits. A log of the pertinent SVE system operating variables, including air flow

TABLE 8-6

MILLER BREWING COMPANY
REYNOLDS CAN PLANT SITE REMEDIATION

ANALYTICAL METHODS AND PROTOCOLS FOR TREATMENT AND RECOVERY SYSTEM GROUNDWATER SAMPLING

Parameter	Method	Method Reference	Holding Time	Preservation	Container
Volatile Organic Compounds Xylenes	601/602 624	(1)	7 days	4 drops concentrated HCL, Cool at 4°C	2-40 ml glass vials w/teflon lined septa
Iron Manganese Copper Zinc	200.7 200.7 200.7 200.7	(1) (1) (1) (1)	180 days 180 days 180 days 180 days	HNO_3 to pH <2 HNO_3 to pH <2 HNO_3 to pH <2 HNO_3 to pH <2	1-1 liter polyethylene bottle
Hardness Oil and grease	130.1 413.1	(1)	6 months 26 days	HNO_3 to pH <2 H_2SO_4 to pH <2 @ 4_0C	1-500 ml polyethylene bottle 1-1 liter glass bottle
pH, Temp, Turbidity, Eh, Specific Conductivity	Field	NA	(2)	None	1-500 ml polyethylene bottle

Notes/References:

(1) 40 CFR Part 136; Chemical Analysis of Water and Wastewater, EPA 600/4-49-020, Rev. March 93.

(2) Conduct test immediately following collection of samples.

rates from each wellhead, the applied vacuum at each wellhead and piezometer, and the vacuum and flow rate across the blower will be established during the start-up period and is maintained on file in the treatment building throughout the operating life of the SVE system. The operating variables are recorded on a daily basis and whenever samples are collected. A summary of the SVE system monitoring program is presented in Table 8-7.

During the first week of SVE system start-up, individual vapor samples were collected from the well heads at RW-6 and RW-7 and analyzed for USEPA Methods 601/602 VOCs, plus xylenes, at a minimum of once per day during the first week of start-up. The degree of vacuum was adjusted during start-up by regulating the bleed valve until the SVE system is optimized (i.e., the point at which maximum VOC removals and maximum vacuum at the well heads is achieved at the lowest vacuum applied at the blower). After the first week of start-up, air samples were collected from each wellhead and analyzed for the same VOCs included above on a weekly basis for the remainder of the start-up period. These samples were extracted from the sample ports using tedlar bags and will be collected in duplicate. These samples were analyzed at an off-site New York State Department of Health ELAP-certified laboratory for VOC analyses in accordance with USEPA Method TO-14.

After the start-up period, tedlar bags samples were collected from the wellhead and on a monthly basis and analyzed for the Method 601/602 VOCs, plus xylenes, in accordance with USEPA Method TO-14. This provided an indication of the degree to which the soils have been remediated as well as a means for monitoring loadings to the vapor phase treatment system. SVE system operating variables are recorded on a daily basis.

8.4 Hazardous Waste Residuals

Groundwater treatment operations may generate hazardous waste residuals as a result of the separation processes incorporated in the treatment system and regular maintenance operations. These potentially may included:

- silts/sludges from filters;
- pre-filtration system components;
- oil/sludge from the oil/water separator; and
- disposable personal protective equipment such as gloves, tyvek, etc..

The wastes generated at the site were stored in 55-gallon drums inside the treatment building prior to off-site disposal. These activities complied with applicable State and Federal regulations concerning permitting, accumulation, recordkeeping and reporting for small quantity generators (SQGs).

TABLE 8-7

MILLER BREWING COMPANY
REYNOLDS CAN PLANT SITE REMEDIATION

SVE SYSTEM MONITORING PROGRAM

Monitoring Activity	Locations	Parameter	Frequency
Startup:			
Air Sampling and Analysis with On-Site GC	SVE well heads	See Note 1	Daily for first week
	Extraction Blower Discharge	See Note 1	Daily for first week
Air Sampling with Tedlar Bags	SVE well heads	See Note 1	Weekly
	Extraction Blower Discharge	See Note 1	Weekly
Post Start-Up:			
Air Sampling with Tedlar Bags	SVE well heads	See Note 1	Monthly
	Extraction Blower Discharge	See Note 1	Monthly
Note 1 - Method 601/602 VOCs, plus xylenes			

8.4.1 Accumulation and Storage

Any hazardous wastes generated from the treatment process are stored within the confines of the treatment building, which is designed to provide adequate secondary containment in the event of a leak or tank/drum rupture. Additionally, the specific labelling and storage requirements for the hazardous waste containers, as well as the minimum preparedness and prevention measures were used to address contingency situations relative to the hazardous waste.

8.4.2 Recordkeeping and Reporting

Complete recordkeeping and reporting requirements relative to the treatment facility, including manifesting and labelling waste shipments and preparation of annual generators reports are monitored at the treatment facility. The annual generators report (6NYCRR Part 372.2 (c)(2)) present an inventory of the types and quantities of hazardous wastes released from the facility and are required by March 1st of the following calendar year. Waste manifests are also completed for each shipment of hazardous waste sent off-site, and the appropriate copies are distributed. Signed copies are retained at the facility for a minimum of three years after shipment. Prior to shipment, a waste profile for each waste type is obtained. Each container/drum is labelled in accordance with U.S. Department of Transportation (USDOT) and NYSDEC requirements and so certified on the manifest form.

SECTION 9
REMEDIAL SYSTEM PERFORMANCE

This section describes the overall remedial system performance during the six month startup period. Based upon the monitoring data collected during the startup study as described in Section 8, the remedial system's overall ability to recover and treat site contaminants is discussed.

9.1 Groundwater Recovery System

Earth Tech installed and operated 13 recovery wells across the site to recover the contaminants of concern identified in the Reynolds Can plant aquifer. Earth Tech monitored groundwater recovery flow and concentrations of contaminants over the 6 month startup period from each recovery well and the equalization tank of the treatment system. Table 9-1 presents the groundwater monitoring results for each of the recovery wells over the startup period. The initial sample results presented in this table were collected during initial recovery well development. These results were used to confirm the expected type and concentrations of contaminants from each recovery well. Based upon these initial results, it was determined that the originally designed groundwater treatment system was capable of treating the recovery well constituents to the required effluent quality. The monitoring results from the recovery wells provide insight into the types and concentrations of contaminants being recovered from each individual recovery well. The data also presents any variations in recovery well concentrations over the startup period.

Earth Tech developed plots of concentrations over time for each of the recovery wells. These plots are included in Appendix E. These plots provide any indication of the fluctuations in contaminant concentrations over time since startup of the groundwater recovery system.

Table 9-2 presents a summary of the average concentrations of contaminants (ug/L) and mass loadings (lbs/day) of volatile organics recovered in each recovery well over the six month startup period. These concentrations and loadings indicate the types and levels of contaminants being recovered by each recovery well in each Operable Unit. The two recovery wells with the greatest yield, recovery wells RW-2 and RW-13, are recovering the greatest mass of contaminants.

The main contaminant recovered by the recovery well system was 1,1,1-trichloroethane (TCA). Other contaminants recovered from the aquifer included tetrachloroethene (PCE), cis-1,2-dichloroethene (cis-1,2-DCE), 1,1-dichloroethene (1,1-DCE) and 1,1 -dichloroethane (1,1-DCA). TCA, PCE and cis-1,2 DCE were the primary contaminants recovered from the Northern Operable Unit and TCA, cis-1,2 DCE and oil and grease were the primary contaminants recovered from the Southern Operable unit. These recovered contaminants are consistent with the documented contaminants delineated during the RI/FS and addressed in the Remedial Design.

TABLE 9-1
SUMMARY OF GROUNDWATER SAMPLING RESULTS – RECOVERY WELLS

	Benzene	Chloro-form	1,1,-DCA	1,1-DCE	c-1,2-DCE	Ethyl-benzene	Methylene Chloride	PCE	Toluene	1,1,1-TCA	TCE	Vinyl Chloride	Acetone	MEK	MIBK	O/G
	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	mg/L
RW-1																
18-Jul-96	<5	<5	<5	<5	<5	<5	<10	<5	<5	<5	<5	<5	<10	<10	<10	NA
20-Feb-97	<5	<5	<5	<5	<5	<5	<10	<5	<5	<5	<5	<5	<10	<10	<10	NA
05-Mar-97	<1	<1	2.1	3.9	1.1	<1	<1	8.4	<1	12	<1	<1	NA	NA	NA	NA
19-Mar-97	<1	<1	1.9	3.5	<1	<1	<1	8.9	<1	9.6	<1	<1	NA	NA	NA	NA
16-Apr-97	<1	<1	4.1	6.9	1.7	<1	<1	16	<1	21	<1	<1	NA	NA	NA	NA
30-Apr-97	<1	<1	2.7	4.7	1.1	<1	<1	10	<1	16	<1	<1	NA	NA	NA	NA
RW-2																
18-Jul-96	<5	<5	15	33	<5	<5	<10	<5	<5	80	<5	<5	<10	<10	<10	NA
20-Feb-97	<5	<5	52	<5	170	<5	<10	<5	<5	260	<5	<5	<10	<10	<10	NA
05-Mar-97	<5	<5	53	65	130	<5	<5	<5	<5	230	<5	<5	NA	NA	NA	NA
19-Mar-97	<5	<5	29	58	100	<5	19	6.5	<5	200	<5	<5	NA	NA	NA	NA
02-Apr-97	<5	<5	22	33	68	<5	5.6	13	<5	120	<5	<5	NA	NA	NA	NA
16-Apr-97	<5	<5	22	35	59	<5	6.8	18	<5	130	<5	<5	NA	NA	NA	NA
30-Apr-97	<10	<10	16	32	46	<10	<10	19	<10	110	<10	<10	NA	NA	NA	NA
RW-3																
18-Jul-96	<50	<50	<50	290	<50	<50	<50	740	<50	1300	80	<50	<100	<100	<100	NA
20-Feb-97	<50	<50	100	300	410	<50	<50	2200	<50	1800	100	<50	<100	<100	<100	NA
05-Mar-97	<20	<20	78	160	270	<20	<20	1700	<20	1500	62	<20	NA	NA	NA	NA
19-Mar-97	<20	<20	68	140	210	<20	<20	1600	<20	1100	61	<20	NA	NA	NA	NA
16-Apr-97	<20	<20	50	130	120	<20	<20	1100	<20	1000	79	<20	NA	NA	NA	NA
30-Apr-97	<20	<20	33	96	87	<20	<20	800	<20	700	72	<20	NA	NA	NA	NA
RW-4																
09-Jul-96	<5	<5	<5	29	<5	<5	<5	230	<5	150	5.3	<5	<10	<10	<10	NA
20-Feb-97	<5	<5	<5	29	10	<5	<5	300	<5	180	10	<5	<10	<10	<10	NA
16-Apr-97	<5	<5	11	34	38	<5	<5	500	<5	200	18	<5	<10	<10	<10	NA
30-Apr-97	<5	<5	13	32	39	<5	<5	490	<5	180	17	<5	NA	NA	NA	NA
RW-5																
16-Jul-96	<5	<5	20	17	<5	<5	<10	58	<5	41	<5	<5	<10	<10	<10	NA
20-Feb-97	<5	<5	16	21	30	<5	<10	88	<5	42	7.7	<5	<10	<10	<10	NA
05-Mar-97	<1	<1	15	17	31	<1	<1	84	<1	45	7.3	<1	NA	NA	NA	NA
19-Mar-97	<1	<1	11	20	20	<1	<1	83	<1	33	8.5	<1	NA	NA	NA	NA
02-Apr-97	<1	<1	13	48	20	<1	<1	110	<1	79	10	<1	NA	NA	NA	NA
16-Apr-97	<1	<1	15	60	18	<1	<1	160	<1	110	13	<1	NA	NA	NA	NA
30-Apr-97	<2	<2	14	88	16	<2	<2	170	<2	120	13	<2	NA	NA	NA	NA

