PERIODIC REVIEW REPORT (2015)
AMERICAN THERMOSTAT SITE
NYSDEC SITE NO. 420006

WORK ASSIGNMENT NO. D007619-01

Prepared for:

New York State Department of Environmental Conservation
Albany, New York

Prepared by:

MACTEC Engineering and Consulting, P.C.
Portland, Maine

MACTEC: 3612112204

FEBRUARY 2016

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GLOSSARY OF ACRONYMS AND ABBREVIATIONS

AGC	Annual Guideline Concentrations
AT	American Thermostat Company
AWQ	Ambient Water Quality
bgs	below ground surface
BOD	Basis of Design
EC	engineering control
EW	bedrock well
GAC	granular activated carbon
gpm	gallon(s) per minute
GWETS	groundwater extraction and treatment system
IC	institutional control
LTM	long term monitoring
MACTEC	MACTEC Engineering and Consulting, P.C.
NYS	New York State
NYSDEC	New York State Department of Environmental Conservation
O&M	operation and maintenance
OM&M	Operation, Maintenance and Monitoring
OU	operable unit
OW	overburden well
PCE	tetrachloroethene
PLC	Programmable Logic Controller

GLOSSARY OF ACRONYMS AND ABBREVIATIONS (CONTINUED)

POET	point of exposure treatment system
PRR	periodic review report
RAO	Remedial Action Objective
ROD	Record of Decision
RSO	remedial systems optimization
SGC	Short-Term Guideline Concentrations
Site	American Thermostat site
SM	site management
SMP	Site Management Plan
SVI	soil vapor intrusion
µg/l	microgram(s) per liter
USEPA	United States Environmental Protection Agency
VI	vapor intrusion
VOC	volatile organic compound

EXECUTIVE SUMMARY

The American Thermostat (Site No. 420006; herein referred to as the Site) is an approximately eight acre site located in South Cairo, Town of Catskill, Greene County, NY. The Site was remediated in accordance with Record of Decision (ROD) for Operable Unit 1 (OU1) (potable water supply) (United States Environmental Protection Agency [USEPA], 1988) and OU2 (soil, sediment, surface water, groundwater, and building contamination) (USEPA, 1990). The Site includes an active groundwater extraction and treatment system (GWETS). The contaminants of concern are volatile organic compounds including tetrachloroethene (PCE), trichloroethene, 1,2-dichloroethene, and vinyl chloride. Remedial goals outlined in the ROD documents for the Site are to ensure protection of groundwater from site contaminants in soil, restore groundwater to drinking water standards or until a point has been reached at which contaminant concentrations in the groundwater "level off", and reduce risk to human health and the environment. Current Site Management (SM) requirements for monitoring the performance and effectiveness of the remedial measures completed at the Site consist of operating the groundwater extraction system to maintain hydraulic control in source area, routine inspection, sampling, and reporting.

The GWETS has been operational for fifteen years, and monitoring results have indicated that achieving groundwater cleanup goals in a reasonable period of time will not be possible. The exposure pathways resulting from Site contaminants being released into the environment have either been eliminated through previous and current actions (i.e., extension of the public water supply and thermal treatment of shallow contaminated soil, as well as residential point of exposure treatment systems), or are not complete (i.e., vapor intrusion). It should be noted that mitigation of the on-Site American Thermostat building may be warranted if occupancy of the currently vacant building resumes. The objective of treating groundwater "until federal and state standards for the organic contaminants have been achieved" is not realistic at this site.

As a result of the 2012 remedial system optimization (RSO) summarized below, the Remedial Action Objective for the Site has been redefined to focus on hydraulic containment of the source area. This is an achievable goal that is protective and cost-effective.

Based on information gathered as part of the RSO Investigation and the updated conceptual site model, optimization measures to the GWETS were implemented in 2013 and are continuing. By focusing on hydraulic containment of the source area and eliminating off-site deep bedrock extraction wells, the northeastern edge of the PCE plume is expected to separate from the plume and migrate towards Catskill Creek. Therefore the effectiveness of the GWETS will be increased, operating costs will decrease, groundwater will continue to be treated and its quality gradually improved with time, and on-going monitoring will evaluate migration pathways and potential receptors.

This Periodic Review Report (PRR) summarizes SM activities completed at the Site from January 2015 through December 2015. The recommendations highlighted in the RSO Implementation Activities Report (MACTEC Engineering and Consulting, P.C. [MACTEC], 2013a), were detailed in a Basis of Design Memorandum for improvement to the treatment facility (MACTEC, 2013b) as well as to the groundwater extraction system (MACTEC, 2013c). The modifications continued throughout 2015, and are anticipated for completion in 2016. During the reporting period, the GWETS was shut down on several occasions for the RSO modifications described above. As of December 2015, the GWETS was essentially modified and returned to operating status. Hydraulic gradient and long term monitoring (15 months) was not performed; however, are scheduled for 2016.

As a result of the GWETS being shut down for optimization measures of the extraction system the engineering controls were not functioning as designed. Reference to Box 2 Engineering Controls Certification Form. This PRR includes a list of Corrective Measures as required to address the uptime factor.

1.0 SITE OVERVIEW

1.1 SITE HISTORY AND DESCRIPTION

American Thermostat Company (AT) produced thermostats and used chlorinated and non-chlorinated solvents in its manufacturing from 1954 to 1985. The waste solvents were disposed on the property and/or discharged to the septic system.

In 1981, the New York State Department of Environmental Conservation (NYSDEC) and the New York State Department of Health sampled nearby residential wells and detected tetrachloroethene (PCE) in residential wells exceeding the federal maximum contaminant levels. Shortly thereafter, the United States Environmental Protections Agency (USEPA) took over the management of the American Thermostat site (Site) and installed a Point of Exposure Treatment System (POET) consisting of carbon filtration units on affected homeowners' wells. AT ended site operations in 1985, and in 1987 USEPA commissioned a focused Feasibility Study to evaluate an Alternative Water Supply for the affected residents. In 1988 a Record of Decision (ROD) was signed for Operable Unit 1 (OU1) that outlined extension of the existing public water supply as well as maintaining POET systems for several private wells including the communal water supply for the Country Estates trailer park, located 3000 feet northwest of the Site, in addition to three residential wells. Country Estates has two bedrock wells that provide water for tenants within the trailer park. Both wells contain site-related contaminants. USEPA conducted a Remedial Investigation for soil, surface water and groundwater at the Site. In 1990 the ROD for OU2 was issued outlining mitigation measures for the source area.

Remedial activities specified in the OU2 ROD included:

- decontamination of the manufacturing building
- cleanup of contaminated soil behind the manufacturing building
- cleanup of the contaminated sediments found in nearby Rath Pond, and
- extraction and treatment of contaminated groundwater from the shallow and deep aquifers using air-stripping and carbon adsorption.

The soil and sediment was to be excavated, thermally treated to achieve a concentration of 1 milligram per kilogram PCE, and then returned to the excavation. A summary of the soil excavation and treatment is presumably provided in a Remedial Action Report for Soil. A Freedom of Information Act request to the USEPA for the report was submitted; however, USEPA has not been able to acquire a copy of this Report from their files so the area, volume treated and effectiveness of the Low Temperature Thermal Desorption treatment has not been verified. Sampling as part of the remedial systems optimization (RSO) Implementation Activities conducted in 2012 showed that contaminant concentrations in the treated soil area and Rath Pond sediments were minimal compared to previous levels, which suggests excavation and treatment did occur to some extent however, the source material beneath the building remains.

The treatment of groundwater was accomplished by the installation of a groundwater extraction and treatment system (GWETS) consisting of 14 open-hole bedrock wells, 16 screened overburden extraction wells, 14 open-hole bedrock re-injection wells and 3 re-injection trenches. Each extraction well is constructed so that it will produce between 3 and 5 gallons per minute. Well pumps are activated by high-low switches; none of the pumps are variable speed and none are equipped with flow metering. Most of the bedrock extraction wells were residential bedrock wells (no longer in use) located within the footprint of the existing plume. To satisfy water yield or injection tests, some wells were deepened up to 340 feet. The overburden extraction wells were installed to a depth of 30 feet. None of the overburden extraction wells produce sufficient water to permit the pumps to operate continuously; in all cases, the pumps cycle.

The re-infiltration galleries, which were constructed in the till for a combined total length of 535 feet, could not sufficiently handle the volume of effluent due to the poor permeability of the soil, and their use was eventually discontinued. Bedrock re-injection wells were located within the footprint of the groundwater plume. The bedrock re-injection wells also proved ineffective at handling the volume of effluent due to the relatively low transmissivity of the bedrock aquifer, and injection into the bedrock aquifer was subsequently terminated; however the open-hole bedrock re-injection wells were never abandoned. Currently, GWETS effluent discharges to a surface drainage swale on the eastern side of the Site that eventually leads to Catskill Creek. Besides the GWETS, the groundwater remedial measure includes off-site treatment of the communal water supply for the Country Estates trailer park (now maintained and operated by its owner), and

individual wellhead treatment of three residential wells with granular activated carbon (GAC). Water supplies at these locations are routinely monitored for potential site-related contaminants.

The ROD for OU2 stated that: "The groundwater treatment will continue until federal and state standards for the organic contaminants have been achieved in the groundwater throughout the contaminated plume area or until a point has been reached at which contaminant concentrations in the groundwater 'level off'. At that point, the remedy will be reevaluated for its effectiveness". It was assumed in the OU2 ROD that the selected remedial alternative for groundwater would take up to 30 years to achieve cleanup levels (5 micrograms per liter [µg/L] for PCE).

The GWETS became fully operational in 1998 and the USEPA conducted 5-year reviews in 2003, 2008 and 2013. In 2008, following 10 years of Site management (SM) by the USEPA, the Site was transferred to NYSDEC. NYSDEC completed a Periodic Review Report (PRR) in 2010. This review indicated that monitoring of plume concentrations was primarily conducted at active extraction wells, and concentrations of site contaminants appear to be steady and/or slightly trending downward in the plume area. However, in the source area, concentrations remain elevated (above 1,000 ug/L) and declining at even a slower rate indicating that concentrations may be sustained by the presence of a residual contaminant source. It appeared that groundwater treatment had reached a point at which contaminant concentrations had more or less 'leveled off' and the remedial action should be reevaluated for its effectiveness.

In the winter 2012, the vapor intrusion (VI) pathway within the plume boundaries was evaluated (MACTEC Engineering and Consulting, P.C. [MACTEC], 2012a). Soil VI (SVI) Sampling indicated potential migration pathway of vapors to the Site manufacturing building and the adjacent Hook property. A sump cover was installed by the property owner to reduce potential exposure to vapors.

In the spring/summer 2012, MACTEC conducted an RSO Implementation field investigation to:

- evaluate remedy performance relative to remedial goals
- identify potential changes to the remedy to enhance effectiveness, reduce costs, and shorten time to closure
- verify site conceptual model and closure strategy;
- identify problem areas and recommend improvements, and
- evaluate progress in reaching closure.