TABLE 9-1
SUMMARY OF GROUNDWATER SAMPLING RESULTS – RECOVERY WELLS

	Benzene ug/L	Chloro-form ug/L	1,1,-DCA ug/L	1,1-DCE ug/L	c-1,2-DCE ug/L	Ethyl-benzene ug/L	Methylene Chloride ug/L	PCE ug/L	Toluene ug/L	1,1,1-TCA ug/L	TCE ug/L	Vinyl Chloride ug/L	Acetone ug/L	MEK ug/L	MIBK ug/L	O/G mg/L
RW-6																
12-Jul-96	<50	<50	1200	<50	<50	<50	230	86	<50	1000	<50	<50	<50	<60	<40	NA
05-Mar-97	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	NA
13-Mar-97	<100	<100	4300	<100	580	<100	<100	<100	<100	300	<100	670	<200	<60	<200	NA
30-Apr-97	<100	<100	3500	<100	2200	<100	<200	<100	<100	740	<100	1700	<200	<200	<200	NA
07-May-97	<100	<100	1000	140	1100	<100	<200	<100	<100	570	<100	330	<200	<200	<200	NA
27-May-97	<100	<100	1200	<100	2300	<100	<200	<100	<100	770	<100	850	<200	<200	<200	NA
28-May-97	<100	<100	390	<100	860	<100	<200	<100	<100	430	<100	<100	<200	<200	<200	NA
19-Jun-97	<30	<30	<30	<30	<30	<30	<60	<30	<30	<30	<30	<30	<30	<30	<30	NA
RW-7																
12-Jul-96	<100	<100	400	150	<100	<100	<100	120	<100	260	<100	<100	<100	<100	<80	NA
05-Mar-97	<30	<30	<30	<30	<30	<60	<30	<30	<30	450	<30	<30	<30	<30	<30	NA
13-Mar-97	<100	<100	170	110	2200	<100	220	<100	<100	1200	<100	<100	<200	<200	<200	NA
30-Apr-97	<100	<100	130	<100	1700	<100	<200	<100	<100	620	<100	<100	<200	<200	<200	NA
07-May-97	<100	<100	200	<100	1200	<100	<200	<100	<100	400	<100	<100	<200	<200	<200	NA
27-May-97	<100	<100	160	<100	1000	<100	<200	<100	<100	290	<100	<100	<200	<200	<200	NA
28-May-97	<100	<100	160	<100	800	<100	<200	<100	<100	200	<100	<100	<200	<200	<200	6700
19-Jun-97	<30	<30	<30	<30	40	<30	<60	<30	<30	100	<30	<30	<30	<30	<30	NA
30-Jun-97	<100	<100	250	<100	1400	<100	<200	<100	<100	640	<100	<100	<200	<200	<200	NA
01-Jul-97	<100	<100	180	<100	910	<100	<200	<100	<100	470	<100	<100	<200	<200	<200	NA
02-Jul-97	<100	<100	<100	<100	470	<100	<200	<100	<100	450	<100	<100	<200	<200	<200	NA
21-Jul-97	<100	<100	210	140	730	<100	<200	<100	<100	680	110	<100	<200	<200	<200	NA
22-Jul-97	<100	<100	<100	120	320	<100	<200	<100	<100	140	<100	<100	<200	<200	<200	25
23-Jul-97	<20	<20	100	55	280	<20	<40	<20	<20	220	<20	<20	<40	<40	<40	NA
24-Jul-97	<20	<20	94	43	220	<20	<40	53	<20	150	<20	<20	<40	<40	<40	NA
25-Jul-97	<20	<20	110	79	360	<20	<40	52	<20	310	<20	<20	<40	<40	<40	30
26-Jul-97	<20	<20	87	51	220	<20	<40	54	<20	150	<20	<20	<40	<40	<40	6.9
27-Jul-97	<20	<20	82	53	240	<20	<40	55	<20	140	<20	<20	<40	<40	<40	<4
28-Jul-97	<20	<20	84	42	220	<20	<40	60	<20	140	<20	<20	<40	<40	<40	21
06-Aug-97	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	29
08-Aug-97	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	20
09-Aug-97	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<4
10-Aug-97	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<4
11-Aug-97	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	7
13-Aug-97	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<4
RW-8																
18-Jul-96	<5	<5	<5	<5	<5	<5	<10	<5	<5	5.6	<5	<5	<10	<10	<10	NA
20-Feb-97	<5	<5	<5	<5	<5	<5	<10	<5	<5	9.4	<5	<5	<10	<10	<10	NA
05-Mar-97	<5	<5	<5	<5	<5	<5	<10	<5	<5	9.3	<5	<5	<10	<10	<10	NA
19-Mar-97	<5	<5	<5	<5	<5	<5	<10	<5	<5	8.5	<5	<5	<10	<10	<10	NA
02-Apr-97	<5	<5	<5	<5	<5	<5	<10	<5	<5	9.9	<5	<5	<10	<10	<10	NA
16-Apr-97	<5	<5	<5	<5	5.7	<5	<10	<5	<5	25	<5	<5	<10	<10	<10	NA
30-Apr-97	<5	<5	7.2	8.5	14	<5	<10	<5	<5	41	<5	<5	<10	<10	<10	NA

TABLE 9-1
SUMMARY OF GROUNDWATER SAMPLING RESULTS – RECOVERY WELLS

	Benzene ug/L	Chloro-form ug/L	1,1-DCA ug/L	1,1-DCE ug/L	c-1,2-DCE ug/L	Ethyl-benzene ug/L	Methylene Chloride ug/L	PCE ug/L	Toluene ug/L	1,1,1-TCA ug/L	TCE ug/L	Vinyl Chloride ug/L	Acetone ug/L	MEK ug/L	MIBK ug/L	O/G mg/L
RW-9																
18-Jul-96	<5	<5	9.5	20	<5	<5	<10	<5	<5	92	<5	<5	<10	<10	<10	NA
20-Feb-97	<5	<5	32	<5	34	<5	43	<5	<5	360	<5	<5	<10	<10	<10	NA
05-Mar-97	<10	<10	35	74	42	<10	38	<10	<10	370	<10	<10	<10	<10	<10	NA
19-Mar-97	<10	<10	39	63	62	<10	47	<10	<10	360	<10	<10	<10	<10	<10	NA
02-Apr-97	<10	<10	49	75	160	<10	47	<10	<10	400	<10	<10	<20	<20	<20	NA
16-Apr-97	<10	<10	63	98	260	<10	52	<10	<10	490	<10	<10	<20	<20	<20	NA
30-Apr-97	<10	<10	69	96	350	<10	52	<10	<10	490	<10	<10	<20	<20	<20	NA
RW-10																
18-Jul-96	<5	<5	<5	19	<5	<5	<10	29	5.9	71	<5	<5	<10	<10	<10	NA
20-Feb-97	<5	<5	8.7	82	12	<5	<10	98	<5	360	<5	<5	<10	1200	<10	NA
05-Mar-97	<10	<10	<10	43	<10	<10	<20	76	<10	230	<10	<10	<20	<20	<20	NA
18-Mar-97	<10	<10	<10	27	<10	<10	<20	78	<10	120	<10	<10	<20	<20	<20	NA
19-Mar-97	<5	<5	<5	<5	<5	<5	<10	70	<5	110	<5	<5	<10	<10	<10	NA
02-Apr-97	<1	<1	2.4	21	4.0	<1	<1	62	<1	100	<1	<1	NA	NA	NA	NA
16-Apr-97	<1	<1	2.5	23	3.9	<1	<1	62	<1	100	<1	<1	NA	NA	NA	NA
30-Apr-97	<1	<1	2.7	26	4.4	<1	<1	68	<1	110	<1	<1	NA	NA	NA	NA
RW-11																
17-Jul-96	<5	<5	<5	18	<5	<5	<10	32	<5	56	<5	<5	<10	<10	<10	NA
20-Feb-97	<5	<5	7	78	10	<5	<10	130	<5	340	<5	<5	<10	<10	<10	NA
05-Mar-97	<2	<2	5.3	55	8.6	<2	2.3	110	<2	280	<2	<2	NA	NA	NA	NA
19-Mar-97	<2	<2	4.1	44	7.2	<2	<2	93	<2	210	<2	<2	NA	NA	NA	NA
02-Apr-97	<2	<2	4.3	45	7.5	<2	<2	110	<2	200	<2	<2	NA	NA	NA	NA
16-Apr-97	<5	<5	4.1	44	7.2	<5	2	100	<5	190	<5	<5	NA	NA	NA	NA
30-Apr-97	<5	<5	<5	40	6	<5	<5	95	<5	160	<5	<5	NA	NA	NA	NA
RW-12																
17-Jul-96	<5	<5	<5	<5	<5	<5	<10	54	<5	130	<5	<5	<10	<10	<10	NA
20-Feb-97	<5	<5	7.9	85	11	<5	<10	120	<5	380	<5	<5	<10	<10	<10	NA
05-Mar-97	<2	<2	7.2	70	11	<2	2.6	130	<2	380	<2	<2	NA	NA	NA	NA
19-Mar-97	<2	<2	5.6	56	8.3	<2	<2	110	<2	260	<2	<2	NA	NA	NA	NA
02-Apr-97	<2	<2	5.1	52	8.9	<2	<2	110	<2	250	<2	<2	NA	NA	NA	NA
16-Apr-97	<5	<5	5	47	8.8	<5	2	99	<5	230	<5	<5	NA	NA	NA	NA
30-Apr-97	<5	<5	<5	48	8	<5	<5	98	<5	200	<5	<5	NA	NA	NA	NA
RW-13																
18-Jul-96	<20	<20	<20	140	<20	<20	<40	130	<20	610	<20	<20	<40	<40	<40	NA
20-Feb-97	<5	<5	27	190	34	<5	<10	220	<5	800	<5	<5	<10	<10	<10	NA
05-Mar-97	<10	<10	27	160	34	<10	<10	240	<10	900	<10	<10	<10	<10	<10	NA

Only those parameters that have been previously detected in monitor wells or recovery wells are included.

All concentrations are in ug/L.

NA denots 'Not Analyzed'.

Detected concentrations are shown in bold print.

Last updated: 15-Oct-97 All recovery wells are scheduled to be sampled semi-annually during the post start-up period.