Results of the RSO Implementation activities were submitted to the NYSDEC in 2013, leading to numerous recommendations for improvement regarding the groundwater remedy; these recommendations are provided in the RSO Implementation Activities Report (MACTEC, 2013a). Specific to the GWETS, a Basis of Design (BOD) memorandum (MACTEC, 2013b) was prepared following the RSO Implementation Activities Report to define modifications that should be made to the groundwater treatment system for a more streamlined system to improve effectiveness and lower operating costs.

Beginning in early 2013, implementation of Phase I (interior treatment plant component demolition) of the BOD recommendations commenced. By the Fall of 2013, Phase II was essentially completed which included the majority of upgrades to the treatment process. In 2014, Phase III activities including retrofitting existing extraction wells, decommissioning numerous extraction and injection wells and re-purposing several injection wells began. Phase III activities continued through 2015 and will be completed in 2016, including installation of a new control system to allow for unattended operation. These upgrades caused the majority of the down time in 2015.

1.2 PHYSICAL SETTING

The Site is located in a rural residential area in South Cairo, Town of Catskill, Greene County, New York, approximately 30 miles southwest of Albany and five miles west of the Village of Catskill. The approximately eight-acre site is bordered by Routes 23B and Route 23 on the north and south, respectively, by a residential property on the west, and by New York State (NYS)-owned property on the east (see Figure 1.1). The Site contains the former American Thermostat building and the water treatment plant constructed for the implementation of the groundwater remedy.

The topography within the vicinity of the Site is characterized by the gently rolling foothills of the Catskill Mountains, which are deeply incised by stream channels. The Site is located on a slight ridge overlooking Catskill Creek Valley. Immediately west of the facility is a small valley which includes Tributary B, a tributary of Catskill Creek. East of the facility is Tributary A, which also flows into Catskill Creek, located approximately a quarter mile to the east of the Site.

Regionally, the bedrock within Greene County consists of interbedded shales and sandstones of Devonian age, known as the Catskill Formation. The Catskill Formation is made up of four distinct bedrock groups. From oldest to youngest, these groups are Hamilton, Genesee, Sonya, and West Falls. The Site lies within the Hamilton Group. In the vicinity of the Site, the bedrock is at an average depth of 28 to 30 feet below the ground surface (bgs); however, in the vicinity of the former manufacturing building, bedrock is approximately 100 feet bgs. The overburden overlying the bedrock is primarily glacially-derived soils.

A groundwater investigation as part of the RSO Implementation activities indicated that there is limited hydraulic connection between the overburden and bedrock at the Site. Overburden groundwater is perched and slowly drains laterally toward low lying areas, and vertically into the bedrock aquifer. Bedrock groundwater level fluctuations recorded during the RSO Implementation activities were compared to barometric fluctuations over the same time period. The resulting relationship between water level fluctuation and barometric fluctuation indicated that the bedrock aquifer is likely semi-confined.

The area surrounding the Site is characterized as rural-residential. There are a few full-time residences, vacation homes, and several small businesses in the vicinity of the Site. The American Thermostat Corporation was the only manufacturing facility in the area.

Approximately 5,000 people live within a 3-mile radius of the Site in low-density residential areas. Until a public water supply line was installed to protect the public from exposure to contaminated groundwater, all homes within ½ mile of the Site used private wells. At present, various residences and businesses within the immediate vicinity of the Site property receive water from the municipal water supply of the Village of Catskill. However, while a municipal water supply was provided, property owners were not required to connect to the system. Therefore the need for GAC systems remains in three private residential wells and the trailer park within the limits of the groundwater plume.

Catskill Creek is classified as a trout stream and has considerable recreational value to local and visiting fishermen. The Creek is also an auxiliary water supply for the Village of Catskill.

1.3 CLEANUP GOALS AND REMEDIAL PROGRESS

Based on the ROD, groundwater treatment will continue until "federal and state standards for the organic contaminants have been achieved in the groundwater throughout the contaminated plume area or until a point has been reached at which contaminants concentrations in the groundwater 'level off'. At that point, the remedy will be reevaluated for its effectiveness". Based on the results of the RSO activities and presented in the 2012 PRR, the remedial objective has been modified by the NYSDEC to be limited to source control and (onsite) hydraulic containment of grossly contaminated groundwater.

Hydraulic containment is accomplished through the use of six bedrock extraction wells and seven overburden wells. Previous offsite extraction wells maintained the shape and direction of the plume against the natural groundwater flow path towards Catskill Creek. The RSO investigation findings predicted eliminating the off-site deep bedrock extraction wells would separate the northeastern edge of the PCE plume from the plume and migrate towards Catskill Creek. As a result a small portion of the offsite plume will be drawn into the Country Estates wells where it will be treated via the existing treatment system that is in place, and the remainder of the plume will begin to slowly move toward Catskill Creek where it will eventually discharge and dilute to low concentrations. Monitoring the migration and/or degradation of the plume is accomplished with the long term monitoring (LTM) program.

2.0 EVALUATION OF REMEDY PERFORMANCE, EFFECTIVENESS AND PROTECTIVENESS

The SM Plan (SMP) for the AT Site includes an institutional controls/engineering controls (ICs/ECs) Plan, Operation and Maintenance (O&M) Plan, LTM Plan, and associated reporting (MACTEC, 2012b). SM requirements are summarized in Table 2.1. The contents of Table 2.1 is a combination of the requirements specified in the SMP and those being implemented as part of the RSO Implementation recommendations (MACTEC, 2013a). The SMP is currently being updated to reflect the numerous changes being implemented at the Site.

2.1 INSTITUTIONAL CONTROLS/ENGINEERING CONTROLS

IC/ECs provide added measures of protection for potentially exposed receptors over and above natural attenuation mechanisms and source area remedial measures. ECs off-site consist of restrictions directing potentially affected residential groundwater supplies through GAC units. These ECs are monitored through the collection and analysis of samples following water supply treatment through the GAC units for three individual residential supply wells. On-site, institutional controls consist of a restriction of groundwater use and well installation, and engineered controls consist of the GWETS and site perimeter fence. Some off-site groundwater is also captured by the GWETS to confine the plume extent and migration and recover contaminant mass.

The RSO Implementation field activities in 2012 identified surface and subsurface soil PCE contamination at the Site that exceeds the ROD cleanup goal of 1 milligram per kilogram. Surface soil contamination was identified immediately adjacent to the former manufacturing building (MACTEC, 2013a). The SMP includes a soil excavation plan controlling exposure to contaminants during excavation of soil, thereby establishing an IC for soil at American Thermostat (MACTEC, 2012b).

The former manufacturing building is now being used to store vintage cars slated for restoration. The building owner is not permitted to excavate soil on the property without permission of the NYSDEC. If the owner uses the building for other than storage (current use), vapor mitigation will be necessary to address exposure to SVI.

2.1.1 Site Controls and Evaluation

Requirements for the Site controls are presented on Table 2.1. Effectiveness of the groundwater remedial measures is directly related to monitoring and maintenance of the groundwater residential well GAC units, and maintenance and monitoring of treatment processes related to the GWETS. Progress of the groundwater remediation is tracked through the LTM program (see Table 2.2), interpretation of plume extent, and evaluation of trends in concentration over time. Observations regarding each of these components are discussed in the following subsections.

2.1.2 GWETS

Operating parameters for the GWETS include monitoring volume treated (gallons), flow rate and flow per reporting period (approximately monthly) and total volatile organic compounds (VOCs) extracted from groundwater. These quantities are summarized on Tables 2.3 and 2.4. During the reporting period, the treatment plant processed approximately 10,523,141 gallons of groundwater at an average flow rate of approximately 25 gallons per minute (gpm), and removed approximately 142 pounds of total VOCs. A summary of GWETS performance monitoring results for 2015 are summarized in the tables and charts provided in Appendix A.

In 2015 modifications to the extraction system continued (BOD Memorandum MACTEC, 2013b). Improvements implemented during 2015 include:

- Upgraded extraction wells - risers extended, new pumps installed, doghouses installed, controls placed above ground, and vaults backfilled with crushed stone.
    - OW-2, -3, -5, -7, -13, -14, & -16
    - EW-2, -6, -7, -9, 16
- Converted extraction and injection wells to monitoring wells – pitless adapter plugged, sanitary seal installed, risers extended, and vaults backfilled with crushed stone.
    - EW - 3, EW - 4, EW-5, EW - 12, IW - 8, IW - 10
    - EW-5 was grouted to approx. drilled out and redeveloped
- Decommissioned nine (9) extraction wells – wells grouted, risers cut below ground and vaults backfilled with crushed stone
    - OW-1, -4, -6, -8, -9, -10, -11, -12, -15
    - Vaults were cut ~ 12” below ground surface at 2 locations: OW-8 and OW-9.
- Removed from service (pitless adapter plugged and sanitary seal installed):

- EW - 8, EW - 11 and EW - 13 (now used as monitoring points)
- IW-1, IW-2, IW-3, IW-4, IW-5, IW-6, IW-9, IW-11, IW-12, IW-14
- EW-1, EW-10, EW-14, EW-15

- Programmable Logic Controller (PLC) panel installation

2.1.3 Residential GAC Treatment Systems

While municipal water is supplied through the town distribution system to many houses in the area, three households located within the plume are equipped with wellhead protection via small ultraviolet and GAC treatment trains. Sampling and reporting are conducted on a quarterly basis.

2.2 OPERATION & MAINTENANCE PLAN

The remedial measures in place require routine inspection, sampling, and maintenance to provide effective remediation and reduction of exposure to site-related contaminants. O&M procedures and requirements are presented in the SMP (MACTEC, 2012b). The O&M Plan is being revised as part of the SMP to incorporate the numerous changes implemented at the Site over the last three years. The following subsections describe requirements and compliance with the O&M Plan with respect to the GWETS, and individual residential GAC units.

2.2.1 GWETS

Monthly progress reports are generated to summarize GWETS system operation and to present operational and maintenance data to the NYSDEC (MACTEC, 2015a-k; MACTEC, 2016).

A total of 12 extraction wells are active and include 5 bedrock wells (EWs) and 7 overburden wells (OWs):

- EW-2, EW-6, EW-7, EW-9, EW-16
- OW-2, OW-3, OW-5, OW-7, OW-13, OW-14, OW-16

During this reporting period, approximately 1500 hours were reported as downtime. The GWETS was shut down on several occasions in 2015 for GWETS improvements. The larger blocks of shut down time occurred in November (30 days) for the installation of the main panel control,

December (22 days) for programming and calibrating the new main panel controls, and May (5 days) for air stripper float and effluent pump repairs. Down time represented approximately 16 percent of total available operating time.

During this reporting period, approximately 10,523,141 gallons of extracted groundwater were processed with an average flow rate of approximately 25 gpm, and approximately 142 pounds of total VOCs were removed (Tables 2.2 and 2.3). The influent and effluent VOC samples are collected and analyzed monthly, so mass removal is an approximation.

Despite the fact that the GWETS was shut down a significant amount of time during the year (16%) the total amount of water pumped over the period was actually slightly greater than the same period in 2013 and 2014.

As of 2013, the NYSDEC started using the Ambient Water Quality (AWQ) Standards and Guidance (NYSDEC, 1998) for comparison to the treated groundwater being discharged to the swale. These limitations are applicable at the point of discharge at the end of the force main which leads to the unnamed Tributary A (a Class C surface water body). Air discharge limits for the Site are based on meeting the requirements in the NYSDEC Division of Air Resources DAR-1 Annual Guideline Concentrations (AGC)/ Short-Term Guideline Concentrations (SGC) guidance tables which require ground-level ambient air concentrations at the property boundary and beyond to not exceed AGC and SGC.