[illegible]

TABLE 9-2

MILLER BREWING COMPANY
REYNOLDS CAN PLANT SITE REMEDIATION

Summary Of Recovery Well Mass Loadings

RECOVERY WELLS	1,1 – DCA	1,1 – DCA	1,1-DCE	1,1-DCE	cis-1,2-DCE	cis-1,2-DCE	PCE	PCE	1,1,1-TCA	1,1,1-TCA	TCE	TCE	TOTAL VOCs	TOTAL VOCs	Oil & Grease	Oil & Grease	Flow
	(mg/L)	(lbs/day)	(mg/L)	(lbs/day)	(mg/L)	(lbs/day)	(mg/L)	(lbs/day)	(mg/L)	(lbs/day)	(mg/L)	(lbs/day)	(mg/L)	(lbs/day)	(mg/L)	(lbs/day)	gpm
Northern Operable Unit																	
RW-1	0.0018	0.000002	0.0032	0.000004	0.0007	0.000001	0.0072	0.000009	0.0098	0.000012	<.001	0.000000	0.02254	0.000027		0.000	0.10
RW-2	0.0299	0.007319	0.0366	0.008954	0.0819	0.020065	0.0081	0.001976	0.1614	0.039589	<.010	0.000000	0.31779	0.077895		0.000	20.41
RW-3	0.0548	0.000171	0.1850	0.000551	0.1828	0.000571	1.3567	0.004235	1.2333	0.003851	0.07567	0.000236	3.08933	0.009645		0.000	0.26
RW-4	0.0060	0.000098	0.0310	0.000505	0.0218	0.000355	0.3800	0.006207	0.1775	0.002899	0.01258	0.000205	0.62883	0.010271		0.000	1.08
RW-5	0.0149	0.000410	0.0387	0.001059	0.0193	0.000533	0.1076	0.002971	0.0671	0.001855	0.0085	0.000235	0.25607	0.007073		0.000	2.30
RW-10	0.0020	0.000013	0.0301	0.000195	0.0030	0.000020	0.0679	0.000440	0.1501	0.000974	<.001	0.000000	0.25315	0.001642		0.000	0.54
RW-11	0.0035	0.000071	0.0463	0.000945	0.0066	0.000136	0.0957	0.001954	0.2051	0.004188	<.005	0.000000	0.35728	0.007294		0.000	1.70
RW-12	0.0044	0.000735	0.0511	0.008549	0.0080	0.001337	0.1030	0.017219	0.2614	0.043704	<.005	0.000000	0.42797	0.071545		0.000	13.92
RW-13	0.0180	0.000218	0.1633	0.001981	0.0227	0.000275	0.1967	0.002386	0.7700	0.009340	<.010	0.000000	1.17067	0.014200		0.000	1.01
Northern Subtotal		0.009039		0.022785		0.023293		0.037400		0.106391		0.000677		0.199594		0.00000	41.50
Southern Operable Unit																	
RW-6	1.4488	0.001914	0.0175	0.000023	0.5800	0.001163	0.0108	0.00001	0.4763	0.000629	<.030	0.000000	2.83325	0.003743		0.000	0.11
RW-7	0.1272	0.001054	0.0444	0.000368	0.6479	0.005369	0.0507	0.00042	0.3690	0.003057	0.11	0.000912	1.34916	0.011180	19.6	0.154	0.62
RW-8	0.0010	0.000231	0.0012	0.000271	0.0028	0.000629	<.005	0.00000	0.0155	0.003477	<.005	0.000000	0.02058	0.004607		0.000	18.64
RW-9	0.0424	0.000382	0.0609	0.000548	0.1297	0.001168	<.010	0.00000	0.3660	0.003297	<.010	0.000000	0.59893	0.005395		0.000	0.75
Southern Subtotal		0.003580		0.001210		0.008329		0.00043		0.010460		0.000912		0.024925		0.15408	20.19

9.2 Recovery Well Performance

The objective of the groundwater recovery system is to result in continued protection of the City of Fulton municipal supply wells while recovering the contaminated groundwater plumes effectively. Groundwater modelling conducted during the remedial design phase indicated that continuous operation of 13 recovery wells at the Reynolds Can Plant will result in hydraulic control and capture of the identified groundwater contaminant plumes.

Aquifer parameters, including temperature, pH, Eh, and turbidity, were measured regularly in recovery wells during the 6-month startup period. The measurements are included as Appendix F. Measured pH in the recovery wells ranged from approximately 6.5 to 8.0. Eh was usually negative, indicating reducing geochemical conditions. Turbidity was less than 1 NTU in most measurements, which indicates very clear water with minimal siltation was being recovered. The turbidity results indicate that proper techniques were utilized during recovery well installation and development that avoided the silt generation that plagued the three pre-existing recovery wells.

During the RI/FS groundwater modelling was performed with a total assumed recovery well flow rate of 123 gallons per minute (gpm). To date, the system has averaged approximately 64 gpm. Pumping rates achieved to date were significantly less than the modelled rate at six recovery wells (RW-1, RW-6, RW-7, RW-9, RW-10, and RW-11). The differences between achieved pump rate and modelled pump rate are attributed to local variations in transmissivity.

Transmissivity differences across the site are partially due to large variations in the thickness of the productive zones above till across the site. Previous investigations demonstrated that the depth to till increases from 20 to 25 feet in the vicinity of MW-5 east of the Reynolds Plant to 85 to 90 feet in the vicinity of RW-2 near the center of the property; however, the depth to till decreases west of RW-2, and is as shallow as 40 feet in the vicinity of RW-10 along the border of the Taylor Property (the so-called "till ridge"). In addition, during the soil boring program performed to determine screen length and slot size for the recovery wells, the thickness of the productive zones above till was less than 5 feet at PHRW11 (the boring advanced along the Taylor Property) and more than 15 feet at PHRW2 (the boring advanced near RW-2).

Groundwater elevations of select monitor wells were collected throughout the start-up period. Two complete rounds of water elevations of recovery wells and accessible monitor wells were collected in July 1997, one during a system shutdown and one during normal operation. Tables of water level elevations are included as Appendix G.

Capture was qualitatively assessed by comparison of groundwater contour maps of natural conditions and under pumping conditions. Contour maps for shallow and deep monitor wells from data collected on 10 July 1997 (during a system shutdown) are presented as Figures 9-1 and 9-2, respectively. Contour maps for shallow and deep monitor wells from data collected on 23 July 1997 (one week after resuming normal operation) are presented as Figures 9-3 and 9-4, respectively.

Under natural conditions, groundwater flow is generally from northeast to southwest, with a mound observed in shallow wells near the center of the property. The mound is probably a function of less permeable sediments in this portion of the property. Groundwater contours generated during non-pumping conditions are similar to maps generated during the RI/FS.

Under pumping conditions, increased drawdown east of the mound created a water table depression. In addition, depressions were observed around each of the recovery wells, indicating local control over portions of the groundwater plume.

In addition, the extent of capture was quantitatively determined at each recovery well based upon pump rates achieved since system initiation and transmissivity determined at each recovery well. Transmissivity was determined at recovery wells utilizing distance-drawdown analysis. At recovery wells where results of distance-drawdown analysis were not valid, whether due to insufficient numbers of nearby monitor wells (RW-11) or due to interference from nearby recovery wells (RW-1 and RW-9), the transmissivity was assumed to be the same as nearby recovery wells with similar sustained pumping rates. The distance-drawdown analysis is included as Appendix H.

Numerical analysis (Grubb[1]) was utilized to determine capture from each recovery well. Grubb utilized the concept of discharge potential to determine the limits of capture (including the stagnation point downgradient and the dividing streamline sidegradient and upgradient) in aquifers based upon transmissivity, natural hydraulic gradient and pump rate. Natural hydraulic gradient was calculated for the site based upon groundwater contours generated when the system was not operating (10 July 1997). Pump rate was well-specific, based upon pump rates generally achieved since system initiation. Results of the Grubb analysis are included in Appendix I. Plotted capture zones, superimposed on contour maps, are included as Figures 9-5 and 9-6 for shallow and deep monitor wells, respectively.

The calculated capture zones were modified to consider site-specific features such as the pond and drainage ditch. Analysis of groundwater elevations at monitor well clusters near the pond revealed several wells (such as MW-26S and MW-26D) with downward hydraulic gradients, indicating that the pond may be a source of groundwater recharge. Even though the well cluster nearest to the pond (MW-60S, MW-60I, and MW-60D) does not exhibit this gradient, indicating that the pond is not a source of groundwater recharge, a conservative capture analysis would be to assume that neither RW-1 nor RW-13 capture extends upgradient of the ditch.

In addition, the capture analysis for recovery well RW-2 indicates that upgradient capture extends northeast to include areas that may be captured by recovery wells RW-3, RW-4, and RW-5. Since the water captured by these wells is not available for recovery well RW-2, it is likely that sidegradient capture of RW-2 must increase to recover the lost volume of groundwater. A conservative capture analysis would be to strictly utilize the capture calculations and not assume

---

1 Grubb, Analytical Model for Estimation of Steady-State Capture Zones of Pumping Wells in Confined and Unconfined Aquifers, *Groundwater*, Volume 31, Number 1, 1993.

that enhanced capture is occurring.

Review of the plots indicates that capture zones from recovery wells RW-2 and RW-8 partially overlap, providing control of the sources of the Northern Operable Unit and Southern Operable Unit plumes. The capture zones of recovery wells RW-10, RW-11, and RW-12 do not overlap, indicating that these wells do not form a barrier to off site migration in the vicinity of the Taylor property. It should be noted that concentrations of VOCs in monitor wells sampled on the Taylor property have declined since system initiation (Section 9.4.3), indicating that the capture analysis is more conservative than actual site conditions. The plots indicate that RW-1 and RW-13 capture includes most wells immediately west of the drainage ditch; however, the capture zone may not include monitor well MW-13D, a sentinel well tested during odd months with detectable concentrations of PCE and 1,1,1-TCA.

Review of the plots indicates good correspondence with modelling performed during the Remedial Design phase indicating hydraulic control, especially for the Northern and Southern Operable Unit recovery wells. Modelling performed during the Remedial Design indicated overlapping capture along the edge of the Taylor Property; recovery achieved to date on the Taylor Property does not match the modelled recovery. However, initial groundwater monitoring of supplemental monitor wells downgradient of recovery wells RW-10, RW-11 and RW-12 has indicated improvement in groundwater quality (Section 9.5) implying hydraulic control in this area. Additional monitoring of this area is required to establish if hydraulic control is being attained.

9.3 Groundwater Treatment System

Treatment system samples were collected according to the monitoring schedule described in Section 8. Samples were collected from the combined recovered groundwater from all thirteen recovery wells. This influent stream also included the effluent from the oil/water separator for recovery wells RW-6 and RW-7 which was pre-treated for oil and grease removal before being pumped to the equalization tank of the treatment system.

The oil/water separator was initiated during startup to provide removal of oil and grease. Based upon bench-scale testing, the pH of the influent from RW-6 and RW-7 was adjusted to 3.5 pHU with sulfuric acid resulting in optimum release of any emulsified oils. The influent stream is then directed to a coalescing plate separator to remove the insoluble oils. The effluent from the oil/water separator is then neutralized with sodium hydroxide and pumped into the equalization tank for further treatment.

9.3.1. Oil/Water Separator

Table 9-3 presents a summary of the samples collected during startup of the oil/water separator. During initial startup of the oil/water separator, problems were encountered relative to recovery of the resultant oils in the influent. Separate storage tanks were acquired and the effluent from the separator was pumped into these tanks prior to combining with the recovery well flows. This

TABLE 9-3

SUMMARY OF TREATMENT SYSTEM SAMPLING RESULTS – FORMER MILLER FACILITY; FULTON, NEW YORK

	Benzene (ug/L)	Chloroform (ug/L)	1,1,-DCA (ug/L)	1,1-DCE (ug/L)	c-1,2-DCE (ug/L)	Ethylbenzene (ug/L)	Methylene Chloride (ug/L)	PCE (ug/L)	Toluene (ug/L)	1,1,1-TCA (ug/L)	TCE (ug/L)	VC (ug/L)	o-Xylene (ug/L)	m,p-Xylene (ug/L)	Acetone (ug/L)	MEK 2-But (ug/L)	2-Hex (ug/L)	MIBK (ug/L)	O/G (mg/L)
OWS-INF																			
23-Jun-97	<200	<200	**330**	<200	**3100**	<200	<400	<200	<200	**1300**	<200	<200	<200	<200	<400	<400	<400	<400	**24**
24-Jun-97	<100	<100	**110**	<100	**570**	<100	<200	<100	<100	**490**	<100	<100	<100	<100	<200	<200	<200	<200	NA
OWS-EFF																			
25-Apr-97	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**4.8**
30-Apr-97	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**5.1**
05-May-97	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**4.1**
07-May-97	<20	<20	**38**	<20	**180**	<20	<40	<20	<20	**33**	<20	<20	**26**	<20	<40	**67**	<40	<40	<4
09-May-97	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<4
14-May-97	<20	<20	**79**	<20	**470**	<20	<40	<20	<20	**86**	<20	<20	**34**	<20	<40	**62**	<40	<40	NA
27-May-97	<20	<20	**49**	<20	**310**	<20	<40	<20	<20	**63**	<20	<20	**48**	<20	<40	<40	<40	<40	**56**
28-May-97	<20	<20	**100**	<20	**540**	<20	<40	<20	<20	**120**	<20	<20	**24**	<20	<40	<40	<40	<40	**14**
23-Jun-97	<5	<5	**6.1**	<5	**51**	<5	<5	<5	<5	**15**	<5	<5	<5	<5	NA	NA	NA	NA	**6.1**
24-Jun-97	<20	<20	**140**	**33**	**760**	<20	<40	<20	<20	**390**	<20	**35**	<20	<20	<40	<40	<40	<40	**87**
30-Jun-97	<20	<20	**86**	<20	**540**	<20	<40	<20	<20	**190**	<20	<20	<20	<20	<40	<40	<40	<40	<4
01-Jul-97	<20	<20	**75**	<20	**380**	<20	<40	<20	<20	**140**	<20	<20	<20	<20	<40	<40	<40	<40	<4
02-Jul-97	<20	<20	**66**	**23**	**330**	<20	<40	**23**	<20	**200**	<20	<20	<20	<20	<40	<40	<40	<40	**4.2**
21-Jul-97	<20	<20	**28**	<20	**92**	<20	<40	<20	<20	**43**	<20	<20	<20	<20	<40	<40	<40	<40	**9**
22-Jul-97	<20	<20	**63**	**32**	**180**	<20	<40	<20	<20	**84**	<20	<20	<20	<20	<40	<40	<40	<40	**12**
23-Jul-97	<20	<20	**44**	**20**	**140**	<20	<40	<20	<20	**66**	<20	<20	<20	<20	<40	<40	<40	<40	NA
24-Jul-97	<20	<20	**26**	<20	**88**	<20	<40	<20	<20	**39**	<20	<20	<20	<20	<40	<40	<40	<40	NA
25-Jul-97	<20	<20	**42**	**16**	**130**	<20	<40	**14**	<20	**60**	<20	<20	<20	<20	<40	<40	<40	<40	NA
26-Jul-97	<20	<20	**38**	<20	**110**	<20	<40	<20	<20	**55**	<20	<20	<20	<20	<40	<40	<40	<40	NA
27-Jul-97	<20	<20	**37**	<20	**120**	<20	<40	<20	<20	**51**	<20	<20	<20	<20	<40	<40	<40	<40	NA
28-Jul-97	<20	<20	**39**	<20	**100**	<20	<40	<20	<20	**39**	<20	<20	<20	<20	<40	<40	<40	<40	<4
06-Aug-97	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**13**
07-Aug-97	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<4
08-Aug-97	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**7.1**
09-Aug-97	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**5.7**
10-Aug-97	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**5.7**
11-Aug-97	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**4.9**
13-Aug-97	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<4
21-Aug-97	<20	<20	**71**	<20	**130**	<20	<40	<20	<20	**38**	<20	<20	<20	<20	**700**	<40	<40	<40	**12**
22-Aug-97	<20	<20	**75**	<20	**180**	<20	<40	<20	<20	**38**	<20	<20	<20	<20	**1200**	**81**	<40	**170**	**18**
27-Aug-97	<5	<5	**53**	**11**	**150**	<5	<5	**14**	<5	**44**	<5	**5.1**	**5.5**	**8.4**	<10	<10	<10	<10	**12**
03-Sep-97	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**10**
10-Sep-97	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<4
17-Sep-97	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<4
24-Sep-97	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**4.7**
COMB-UST																			
07-Jan-97	<50	<50	<50	<50	<50	<50	<100	<50	<50	<50	<50	<50	NA	NA	**900**	**1500**	NA	<100	**240**
16-Apr-97	<50	<50	**56**	<50	**81**	<50	<100	<50	<50	<50	<50	**67**	NA	NA	**470**	<100	NA	<100	NA
21-Aug-97	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**36**
22-Aug-97	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**40**
COMB-RW6&7																			
25-Apr-97	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**13**
19-Jun-97	<30	<30	<30	<30	<30	<30	<60	<30	<30	**43**	<30	<30	NA	NA	<30	<30	NA	<30	NA

NR denotes results "Not Reported" by laboratory as of this date

NA denotes "Not Analyzed"

Detected concentrations are shown in bold print

Permit limits for treatment system effluent:

Total VOCs – 10 ug/L

Oil & Grease – 15 mg/L

Last updated: 15-Oct-97

All recovery wells are scheduled to be sampled semi-annually during the post start-up period.

F:\[illegible]

allowed the separator startup procedures to be conducted without the potential for permit exceedances. Once the oil/water separator was operated on a continuous basis, the removal efficiencies increased resulting in oil removal to the required criteria (<15 mg/L).

9.3.2 Treatment System Influent

Table 9-4 presents a summary of the treatment system influent monitoring results during the startup study. These results present the types and concentrations of contaminants being pumped through the treatment system. Table 9-4 also presents a summary of the inorganic constituents present in the recovered groundwater. During the design phase there was concern relative to carbonate and iron bacteria fouling in the treatment system. Earth Tech initially operated the system without the addition of sequestering agent. Due to buildup of scaling in the air stripper and activated carbon units, sequestering agent was introduced to the system to prevent this scaling problem. The addition of sequestering agent effectively reduced the scaling problem.

Table 9-5 presents a summary of the average concentrations of contaminants and mass loadings present in the influent to the groundwater treatment system. The average loading to the treatment system of total VOCs was approximately 0.5 lbs per day. The total VOCs recovered for the aquifer over the startup study was approximately 84.5 lbs with the primary contaminants recovered being TCA and PCE. Other VOCs recovered included cis-1,2-DCE, 1,1-DCE and 1,1-DCA. It should be noted that TCE was not detected in the influent to the treatment system over the startup period. TCE was detected at low concentrations in recovery wells RW-3, RW-4 and RW-5. The concentrations of contaminants and loadings to the treatment system were significantly lower than designed due to reduced recovery well flow rates.

No significant silt or suspended solids concentrations were realized at the influent to the treatment system. Any fines being recovered have been effectively removed by the pre-filtration system. The pre-filtration system is currently using 25 micron and 10 micron filters in series. These filters have effectively removed fines from interfering with the treatment system. These filters are regularly replaced as a standard maintenance procedure.

9.3.3 Air Stripper Effluent

Table 9-6 presents a summary of the air stripper effluent sample results. These results indicate that the air stripper is effectively volatilizing all of the contaminants being recovered into the vapor phase for treatment by the vapor phase activated carbon treatment system. The air stripper is essentially providing greater than 99% removal of the detected contaminants in the inlfuent stream.

9.3.4 Final Effluent

Table 9-7 presents a summary of the final effluent sample results collected over the six month startup study period. Effluent samples collected over the six month period showed compliance with the substantive requirements of the SPDES permit with minor exceedances. These initial

TABLE 9-4
SUMMARY OF TREATMENT SYSTEM SAMPLING RESULTS – FORMER MILLER FACILITY; FULTON, NEW YORK

	Benzene (ug/L)	Chloroform (ug/L)	1,1,-DCA (ug/L)	1,1-DCE (ug/L)	c-1,2-DCE (ug/L)	Ethylbenzene (ug/L)	Methylene Chloride (ug/L)	PCE (ug/L)	Toluene (ug/L)	1,1,1-TCA (ug/L)	TCE (ug/L)	VC (ug/L)	o-Xylene (ug/L)	m,p-Xylene (ug/L)	Acetone (ug/L)	MEK 2-But (ug/L)	2-Hex (ug/L)	MIBK (ug/L)	O/G (mg/L)	Iron (mg/L)	Manganese (mg/L)	Copper (mg/L)	Zinc (mg/L)
AST-INF																							
17-Feb-97	<5	<5	17	44	NA	<5	<5	34	<5	190	<5	<5	<5	<5	NA	NA	NA	NA	<4	0.16	NA	<0.02	0.034
20-Feb-97	<5	<5	18	55	49	<5	11	97	<5	260	<5	<5	<5	<5	<10	<10	<10	<10	<4	<0.05	0.15	NA	NA
26-Feb-97	<10	<10	18	54	48	<10	<20	100	<10	300	<10	<10	<10	<10	<20	<20	<20	<20	27	0.090	0.16	NA	NA
27-Feb-97	<10	<10	17	43	41	<10	<20	98	<10	290	<10	<10	<10	<10	<10	<10	<10	<10	<4	NA	NA	NA	NA
01-Mar-97	<10	<10	21	51	47	<10	<20	120	<10	280	<10	<10	<10	<10	<20	<20	<20	<20	NA	NA	NA	NA	NA
12-Mar-97	<10	<10	17	36	44	<10	<20	49	<10	180	<10	<10	<10	<10	<20	<20	<20	<20	<4	<0.05	0.081	NA	NA
19-Mar-97	<10	<10	16	34	42	<10	<20	51	<10	190	<10	<10	<10	<10	<20	<20	<20	<20	<4	0.083	0.079	NA	NA
26-Mar-97	<5	<5	13	<5	35	<5	<10	48	<5	140	<5	<5	<5	<5	<10	<10	<10	<10	14	NA	NA	NA	NA
02-Apr-97	<5	<5	12	26	29	<5	<10	38	<5	120	<5	<5	<5	<5	<20	<20	<20	<20	15	NA	NA	NA	NA
09-Apr-97	<5	<5	12	30	29	<5	<10	67	<5	140	<5	<5	<5	<5	<10	<10	<10	<10	8.3	NA	NA	NA	NA
16-Apr-97	<5	<5	11	29	<5	<5	<10	68	<5	130	<5	<5	<5	<5	<10	<10	<10	<10	<4	NA	NA	NA	NA
24-Apr-97	<5	<5	11	26	<5	<5	<10	60	<5	120	<5	<5	<5	<5	<10	<10	<10	<10	4.6	NA	NA	NA	NA
30-Apr-97	<5	<5	12	30	30	<5	<10	68	<5	140	<5	<5	<5	<5	<10	<10	<10	<10	<4	NA	NA	NA	NA
07-May-97	<5	<5	14	36	41	<5	<10	68	<5	150	<5	<5	<5	<5	<10	<10	<10	<10	31	NA	NA	NA	NA
28-May-97	<5	<5	16	43	34	<5	<10	72	<5	130	<5	<5	<5	<5	<10	<10	<10	<10	<4	NA	NA	NA	NA
29-May-97	<10	<10	15	51	30	<10	<20	<10	<5	220	<10	<10	<10	<10	<20	<20	<20	<20	<4	NA	NA	NA	NA
26-Jun-97	<10	<10	19	130	33	<10	<20	180	<10	450	<10	<10	<10	<10	<20	<20	<10	<10	<4	NA	NA	NA	NA
02-Jul-97	<10	<10	24	130	73	<10	<20	200	<10	560	<10	<10	<10	<10	<20	<20	<10	<10	<4	NA	NA	NA	NA
18-Jul-97	<10	<10	22	140	56	<10	<20	190	<10	510	<10	<10	<10	<10	<20	<20	<10	<10	15	NA	NA	NA	NA
24-Jul-97	<20	<20	25	210	61	<20	<40	290	<20	640	<20	<20	<20	<20	<40	<40	<20	<20	NA	NA	NA	NA	NA
25-Jul-97	<20	<20	20	170	51	<20	<40	260	<20	580	<20	<20	<20	<20	<40	<40	<20	<20	<4	NA	NA	NA	NA
30-Jul-97	<20	<20	24	240	30	<20	<40	440	<20	850	<20	<20	<20	<20	<40	<40	<20	<20	15	NA	NA	NA	NA
04-Aug-97	<20	<20	20	140	58	<20	<40	260	<20	490	<20	<20	<20	<20	<40	<40	<20	<20	<4	NA	NA	NA	NA
06-Aug-97	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	12	NA	NA	NA	NA
08-Aug-97	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6.8	NA	NA	NA	NA
11-Aug-97	<20	<10	21	160	73	<20	<40	290	<20	560	<20	<20	<20	<20	<40	<40	<20	<20	<4	NA	NA	NA	NA
13-Aug-97	<20	<20	24	160	79	<20	<40	320	<20	590	<20	<20	<20	<20	<40	<40	<20	<20	<4	NA	NA	NA	NA
20-Aug-97	<20	<20	21	130	65	<20	<40	270	<20	490	<20	<20	<20	<20	<40	<40	<20	<20	NA	NA	NA	NA	NA
27-Aug-97	<10	<10	20	120	66	<10	<20	270	<5	410	<10	<10	<10	<10	<20	<20	<20	<20	<4	NA	NA	NA	NA

Permit limits for treatment system effluent:
Total VOCs – 10 ug/L
Oil & Grease – 15 mg/L
Last updated: 20-Oct-97
[illegible]

NR denotes results "Not Reported" by laboratory as of this date.
NA denotes "Not Analyzed".