Performance monitoring results are summarized in Table 2.5. As shown, effluent iron concentrations were observed to exceed the AWQ criterion for two months during 2015; however, air discharge criteria were met and all influent VOCs were removed by the air stripper in 2015. Treated groundwater effluent is discharged to a drainage swale which ultimately leads to Catskill Creek. With the exception of one iron detection, the treated effluent met surface discharge limits during the reporting period.

2.2.2 Residential GAC Treatment Systems

Maintenance and monitoring of the three residential wellhead protection systems (Klinke, Kubler, and Viella) is performed on a quarterly basis. Results are summarized in Table 2.6. As shown, cis-

1,2-Dichloroethene was detected above the reporting limit (but below the NYS Class GA groundwater standard) at one residential system during the first two quarterly sampling events in January and April 2015. As a result, carbon filter change out occurred during the reporting period.

2.3 LONG TERM MONITORING

The LTM program includes collecting samples and recording water level measurements (depth to groundwater) at selected extraction wells and monitoring wells for plume delineation and bedrock potentiometric surface maps (see Figure 2.1). The SMP currently indicates that semiannual groundwater sampling in April and October is required; however, based on recommendations presented in the BOD, sampling frequency was reduced to annual sampling for 2014 and then subsequent sampling events are to be every 15-months (MACTEC, 2013c). The last LTM sampling event was in December 2014; therefore, the next sampling event is scheduled to occur in March 2016.

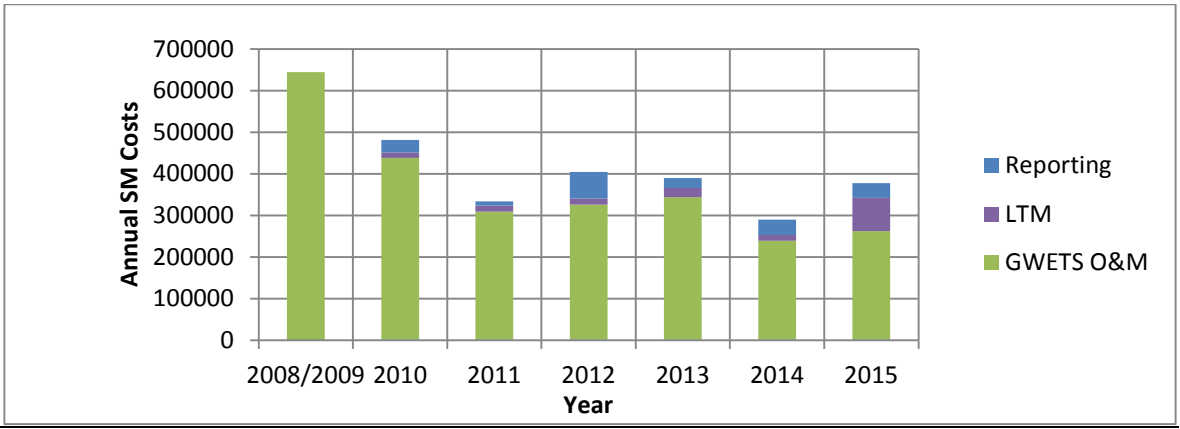
3.0 COST CONTROL SUMMARY

A cost summary for the reporting period is provided below by task. As shown, the majority of SM costs for the reporting period were incurred for operation and maintenance of the GWETS.

Task 2 (GWETS OM&M)[a]	
Labor	$143,114
Lodging, Travel, and MI&E	$10,162
Shipping	$55
Waste Disposal	$5,797
Phone/Internet	$1,771
Plowing	$4,534
Supplies & Equipment	$16,920
Electricity*	$7,856
Propane*	$1,400
Water*	$216
Laboratory Services*	$6,342
	$198,197
Task 3 (LTM)	
Labor	$21,782
Lodging, Travel, and MI&E	$2,115
Subcontractor (Decommissioning)	$53,217
Supplies & Equipment	$3,170
	$80,284
Task 4 (Reporting, incl PRR)	
Labor	$28,712
Task 5 (SMP updates)	
Labor	$6,813
Task 6 (GWETS Modifications)	
Labor	$59,394
Lodging, Travel, and MI&E	$2,518
	$61,912
Annual Total:	$375,918

NOTES:
[a] includes residential GAC system Operation, Maintenance & Monitoring (OM&M)
*NYSDEC direct expense

Since the NYSDEC has assumed responsibility for the Site, annual OM&M costs have decreased by an average of 42 percent. Optimization measures to reduce the overall operating expenses have been and will continue to be implemented in an effort to provide further cost savings at the Site.



Notes:

GWETS O&M includes Country Estates and residential GAC system O&M, as applicable.

2008/2009: Costs as of 10/1/2008

2010: Reporting includes preparation of 2008/2009 PRR.

2012: O&M includes preparation of detailed design drawings for GWTS improvements; Reporting includes preparation of SMP and 2001/2011 PRR.

2013: O&M does not include preparation of detailed design drawings for GWTS improvements or implementation of RSO improvements. LTM includes conducting hydraulic effectiveness monitoring and EW-9 step test.

2014: Reporting includes 2014 PRR and drafting SMP update. O&M does not include GWETS Modifications.

2015: GWETS O&M includes oversight and coordination of GWETS upgrades/modifications; LTM reflects quarterly residential GAC system OM&M, extraction well decommissioning, EW-5 over drilling/MW conversion, & EW-5 investigation derived waste disposal.