(*) denotes that the duplicate vial did not confirm this result, and that the high hits may be due to laboratory contamination. The dilution factor for (MEK) is <40 ug/L.

TABLE 9-5

MILLER BREWING COMPANY
SUMMARY OF INFLUENT CHARACTERISITCS

Average Flow - 64 gpm

PARAMETER	INFLUENT CONCENTRATION* (ug/L)	INFLUENT LOADINGS (lbs/day)
Methylene Chloride	<40	<0.0307
1,1-Dichloroethylene	85	0.0653
1,1-Dichloroethane	18	0.0138
1,1,1-Trichloroethane	337	0.2590
Trichloroethylene	<20	<0.0154
Tetrachloroethylene	148	0.1138
cis-1,2-Dichloroethylene	45	0.0346
Toluene	<20	<0.0154
Ethylbenzene	<20	<0.0154
Total Xylenes	<20	<0.0154
1,2-Dichloroethane	<20	<0.0154
trans-1,2-Dichloroethylene	<20	<0.0154
Carbon Tetrachloride	<20	<0.0154
Dibromochloromethane	<20	<0.0154
Acetone	<40	<0.0307
Methyl Isobuty Ketone (MIBK)	<20	<0.0154
Methyl Ethyl Ketone (MEK)	<40	<0.0307
Chloroform	<20	<0.0154
Vinyl Chloride	<20	<0.0154
Trichlorodifluoromethane	<20	<0.0154
1,1,2-Trichloroethane	<20	<0.0154
Benzene	<20	<0.0154
Bromodichloromethane	<20	<0.0154
1,2-Dichloropropane	<20	<0.0154
Total VOCs	633	0.4865

* - average influent concentration over startup study.

TABLE 9-6

SUMMARY OF TREATMENT SYSTEM SAMPLING RESULTS – FORMER MILLER FACILITY; FULTON, NEW YORK

	Benzene (ug/L)	Chloroform (ug/L)	1,1,-DCA (ug/L)	1,1-DCE (ug/L)	c-1,2-DCE (ug/L)	Ethylbenzene (ug/L)	Methylene Chloride (ug/L)	PCE (ug/L)	Toluene (ug/L)	1,1,1-TCA (ug/L)	TCE (ug/L)	VC (ug/L)	o-Xylene (ug/L)	m,p-Xylene (ug/L)	Acetone (ug/L)	MEK 2-But (ug/L)	2-Hex (ug/L)	MIBK (ug/L)
AST-EFF																		
19-Feb-97	<5	<5	<5	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	<5	<10	<10	<10	<10
20-Feb-97	<5	<5	<5	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	<5	<10	<10	<10	<10
26-Feb-97	<5	<5	<5	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	<5	<10	<10	<10	<10
27-Feb-97	<5	<5	<5	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	<5	<10	<10	<10	<10
28-Feb-97	<5	<5	<5	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	<5	<10	<10	<10	<10
01-Mar-97	<5	<5	<5	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	<5	<10	<10	<10	<10
02-Mar-97	<5	<5	<5	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	<5	<10	<10	<10	<10
03-Mar-97	<5	<5	<5	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	<5	<10	<10	<10	<10
04-Mar-97	<5	<5	<5	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	<5	<10	<10	<10	<10
10-Mar-97	<5	<5	<5	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	<5	<10	<10	<10	<10
11-Mar-97	<5	<5	<5	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	<5	<10	<10	<10	<10
12-Mar-97	<5	<5	<5	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	<5	<10	<10	<10	<10
19-Mar-97	<5	<5	<5	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	<5	<10	<10	<10	<10
26-Mar-97	<5	<5	<5	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	<5	<10	<10	<10	<10
09-Apr-97	<5	<5	<5	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	<5	<10	<10	<10	<10
16-Apr-97	<5	<5	<5	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	<5	<10	95	<10	<10
24-Apr-97	<5	<5	<5	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	<5	<10	80	<10	<10
30-Apr-97	<5	<5	<5	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	<5	<10	<10	<10	<10
21-May-97	<5	<5	<5	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	<5	<10	11	<10	<10
28-May-97	<5	<5	<5	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	<5	<10	<10	<10	<10
29-May-97	<5	<5	<5	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	<5	<10	<10	<10	<10
26-Jun-97	<5	<5	<5	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	<5	<10	<10	<10	<10
02-Jul-97	<5	<5	<5	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	<5	<10	<10	<10	<10
14-Jul-97	<5	<5	<5	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	<5	<10	17	<10	<10
24-Jul-97	<5	<5	<5	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	<5	<10	<10	<10	<10
30-Jul-97	<5	<5	<5	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	<5	<10	<10	<10	<10
04-Aug-97	<5	<5	<5	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	<5	<10	<10	<10	<10
06-Aug-97	<5	<5	<5	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	<5	<10	<10	<10	<10
20-Aug-97	<5	<5	<5	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	<5	<10	<10	<10	<10
27-Aug-97	<5	<5	<5	<5	<5	<5	<10	7.1	<5	23	<5	<5	<5	<5	<10	<10	<10	<10

F:\j23data.r34\docs\[illegible]

TABLE 9-7
SUMMARY OF TREATMENT SYSTEM SAMPLING RESULTS -- FORMER MILLER FACILITY; FULTON, NEW YORK

	Benzene	Chloroform	1,1,-DCA	1,1-DCE	c-1,2-DCE	Ethylbenzene	Methylene Chloride	PCE	Toluene	1,1,1-TCA	TCE	VC	o-Xylene	m,p-Xylene	Acetone	MEK 2-But	2-Hex	MIBK	O/G	Iron	Copper	Zinc
	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
FINAL-EFF																						
10-Feb-97	<5	<5	<5	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	<5	<10	<10	<10	<10	<4	<0.05	<0.02	<0.01
13-Feb-97	<5	<5	<5	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	<5	<10	<10	<10	<10	<4	<0.05	<0.02	0.016
17-Feb-97	<5	<5	<5	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	<5	NS	NS	NS	NS	30	<0.05	1.9	0.25
19-Feb-97	<5	<5	<5	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	<5	<10	84	<10	<10	<4	NA	NA	NA
20-Feb-97	<5	<5	<5	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	<5	<10	<10	<10	<10	<4	NA	NA	NA
26-Feb-97	<5	<5	<5	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	<5	<10	<10	<10	<10	<4	<0.05	<0.02	0.065
27-Feb-97	<5	<5	<5	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	<5	<10	<10	<10	<10	5.2	0.018	<0.02	0.017
28-Feb-97	<5	<5	<5	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	<5	<10	<10	<10	<10	<4	<0.05	<0.02	0.011
01-Mar-97	<5	<5	<5	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	<5	<10	<10	<10	<10	<4	<0.01	<0.02	0.15
02-Mar-97	<5	<5	<5	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	<5	<10	<10	<10	<10	<4	<0.01	<0.02	0.15
03-Mar-97	<5	<5	<5	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	<5	<10	<10	<10	<10	<4	<0.01	<0.02	<0.01
04-Mar-97	<5	<5	<5	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	<5	<10	<10	<10	<10	11	<0.05	<0.02	0.048
05-Mar-97	<5	<5	<5	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	<5	<10	<10	<10	<10	12	<0.05	<0.02	0.02
06-Mar-97	<5	<5	<5	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	<5	<10	<10	<10	<10	NA	NA	NA	NA
07-Mar-97	<5	<5	<5	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	<5	<10	<10	<10	<10	NA	NA	NA	NA
08-Mar-97	<5	<5	<5	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	<5	<10	<10	<10	<10	NA	NA	NA	NA
09-Mar-97	<5	<5	<5	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	<5	<10	<10	<10	<10	NA	NA	NA	NA
10-Mar-97	<5	<5	<5	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	<5	<10	<10	<10	<10	9.8	<0.05	<0.01	0.092
11-Mar-97	<5	<5	<5	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	<5	<10	<10	<10	<10	<4	<0.05	<0.01	0.019
12-Mar-97	<5	<5	<5	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	<5	<10	<10	<10	<10	10	<0.05	<0.02	0.015
19-Mar-97	<5	<5	<5	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	<5	<10	<10	<10	<10	<4	<0.05	<0.02	0.11
26-Mar-97	<5	<5	<5	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	<5	<10	<10	<10	<10	<4	NA	NA	NA
09-Apr-97	<5	<5	<5	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	<5	<10	<10	<10	<10	<4	NA	NA	NA
16-Apr-97	<5	<5	<5	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	<5	<10	<10	<10	<10	<4	NA	NA	NA
24-Apr-97	<5	<5	<5	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	<5	<10	<10	<10	<10	<4	NA	NA	NA
30-Apr-97	<5	<5	<5	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	<5	<10	<10	<10	<10	<4	NA	NA	NA
07-May-97	<5	<5	<5	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	<5	<10	<10	<10	<10	<4	NA	NA	NA
27-May-97	<5	<5	<5	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	<5	<10	<10	<10	<10	77	NA	NA	NA
28-May-97	<5	<5	<5	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	<5	<10	<10	<10	<10	7.2	NA	NA	NA
29-May-97	<5	<5	<5	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	<5	<10	<10	<10	<10	<4	NA	NA	NA
06-Jun-97	<5	<5	<5	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	<5	<10	<10	<10	<10	<4	NA	NA	NA
12-Jun-97	<5	<5	<5	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	<5	<10	<10	<10	<10	<4	NA	NA	NA
19-Jun-97	<5	<5	<5	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	<5	<10	<10	<10	<10	<4	NA	NA	NA
26-Jun-97	<5	<5	<5	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	<5	<10	<10	<10	<10	<4	NA	NA	NA
02-Jul-97	<5	<5	<5	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	<5	<10	<10	<10	<10	<4	NA	NA	NA
18-Jul-97	<5	<5	<5	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	<5	<10	<10	<10	<10	<4	NA	NA	NA
23-Jul-97	<5	<5	<5	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	<5	<10	<10	<10	<10	<4	NA	NA	NA
30-Jul-97	<5	<5	<5	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	<5	<10	<10	<10	<10	11	NA	NA	NA
04-Aug-97	<5	<5	<5	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	<5	<10	<10	<10	<10	<4	NA	NA	NA
06-Aug-97	<5	<5	<5	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	<5	<10	<10	<10	<10	36	NA	NA	NA
07-Aug-97	<5	<5	<5	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	<5	<10	<10	<10	<10	8.6	NA	NA	NA
08-Aug-97	<5	<5	<5	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	<5	<10	<10	<10	<10	14	NA	NA	NA
11-Aug-97	<20	<20	<20	<20	<20	<20	<40	<20	<20	<20	<20	<20	<20	<20	<40	1700 *	<20	<20	<4	NA	NA	NA
13-Aug-97	<5	<5	<5	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	<5	<10	<10	<10	<10	<4	NA	NA	NA
20-Aug-97	<5	<5	<5	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	<5	<10	<10	<10	<10	<4	NA	NA	NA
21-Aug-97	<5	<5	<5	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	<5	<10	<10	<10	<10	8.6	NA	NA	NA

Permit limits for treatment system effluent:
Total VOCs = 10 ug/L
Oil & Grease = 15 mg/L
Last updated: 20-Oct-97

NR denotes results "Not Reported" by laboratory as of this date.
NA denotes "Not Analyzed".

(*) denotes that the duplicate vial did not confirm this result, and that the high hit may be due to laboratory contamination. The dilution factor for (MEK) is <40 ug/L.

F:\20hear\Miller\summtables_97.xls

exceedances were attributed to MEK which was identified in the treatment system due to glue used in repairing PVC piping. These exceedances were corrected by flushing any lines which were subjected to the glue. An oil and grease exceedance occurred during initial startup of the oil/water separator. This was corrected once the oil/water separator was operating on a continuous basis. One MEK concentration was realized on 11 August 1997; however, a second vial collected during this period was analyzed and did not confirm the result. It was determined that the detected concentration was due to laboratory contamination and not associated with the actual concentration in the effluent of the system.

The groundwater treatment system is effectively treating the recovered contaminants from the recovery wells. The air stripper is essentially transferring all of the volatile organics present in the influent stream into the vapor phase. Therefore, the liquid phase activated carbon units are essentially acting as polishing units to ensure compliance with effluent criteria.

Table 9-8 presents a summary of the average influent and effluent concentrations of the treatment system over the startup study compared to the substantive requirements of the SPDES Permit. The treatment system has demonstrated effective treatment of the recovered contaminants to the substantive requirements of the SPDES Permit.

The groundwater treatment system effectively treated the contaminants being recovered by the recovery well system. During initial operation of the UST recovery system, elevated concentrations of acetone were identified to be present in this recovery stream. The resultant flow recovered from this system was staged in separate storage tanks until analysis could be conducted. Based upon the characterization analysis, it was established that the UST recovery system water could be pumped into the equalization tank at a reduced flow rate without adversely impacting the treatment system.

The current groundwater treatment system does not have the capabilities to treat the elevated ketone concentrations detected in the UST recovery system at the initially observed flow rates from this system (10-15 gpm). Additional characterization and evaluation including the potential need for an alternative treatment system for this segregated recovery stream is currently being conducted.

As per the substantive requirements of the SPDES permit, Earth Tech collected 24 consecutive weekly effluent samples from the treatment system. These effluent analytical results revealed compliance with the SPDES permit. The effluent sampling program was reduced to monthly sampling on 24 September 1997.

9.3.5 Vapor Phase Treatment

Due to the reduced loadings present in the influent stream to the groundwater treatment system, vapor phase monitoring of the vapor phase treatment system was conducted based upon calculated loadings to the carbon units. During initial startup of the SVE system, air samples were collected from the SVE off gas and the vapor phase treatment system discharge for

TABLE 9-8

MILLER BREWING COMPANY
GROUNDWATER TREATMENT SYSTEM PERFORMANCE

Average Flow – 64 gpm

PARAMETER	INFLUENT CONCENTRATION* (ug/L)	INFLUENT LOADINGS (lbs/day)	EFFLUENT CONCENTRATION (ug/L)	EFFLUENT LOADINGS (lbs/day)	EFFLUENT CRITERIA** (ug/L)	EFFLUENT CRITERIA** (lbs/day)
Methylene Chloride	<40	<0.0307	<5	<0.0038	30	0.080
1,1-Dichloroethylene	85	0.0653	<5	<0.0038	10	0.026
1,1-Dichloroethane	18	0.0138	<5	<0.0038	10	0.026
1,1,1-Trichloroethane	337	0.2590	<5	<0.0038	10	0.026
Trichloroethylene	<20	<0.0154	<5	<0.0038	10	0.026
Tetrachloroethylene	148	0.1138	<5	<0.0038	10	0.026
cis-1,2-Dichloroethylene	45	0.0346	<5	<0.0038	10	0.026
Toluene	<20	<0.0154	<5	<0.0038	10	0.026
Ethylbenzene	<20	<0.0154	<5	<0.0038	10	0.026
Total Xylenes	<20	<0.0154	<5	<0.0038	30	0.080
1,2-Dichloroethane	<20	<0.0154	<5	<0.0038	10	0.026
trans-1,2-Dichloroethylene	<20	<0.0154	<5	<0.0038	10	0.026
Carbon Tetrachloride	<20	<0.0154	<5	<0.0038	10	0.026
Dibromochloromethane	<20	<0.0154	<5	<0.0038	10	0.026
Acetone	<40	<0.0307	<10	<0.0077	10	0.026
Methyl Isobuty Ketone (MIBK)	<20	<0.0154	<10	<0.0077	10	0.026
Methyl Ethyl Ketone (MEK)	<40	<0.0307	<10	<0.0077	10	0.026
Chloroform	<20	<0.0154	<5	<0.0038	10	0.026
Vinyl Chloride	<20	<0.0154	<5	<0.0038	10	0.026
Trichlorodifluoromethane	<20	<0.0154	<5	<0.0038	10	0.026
1,1,2-Trichloroethane	<20	<0.0154	<5	<0.0038	10	0.026
Benzene	<20	<0.0154	<5	<0.0038	10	0.026
Bromodichloromethane	<20	<0.0154	<5	<0.0038	10	0.026
1,2-Dichloropropane	<20	<0.0154	<5	<0.0038	10	0.026

* – average influent concentration over startup study.
** – substantive requirements of the SPDES Permit.

laboratory analysis. During initial startup of the groundwater recovery and treatment system, an additional air sample was collected from the vapor phase carbon treatment system discharge. Both of these air samples revealed non-detectable concentrations confirming effective vapor phase treatment.

Based upon the observed loadings to the vapor phase treatment system, the carbon vendor was contacted to establish the approximate operating period for anticipated breakthrough of the initial vapor phase activated carbon unit. Based upon the detected concentrations in the influent it was determined that cis-1,2-DCE will be the compound with initial breakthrough. Based upon the calculated loading of this compound to the system, breakthrough of the initial activated carbon unit was anticipated to be realized in approximately 9 months of current operation. Earth Tech initiated vapor phase sampling events in September 1997.

Due to the high air flow rates and the low mass of contaminants, Earth Tech used an alternative method of sample collection. A specified volume of air was pumped through an absorbent tube for volatile organics analysis. The adsorbent media was extracted and analyzed for volatile organics using Method 8260. This method provided a lower method detection limit and better quantification of the concentration of contaminants in the air stream. Samples were collected from the influent to the vapor phase activated carbon system, between the two vapor phase activated carbon units in series and the vapor phase activated carbon system discharge. The analytical results from these samples revealed no detectable concentrations of contaminants at the vapor phase activated carbon system discharge and a low detectable concentration of cis-1,2-DCE between the activated carbon units. No other compounds were detected above the method detection limit between the activated carbon units. Based upon the low concentration of cis-1,2-DCE, an additional vapor phase sampling event was conducted in October 1997. Additional sample volume was collected to allow a better quantification of breakthrough. Based upon this result, activated carbon change out will be made when the primary unit is exhausted. This sampling methodology will be used for long term evaluation of the activated carbon units. Table 9-9 presents the vapor phase sampling results for September 1997 and October 1997.

In addition, the low concentrations of volatile organics in the vapor phase discharge are currently being evaluated using NYSDEC air modelling techniques to establish if the activated carbon treatment is required under current operating conditions. The vapor phase activated carbon system will remain in operation until the final evaluation is completed. Monthly sampling of the vapor phase system will be continue to verify required treatment.

9.4 Soil Vapor Extraction System

The SVE system was initiated prior to startup of the groundwater recovery and treatment system. The SVE system was operated continuously from 11 November 1996 to 3 June 1997. The SVE system was shutdown in June 1997 due to reduced VOC concentrations in the recovered offgas and problems encountered with the startup operation of recovery wells RW-6 and RW-7. The applied vacuum to these dual extraction wells interfered with the water elevation pressure transducers controlling the variable speed recovery pumps. In order to allow operation of

TABLE 9–9
MILLER BREWING COMPANY
VAPOR PHASE SYSTEM SAMPLE RESULTS

SAMPLE LOCATION DATE UNITS	Influent 9/19/97 mg/m ^ 3	Intermediate 9/19/97 mg/m ^ 3	Final Discharge 9/19/97 mg/m ^ 3
PARAMETER NYSDOH 311.2			
1,1–Dichloroethane	< 0.0005	< 0.0005	< 0.0005
1,1–Dichloroethene	0.00054	< 0.0005	< 0.0005
Tetrachlorethene	0.01	< 0.0005	< 0.0005
1,1,1–Trichloroethene	0.014	< 0.0005	< 0.0005
cis–1,2–Dichloroethene	0.0015	0.00055	< 0.0005

SAMPLE LOCATION DATE UNITS	Influent 10/20/97 mg/m ^ 3	Intermediate 10/20/97 mg/m ^ 3	Final Discharge 10/20/97 mg/m ^ 3
PARAMETER NYSDOH 311.2			
1,1–Dichloroethane	< 0.00002	< 0.00002	< 0.00002
1,1–Dichloroethene	< 0.00002	< 0.00002	< 0.00002
Tetrachlorethene	0.002	< 0.00002	< 0.00002
1,1,1–Trichloroethene	0.0013	< 0.00002	< 0.00002
cis–1,2–Dichloroethene	0.00006	0.000059	< 0.00002

recovery wells RW-6 and RW-7, the SVE system was shutdown. Currently, this operation problem is being corrected to allow dual operation of these recovery wells. The SVE system will be restarted concurrent with operation of the UST recovery system. The UST recovery system operation will dewater this area and expose additional contaminated soils for remediation by the SVE system. The SVE system will be monitored closely during startup to establish enhanced removal rates due to the operation of the UST recovery system.

A summary of the SVE system operating parameters and air sampling results over the startup study are included as Appendix G. During the startup study, VOC concentrations were detected primarily in three SVE wells: RW-7, SVE-1 and SVE-4. The highest concentrations of VOC were detected in RW-7. Compounds detected in RW-7 included 1,1-DCA, 1,2-DCA, 1,1-DCE, c-1,2-DCE and TCA. Air samples collected from SVE-4 contained concentrations of TCA from November 26, 1996 to December 24, 1996, and c-1,2-DCE on December 17, 1996. Air samples collected from SVE-1 contained concentrations of TCA from December 10, 1996 to December 17, 1996, and c-1,2-DCE on December 10, 1996.

VOC concentrations declined to below detection limits in all wells by April 2, 1997, with the exception of RW-7. TCA concentrations were approximately 0.05 mg/m^3 (0.0091 ppm) on April 2, 1997. This concentration has been relatively constant since December 31, 1996, indicating a continuing source of TCA within the influence of RW-7.