4.0 CONCLUSIONS AND RECOMMENDATIONS

The Remedial Action Objective (RAO) was redefined in 2012 to focus on hydraulic containment of the source area. During the 2015 reporting period progress continued to be made toward the implementation of the RSO improvements/upgrades. Completion of the site improvements, anticipated in 2016, will result in an achievable goal that is protective and cost-effective. The following recommendations reflect the redefined RAO.

4.1 INSTITUTIONAL CONTROLS/ENGINEERING CONTROLS

The current ICs/ECs are adequate to achieve the objectives for protection of human health and the environment based on current Site use. A soil vapor exposure pathway exists at the former manufacturing building; however, the building is currently used only for storage purposes. Therefore, mitigation would be necessary to address exposure to SVI should the building be occupied.

Effluent concentrations of site-related VOCs did not exceed the surface water or DAR-1 discharge criteria in 2015. Monthly influent and effluent water concentrations could be used to calculate the air discharge concentrations if needed; therefore, the collection of monthly air discharge samples is no longer needed.

GAC systems on three residential wells continue to provide adequate protection from site-related contaminants of concern.

4.2 O&M PLAN

The O&M Plan (a component of the SMP) will be updated in 2016 to reflect the changes made to the GWETS. As a result of the system modification, once fully implemented a reduction in OM&M operator level of effort and supplies will result in 2016.

4.3 GROUNDWATER MONITORING PROGRAM

LTM sampling was not scheduled and did not occur in 2015. The next LTM sampling event will be conducted in March 2016. Changes in concentration resulting from the implemented changes to the extraction well array will continue to be monitored using a modified list of wells as presented in this report. The SMP will be updated in 2016 to reflect the current network of wells that are being monitored for plume migration, hydraulic gradient monitoring, and system performance.

4.4 PHASE II AND III UPGRADE ACTIVITIES

Phase II and Phase III upgrade activities continued to be worked on throughout 2015. Final plant component modifications, installation of the PLC, and well upgrades continued to be worked on through 2015 and are anticipated for completion in 2016.

4.5 SMP

The SMP will be modified in 2016 to reflect the various changes and revisions implemented at the Site during 2013, 2014, and 2015.

4.6 PLANNED CORRECTIVE MEASURES

A corrective measure plan is required whenever the ICs/ECs are not functioning as designed. The GWTS met all discharge limits during the reporting period. However, the GWETS was out of operation for a significant amount of time for system modifications necessary for optimizing the extraction system. The system was down for 16 percent of the time during the reporting period for the improvements. Despite the downtime, the total amount of groundwater extracted was similar to earlier years, see Table 2.3. Corrective measures to be performed include the following:

- Complete modifications to extraction system controls to improve system uptime.
- Re-survey extraction wells in 1Q 2016 that were extended above ground in 2015.
- Conduct a comprehensive water level measurement survey in 1Q 2016 for assessing hydraulic gradients.
- Perform 15month long term monitoring in 1Q 2016 to evaluate plume migration and confirm conceptual site model.

- Assess results from above to evaluate/certify system effectiveness at maintaining hydraulic gradients toward the site (2Q 2016).
- Reduce operator hours on site as system automation is accomplished.

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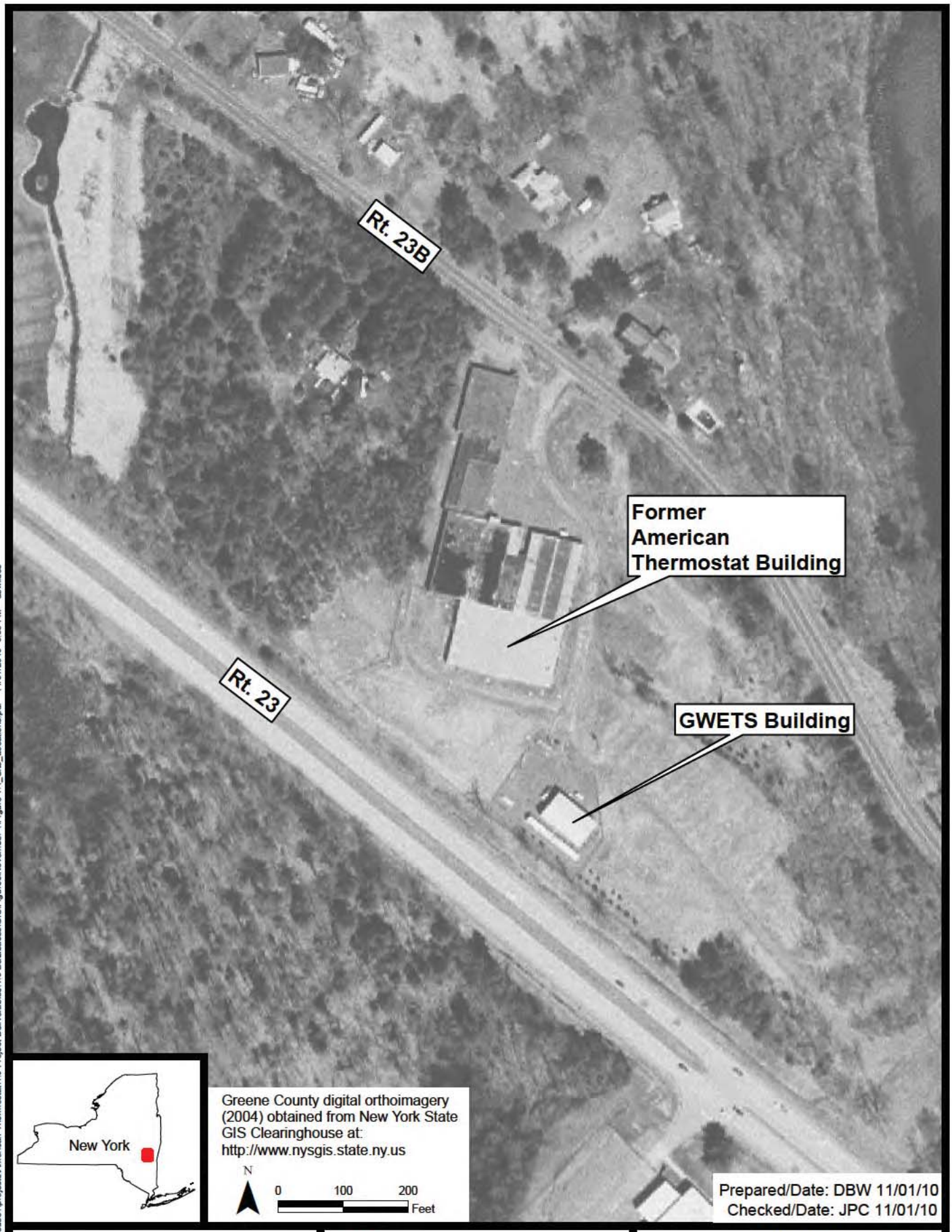
FIGURES