Following startup and operation of the UST pumping system, the SVE system will be restarted to treat areas dewatered by the UST recovery system. It is expected that the SVE system will operate approximately 6 months following startup of the UST recovery system. Once offgas concentrations have declined to asymptotic levels, the system will be shut down for 1 month, to allow the soil atmosphere to come to equilibrium with any contaminants in dead end pores of areas not within the influence of the SVE system. The system will then be restarted, and air samples will be collected and analyzed. If VOC concentrations are below detectable levels, then a soil boring program will be conducted to verify treatment of the vadose soils. If concentrations are detectable, then the system will continue to operate.

9.5 Groundwater Quality

Monitor wells on site and on the City of Fulton property are currently sampled on an alternating monthly schedule (the Early-Warning Network) and a semi-annual schedule (supplementary wells). The total network includes plume and downgradient wells from the Northern Operable Unit, source and plume wells from the Southern Operable Unit, wells on and near the Taylor property, and wells upgradient of the City of Fulton Well Field.

Early-Warning Network monitoring well results and concentration plots over time since November 1994 are included as Appendix I. Figures 9-7 through 9-12 present the monitor well analytical results on a site plan for the six months since startup of the groundwater recovery system.

9.5.1 Monitor Well Network - Northern Operable Unit

Early-Warning Network monitor wells located at the Northern Operable Unit include monitor wells MW-8I, MW-8D, MW-17D, MW-38S, MW-51I, MW-51D, MW-56D, and MW-6ID. Supplemental monitor wells sampled semi-annually in the Northern Operable Unit include monitor wells MW-62S and MW-63S. All of these monitor wells are within or downgradient of the contaminant plume, and none of the monitor wells are within the source area of the Northern Operable Unit. All of the listed monitor wells except for MW-51I and MW-62S historically exhibited significant concentrations of TCA, 1,1-DCA, PCE, TCE, 1,1-DCE, and/or cis-1,2-DCE during the monitoring program. Concentrations of these VOCs have historically exceeded concentrations in downgradient municipal wells K-2 and M-2. The concentration plots over time provided in Appendix I should be referenced during the following discussions of concentration trends.

The majority of monitor wells in this area have historically shown decreasing total VOC concentrations since the initiation of monitoring in 1994. This indicates that there is no continual source of groundwater contamination in the Northern Operable Unit.

Monitor wells MW-8I and MW-8D are located within the capture zone of recovery well RW-13. This monitor well cluster has shown significant decreases in total VOC concentrations since the imitation of groundwater monitoring. Once the groundwater recovery system was operational, monitor well MW-8I has shown an increase in total VOC concentrations from 15 ug/L to 50 ug/L. This increase indicates that the groundwater recovery system may be drawing down higher contaminants from the shallow zone and surrounding area into the influence of this recovery well. Total VOC concentrations in MW-8D have remained consistent with concentrations (250 ug/L) prior to initiation of the groundwater recovery system.

Monitor well MW-17D which is located downgradient of RW-1 and upgradient of RW-12 has shown a significant decrease in total VOC concentrations since initiation of monitoring (115 ug/L to 20 ug/L). Since startup of the groundwater recovery system, total VOC concentrations have remained consistent in this monitor well.

Monitor well MW-38S is located at the northern boundary of the Northern Operable Unit. It should be noted that monitor well MW-38S is located within the capture zone of recovery well RW-4. The main contaminants of concern in this monitor well are PCE and TCE. Concentrations of total VOCs have shown a decrease since the initiation of monitoring (1,590 ug/L to 1,280 ug/L). Since initiation of the groundwater recovery system, a decrease has been realized in total VOC concentration from 1,280 ug/L to 1,000 ug/L.

Monitor wells MW-51I and MW-51D from a monitor well cluster located north of RW-13 within the calculated capture zone of RW-13. MW-51I has shown non-detectable concentrations of total VOCs since the initiation of monitoring. Monitor well MW-51D has revealed low concentrations of Total VOCs (2.4 ug/L to 7 ug/L) with TCA being the prominent contaminant of concern. The TCA concentrations increased slightly since the implementation of monitoring. Since initiation of the groundwater recovery system total VOC concentrations have remained consistent (8 ug/L).

Monitor well MW-56D is located immediately north of RW-13 within the calculated capture zone of RW-13. Groundwater monitoring at MW-56D has revealed slowly increasing concentrations since the initiation of groundwater monitoring with a peak total VOC concentration of approximately 2,900 ug/L in February 1997. Since initiation of the groundwater recovery system, MW-56D's total VOC concentration has significantly decreased to approximately 250 ug/L. This monitor well is within the capture zone of recovery well RW-13. Groundwater monitoring has indicated that the groundwater recovery system has significantly impacted groundwater quality in the area of MW-56D.

Monitor well MW-61D is located south of RW-1 and upgradient of recovery wells RW-10, RW-11 and RW-12 near the southern boundary of the Northern Operable Unit. Groundwater monitoring conducted at MW-61D has shown the primary contaminant of concern in this monitor well is PCE at concentrations ranging from 65 ug/L to 100 ug/L. Since initiation of the groundwater recovery system, PCE concentrations in MW-61D have shown a decrease to 33 ug/L in August 1997. Monitor well MW-61D is located downgradient of the overlapping capture zones of recovery wells RW-2, RW-9 and RW-8. This decreasing concentration indicates that the capture zone is having a positive impact to downgradient groundwater quality in this area. Additional groundwater monitoring will be required to confirm this trend.

Insufficient sampling rounds have been collected to determine trends for monitor wells MW-62S and MW-63S. However, the initiate sampling of MW-63S in March 1997 revealed no detectable concentrations. In September 1997, significant concentrations of 1,1-DCA, 1,1-DCE, cis-1,2-DCE, PCE, TCA and TCE were detected in this well. Additional monitoring in this area will be required to evaluate this increase in VOC concentration.

Additional monitoring will be necessary to determine whether concentrations in downgradient monitor wells such as MW-13D will decline in response to improvements in groundwater quality near recovery well RW-13 (monitor wells MW-8I, MW-8D, and MW-56D).

9.5.2 Monitor Well Network - Southern Operable Unit

Early-Warning Network monitor wells located at the Southern Operable Unit include monitor wells MW-53I and MW-54ID. Supplemental monitor wells sampled semi-annually on the Southern Operable Unit include monitor wells MW-36S, MW-37I, MW-47S, and MW-48S. Monitor wells MW-36S and MW-37I are within the contaminant plume, monitor wells MW-53I and MW-54I are downgradient of the contaminant plume, and monitor wells MW-47S and MW-48S are within the source area of the Southern Operable Unit. All of the listed monitor wells except for MW-47S, MW-53I, and MW-54I have exhibited significant concentrations of 1,1,1-TCA, 1,1-DCA, 1,1-DCE, cis-1,2-DCE, and/or vinyl chloride. Concentrations of these VOCs have historically exceeded concentrations in downgradient municipal wells K-2 and M-2; however, the results of Early-Warning monitoring (non-detectable concentrations in monitor well MW-53I and low concentrations in monitor well MW-54I) indicate insufficient migration of contaminants from this unit to impact the City of Fulton wells.

Insufficient sampling rounds have been collected to determine trends for monitor wells MW-36I, MW-37S, MW-47S, and MW-48S. VOCs have not been detected in monitor well MW-53I since November 1994. Concentrations of total VOCs have decreased in monitor well MW-54I from approximately 12 ug/L in November 1994 to approximately 2 ug/L in February 1997, just before system initiation. Since initiation of the groundwater recovery system, Total VOC concentrations have subsequently declined to non-detectable levels. Initial results of sampling at monitor well MW-53I indicate limited migration of contaminants emanating from the Southern Operable Unit.

Additional monitoring will be necessary to establish the full impact to the Southern Operable Unit contaminant plume.

9.5.3 Monitor Well Network - Taylor Property

Early-Warning Network monitor wells located on the Taylor Property include MW-14D and MW-21S. Supplemental monitor wells sampled semi-annually on the Taylor Property include MW-32D, MW-33S, and MW-35D. All of the listed monitor wells have exhibited significant concentrations of TCA, 1,1-DCA, PCE, 1,1-DCE, and cis-1,2-DCE. Concentrations of these VOCs have historically exceeded concentrations in downgradient municipal wells K-2 and M-2.

Monitor well MW-14D is located immediately north of recovery well RW-12 within the calculated capture zone of this recovery well. Groundwater monitoring conducted at MW-14D has shown historical increases in total VOC concentrations since the initiation of groundwater monitoring with TCA and PCE being the primary contaminants of concern. Since initiation of the groundwater recovery system, total VOC concentrations have decreased significantly from 450 ug/L to 80 ug/L. This indicates that recovery well RW-12 is positively impacting groundwater quality in the area of MW-14D.

Monitor well MW-21S is located immediately east of recovery well RW-10. Groundwater monitoring at MW-21S has historically shown an increase in total VOC concentrations. Since initiation of the groundwater recovery system, total VOC concentrations have significantly decreased from 300 ug/L to 60 ug/L. This indicates that the groundwater capture zone created by recovery well RW-10 is impacting groundwater quality in the area of MW-21S.

In addition, the concentrations of VOCs in the supplemental monitor wells, MW-32D, MW-33S and MW-35D, have also declined during the September 1997 sampling event (after several months of system operation) compared to the March 1997 sampling round (after weeks of system operation). These monitor wells are located downgradient of recovery wells RW-10, RW-11 and RW-12 on the Taylor property. Further monitoring will determine whether concentrations of VOCs in the municipal wells K-2 and M-2 will decline in response to attenuation of VOC concentrations on the Taylor property.

9.5.4 Monitor Well Network - City of Fulton Well Field

Early-Warning Network monitor wells directly upgradient of the City of Fulton Well Field include MW-9D, MW-10I, MW-13D, MW-15D, MW-25S, MW-25D, MW-31I, MW-46S, MW-46D, MW-49I, MW-49D, MW-50I, MW-60I, and MW-60D. Except for sporadic detections of low concentrations of methylene chloride, a common laboratory artifact, the following Early-Warning Network monitoring wells upgradient of the City of Fulton Well Field have had no detections of VOCs since November 1994: MW-9D, MW-10I, MW-46S, MW-46D, MW-49I, MW-49D, MW-50I, MW-60I, and MW-60D. These wells are upgradient of the K1/M1 municipal well cluster. No VOCs have been detected in monitor well MW-31I, located within the capture zone of municipal wells K-2 and M-2. The only monitor wells on the Early-Warning Network directly upgradient of the Well Field are monitor wells MW-13D, MW-15D, MW-25S, MW-25D, and the wells located on the Taylor Property discussed above.

Concentrations of VOCs in monitor well MW-13D, including TCA, 1,1-DCA, 1,1-DCE, and cis-1,2-DCE, have increased since November 1994. Up to 280 ug/L of total VOCs have been detected in this well during recent months, compared to 60 to 65 ug/L when the monitoring program was initiated. The concentrations declined slightly in September 1997 when compared to July 1997; however, further monitoring will be necessary to determine if a trend of declining concentrations is occurring at this well.

Low concentrations of TCA, ranging from non-detect to a peak concentration of 3.8 ug/L, have been detected in monitor well MW-15D, located sidegradient to MW-13D. Concentrations increased just before system initiation, and have declined to non-detect after system initiation.

Low concentrations of 1,1-DCA, ranging from non-detect to a peak concentration of 4.0 ug/L, have been detected in monitor well MW-25S and low concentrations of 1,1,1-TCA, ranging from non-detect to a peak concentration of 4.2 ug/L, have been detected in monitor well MW-25D. The peak concentrations are less than concentrations typically observed in the downgradient municipal supply wells K-2 and M-2. Due to the lower concentrations in these monitor wells, it is possible that the source of VOCs in the municipal well field is not associated with contaminants identified in monitor wells MW-25S and MW-25D or with wells directly upgradient of these wells (i.e., MW-13D).

Additional monitoring of these downgradient monitor wells will be necessary to establish overall impact of the groundwater recovery and treatment system on the downgradient migration of contaminants.

9.5.5 Summary of Groundwater Quality Monitoring

Review of the overall groundwater monitoring results revealed that initiation of the groundwater recovery system has positively impacted the majority of the monitor wells in the current monitoring program. There is significant impact observed in monitor wells that are located within the calculated capture zones of specific recovery wells. Other monitor wells that are located downgradient of recovery well capture zones have also shown improved groundwater quality. Since the groundwater recovery and treatment system has only been in operation for a six month period it is not possible to draw conclusions based upon these initial trends. Additional monitoring will be required to confirm the overall impact to site groundwater quality.

SECTION 10
CONCLUSIONS

The remedial action identified in the ROD has been implemented under the Order of Consent between Miller Brewing and the NYSDEC. The selected remedial system has been constructed in accordance with the NYSDEC-approved Remedial Design. Any modifications to the Department-approved remedial design required to be incorporated into the construction of the system were approved by NYSDEC prior to implementation and are identified in this Final Engineering Report.

Based upon the evaluation of data collected during the startup study of the constructed remedial system, the following conclusions are presented:

- The soil vapor extraction system effectively removed volatile organics from the unsaturated zone in the Southern Operable Unit during the startup study. Continued operation of the SVE system is required once the UST recovery system is fully operational.

- The groundwater recovery system effectively recovered volatile organic contaminants from the impacted aquifer. During the startup study approximately 84.5 lbs of Total VOCs were recovered from the aquifer. The groundwater recovery system is recovering groundwater at a decreased total flow than designed due to inherent aquifer characteristics.

- The groundwater recovery system is impacting groundwater flow direction at the site. Capture zone analysis indicates that hydraulic control of the aquifer is being realized in the Northern Operable Unit source area and Southern Operable Unit source area. Capture zone analysis indicates that hydraulic control has not been fully realized in the area of the Taylor Property monitor well network.

- The groundwater treatment system effectively treated the recovered groundwater from the recovery well network. The groundwater treatment system effectively removed greater than 99% of contaminants to the required substantive requirements of the SPDES Permit.

- The vapor phase treatment system effectively removed the volatilized contaminants from the off gas of the air stripper to required emission criteria.

- The recovered perched groundwater from the UST recovery system was identified to have characteristics not amenable to treatment with the current groundwater treatment system. Additional characterization and evaluation of the UST recovery perched groundwater must be conducted to determine the appropriate treatment of this contaminated stream.

- Groundwater monitoring results indicate that implementation of the groundwater recovery system has positively impacted groundwater quality in areas of the contaminant plume throughout the site. The monitoring program indicates decreasing trends in contaminant concentrations in monitor wells within the deep zone influenced by recovery well capture. In addition, shallow and deep monitor wells located downgradient of recovery wells RW-10, RW-11 and RW-12 have shown decreased contaminant concentrations over time since initiation of the groundwater recovery system. Although hydraulic control has not been attained in this area, the improving downgradient groundwater quality indicates that a positive impact to the aquifer is occurring.

- Additional groundwater monitoring and evaluation of groundwater flow direction under pumping conditions is required to fully assess the impact of the groundwater recovery and treatment system on the site aquifer and the control of off site migration of contaminants.

SECTION 11
RECOMMENDATIONS

Based upon the conclusions presented in this Final Engineering Report, the following recommendations are presented:

- Upon initiation of the UST recovery system on a continuous basis, the SVE system will be operated for a 6 month period to further remediate contaminants present in the Southern Operable Unit. At the end of the 6 month period an evaluation of the overall effectiveness of the system to remediate the contaminated soil present in this area will be conducted and the results submitted to NYSDEC for concurrence.

- An evaluation of the recovered water from the UST recovery system is required to establish the amenability of this stream to the groundwater treatment system. The UST recovery system must be characterized for sustainable flow and contaminant characteristics for long term operation. This evaluation is currently being conducted and the results and proposed actions will be presented upon completion of this evaluation.

- In order to fully evaluate the current groundwater recovery and treatment system's ability to control the potential migration of contaminants, an additional 6 month evaluation period is proposed with a modified monitoring program to provide the required data to assess recovery and control of the contaminant plumes. At the end of the 6 month period, an annual report will be submitted providing a summary of the data collected during the evaluation period and present conclusions relative to the effective hydraulic control and recovery of contaminants. If the evaluation indicates that the current groundwater recovery system is not effectively controlling off site migration of contaminants, a proposal detailing the corrective measures to attain the required hydraulic control and recovery of contaminants will be submitted for approval.

The following modified monitoring program is proposed for post startup operation. Upon completion of this monitoring program an annual report will be submitted summarizing the results of the monitoring program.

The current Early-Warning monitoring and supplemental well sampling schedule will continue with the following modifications:

Site Groundwater Flow Direction

A complete round of groundwater elevations from all site monitor wells and recovery wells will be collected on a semi-annual basis to allow evaluation of overall site groundwater flow direction under pumping conditions.

Northern Operable Unit

The current monitoring program does not include sampling of monitor wells within the Northern Operable Unit source area; all of the wells are within or downgradient of the contaminant plume. It is proposed that monitor wells MW-2S, MW-3D, and MW-16D, the wells with the highest historical concentrations of contaminants, be added to the monitoring program to assess impact to the source area. These wells will be sampled semi-annually for EPA 624 plus xylene.

Groundwater sampling at MW-62S has revealed no detectable VOCs. This monitor well will serve as a sentinel well confirming that recovery well RW-4 is effectively capturing contaminants in the northern edge of the Northern Operable Unit contaminant plume. Therefore, sampling of monitor well MW-62S will be modified to a bimonthly basis.

Southern Operable Unit

No modifications are proposed for this monitoring program.

Taylor Property Monitor Well Network

No modifications are proposed for this monitoring program.

City of Fulton Well Field

Monitor wells MW-46S, MW-46D, MW-49I, MW-49D, and MW-50I, located upgradient of municipal wells K1 and M1, have been sampled bi-monthly since November 1994. Except for laboratory contaminants, VOCs have not been detected in these monitor wells. This data indicates that the source of VOCs in the referenced municipal wells is not related to these monitor wells; therefore, these wells are not Early-Warning wells for the K1/M1 well system. It is proposed that the monitoring program be reduced in these wells from bi-monthly to semi-annually.

Monitor wells MW-60I and MW-60D, located at the northern edge of the former Miller property, have been sampled bi-monthly since November 1994. Except for laboratory contaminants, VOCs have not been detected in these wells. Based upon groundwater flow direction, these monitor wells do not appear to lie in the migration path of the Northern Operable Unit. It is proposed that monitoring of these wells be terminated.

Monitor well MW-31I, located within the capture zone of municipal wells K2 and M2, has been sampled bi-monthly since November 1994. VOCs have not been detected in this well. Based upon groundwater flow direction, this well is not located in the migration path from the Taylor Property and the municipal wells. It is proposed that bi-monthly monitoring of this well be terminated and sampling of monitor well MW-28I be initiated on a bi-monthly basis to more accurately evaluate groundwater quality in the capture zone of these impacted municipal wells.

Tables 11-1 and 11-2 present the modified groundwater monitoring program proposed for implementation. This modified monitoring program will be implemented upon receipt of approval from NYSDEC.

TABLE 11-1

MILLER BREWING COMPANY
REYNOLDS CAN PLANT SITE REMEDIATION

SUPPLEMENTAL MONITOR WELL SAMPLING LOCATIONS			
APRIL & OCTOBER		MARCH & SEPTEMBER	
MW-36S* MW-37I* MW-38S* MW-47S* MW-48S*	MW-2S* MW-3D* MW-16D*	MW-32D MW-33S MW-35D MW-63I*	MW-46S MW-46D MW-49I MW-49D MW-50I
CITY OF FULTON WTF EARLY WARNING MONITOR WELL SAMPLING LOCATIONS			
EVEN MONTHS		ODD MONTHS	
MW-8I MW-8D MW-9D MW-17D MW-28I MW-38S	MW-51I MW-51D MW-53I MW-54I MW-56D MW-61D	MW-10I MW-13D MW-14D MW-15D	MW-21S MW-25S MW-25D MW-62I*

NOTE: Unless otherwise designated, the samples will be analyzed for EPA Methods 601/602 plus xylenes.

* - EPA Method 624 plus xylenes

TABLE 11-2

MILLER BREWING COMPANY
REYNOLDS CAN PLANT SITE REMEDIATION

GROUNDWATER RECOVERY SYSTEM MONITORING PROGRAM
MODIFIED POST START-UP PERIOD

Location	Parameter(s)	Frequency
Water Quality Monitoring		
Supplemental Monitoring Wells	EPA Method 601/602, plus xylenes, EPA Method 624 (select wells), Eh, pH, Temperature, Turbidity, Specific Conductivity	Semi-annually
Recovery Wells (Except RW-6, RW-7, RW-8 & RW-9)	EPA Method 601/602, plus xylenes, Eh, pH, Temperature, Turbidity, Specific Conductivity	Semi-annually
RW-6 & RW-7	EPA Method 624, plus xylenes, Eh, pH, Temperature, Turbidity, Specific Conductivity	Semi-annually
RW-8 & RW-9	EPA Method 624, plus xylenes, Eh, pH, Temperature, Turbidity, Specific Conductivity	Semi-annually
Early Warning Monitoring Wells	EPA Method 601/602, plus xylenes	Alternating Monthly (See Table 8-1)
Municipal Wells (K-1, K-2 & M-2)	EPA Method 502.2	Monthly
WTF Influent & Effluent	EPA Method 502.2	Monthly
Water Level Monitoring		
Early Warning Monitoring Wells	Water Level Elevation	Monthly
Supplemental Monitoring Wells	Water Level Elevation	Monthly
Recovery Wells	Water Level Elevation	Monthly
All Site Monitor Wells and Recovery Wells	Water Level Elevations	Semi-annual
Flow Rate Monitoring		
Recovery Wells	Flow Rate (gpm)	Daily

SECTION 12
REFERENCES

1. Order on Consent, New York Department of Environmental Conservation and Miller Brewing Company Index # A7-0322-9411, Site # 7-38-029, December 12, 1995.

2. Final Remedial Design Submittals, Reynolds Can Plant Site, Fulton, New York, ??????????.

3. Remedial Design Report Addendum, Reynolds Can Plant Site, Fulton, New York, September 1995.

4. Remedial Design Report, Reynolds Can Plant Site, Fulton, New York, March 1995, Revised May 1995.

5. Record of Decision, Former Miller Container Site, Town of Volney, Oswego County, Site Number 7-38-029, March 1995.

6. Request for Proposals, Design/Build/Operate Technical Specifications, Reynolds Can Plant Facility, Site Remediation Project, Fulton, New York, May 1995.

7. Functional Guidelines for Evaluating Organic Analyses, EPA, (EPA 68-01-6699).

8. RCRA Quality Assurance Project Plan Guidance, New York State Department of Environmental Conservation, March 29, 1991.

9. Driscoll, *Groundwater and Wells* 2nd Edition, Johnson Filtration Systems, 1986.

10. Grubb, Analytical Model for Estimation of Steady-State Capture Zones of Pumping Wells in Confined and Unconfined Aquifers, *Groundwater*, Volume 31, Number 1, 1993.