PERIODIC REVIEW REPORT
AMERICAN THERMOSTAT
SOUTH CAIRO, NEW YORK

MACTEC

Site Location
PROJECT 3612112204
FIGURE 1.1

Document: P:\Projects\nysdec1\projects\American Thermostat\4.0 Project Deliverables\4.5 Databases\GIS\MapDocuments\AmericanThermostat_SiteLocMap.mxd
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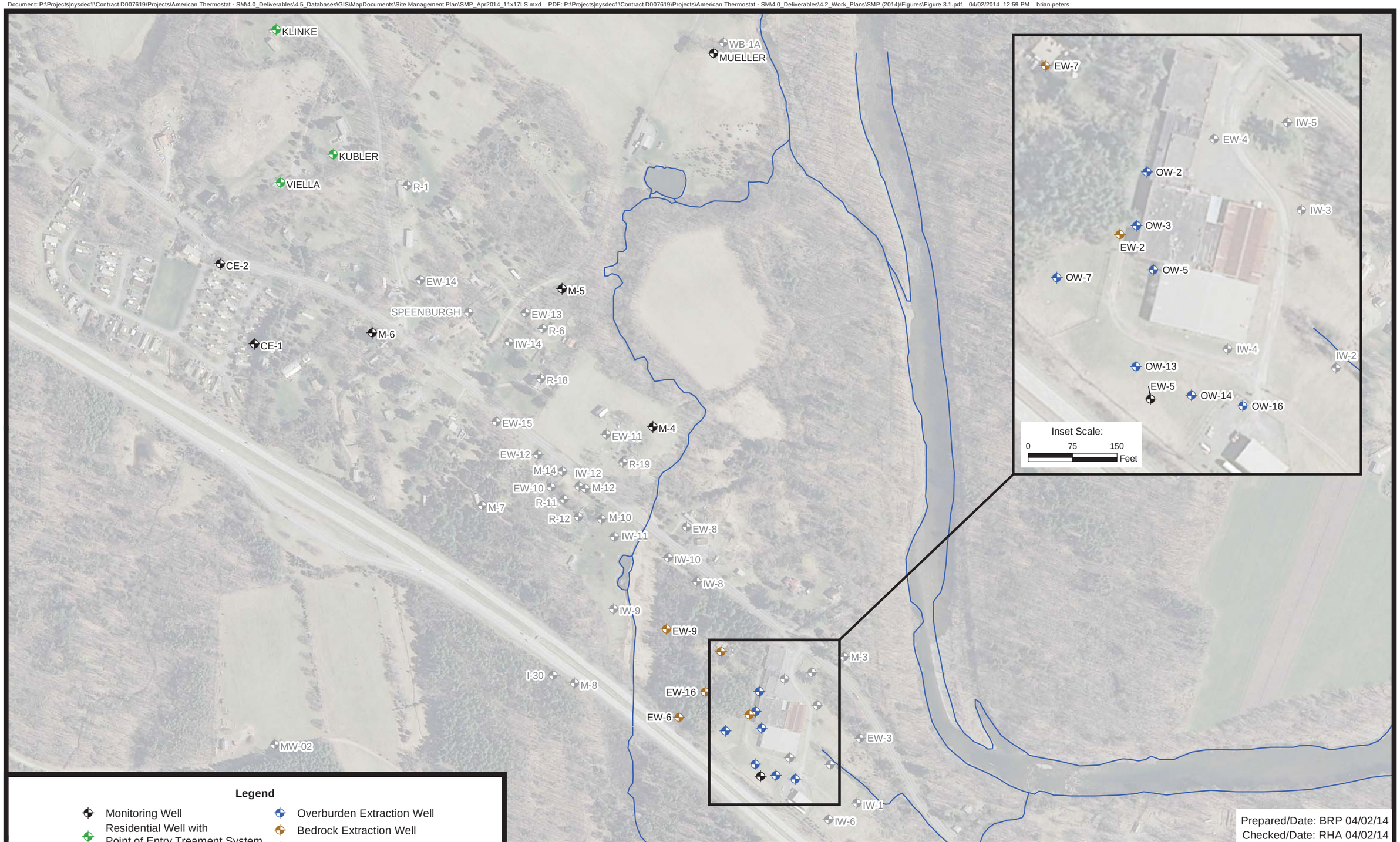


Legend

- Monitoring Well
- Residential Well with Point of Entry Treament System
- Overburden Extraction Well
- Bedrock Extraction Well
- Decommissioned Well

N

0 200 400 Feet

Greene County digital orthoimagery (2009) obtained from New York State GIS Clearinghouse at: http://www.nysgis.state.ny.us

Prepared/Date: BRP 04/02/14
Checked/Date: RHA 04/02/14

SITE MANAGEMENT PLAN
AMERICAN THERMOSTAT SITE (420006)
SOUTH CAIRO, NEW YORK

MACTEC

GROUNDWATER WELL LOCATIONS

Project 3612-11-2204 Figure 3.1

TABLES

Table 2.1: Site Management Requirements

Component	Action	Required Frequency	Comments/Recommendations
Groundwater Extraction and Treatment			
GWETS Operation - Daily Checklist	Inspection	Weekly (currently being conducted approx 3 days/week as plant operator visits site)	Check water treatment operation: flow rates, chemical usage, meter readings, system components.
Well Vaults, pumps and motors, Pneumatic traps	Inspection	Weekly	Check vaults for water buildup and component function. Inspect pumps and motors for excessive noise, heat, leakage. Drain condensate from traps.
Control panel, heaters, septic holding tank	Inspection	Weekly	Check function of all control panel indicating lights. Check level of septic holding tank. In cold weather verify pilot light operation of heaters.
Temporary Hazardous Waste Storage Unit	Inspection	Weekly	Check container condition, container markings and accumulation point.
Safety equipment, vault sump pumps, plant lighting	Inspection	Monthly	Inspect safety equipment (ladders, eyewash, fire extinguishers, etc.). Verify operation of vault sump pumps. Inspect plant lighting for proper operation.
Site Security	Inspection	Monthly	Check treatment building door locks, fencing, and site perimeter fence for defects.
Air stripper	Inspection	Annually	Perform cleaning of air stripper unit trays and sump.
Plant heaters	Inspection	Annually	Have subcontractor perform maintenance on treatment plant heaters.
Ground Water Monitoring System	Inspection	15-month sampling interval	Repair to well pads/installation of locks needed at various site wells to maintain integrity and security.
System Performance Monitoring			
Influent equalization tanks.	Influent water sampling	Monthly	Grab samples collected to evaluate and monitor GWETS system performance.
Air stripper effluent air/water	Air stripper effluent water and air sampling	Monthly	Grab samples collected to evaluate and monitor GWETS system performance.
Environmental Monitoring			
Ground Water Monitoring Program			
POET system sampling at Viella, Kubler and Klinke (See Table 2.2)	Residential water supply sampling	Quarterly	Grab samples collected to evaluate and monitor water supply and carbon filter integrity. Revised to quarterly frequency in 2010 per NYSDEC/NYSDOH concurrence.
Refer to Table 2.2	Groundwater sampling of 31 wells	15-month sampling interval	Grab samples collected from 31 locations; including 3 residential wells, 2 public supply wells, monitoring wells, former and active bedrock and overburden extraction wells, and former injection wells.

Table 2.2: Long Term Monitoring and System Performance Sampling - 2015

Sample Locations	Well Depth (ft)	Sample Description	Sample Depth (ft)	VOC	Water Level
Monitoring Wells					
M-4	200	PDB	130	15-months - Scheduled March 2016	15-months - Scheduled March 2016
M-5	200	grab	composite		
M-6	100	grab	composite		
Mueller	114	grab	composite		
CE-1 BEF	535	Before filters	composite		
CE-2 BEF	287	Before filters	composite		
Active Bedrock Extraction Wells					
EW-2	322	grab	composite	15-months - Scheduled March 2016	15-months - Scheduled March 2016
EW-5*	301.5	PDB	150		
EW-6	325	grab	composite		
EW-7	227	grab	composite		
EW-9	365	grab	composite		
EW-16	417	grab	composite		
Active Overburden Extraction Wells					
OW-2	30	grab	composite	15-months - Scheduled March 2016	15-months - Scheduled March 2016
OW-3	25	grab	composite		
OW-5	30	grab	composite		
OW-7	25	grab	composite		
OW-13	29.5	grab	composite		
OW-14	30	grab	composite		
OW-16	30	grab	composite		
Residential Wells					
VIELLA BEF	300	Before filters	composite	Quarterly	
VIELLA BET	300	Between filters	composite	Quarterly	
KUBLER BEF	300	Before filters	composite	Quarterly	Bi-annual
KUBLER BET	300	Between filters	composite	Quarterly	
KLINKE BEF	240	Before filters	composite	Quarterly	
KLINKE BET	240	Between filters	composite	Quarterly	

System Performance Monitoring				VOC	Metals	TDS/TSS
PS-INFLUENT		Influent		monthly	monthly	monthly
PS-AS-EFFLUENT		Air stripper effluent water		monthly	----	----
PS-AS-DISCHARGE		Air stripper effluent air		monthly	----	----

EW-5* = will be online in 2015
VOCs = Volatile Organic Compounds by method 8260
**VOCs by method TO-14 (air)
Metals = Total metals by method 6010
TDS = Total dissolved solids
TSS = Total suspended solids
CE-1 = Country Estates Well #1
CE-2 = Country Estates Well #2

Table 2.3: Treatment Plant Monthly Throughput

Month	Calendar Year (Gallons)																	
	1998	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
January	-	2,327,342	2,188,662	3,154,385	2,643,561	3,112,140	1,452,060	1,969,101	1,850,648	1,860,431	1,621,909	2,009,299	1,715,140	1,660,400	1,617,600	1,287,600	605,868	1,055,444
February	-	1,946,464	1,828,969	3,202,253	2,400,906	2,640,103	1,323,679	1,627,579	1,724,943	1,484,866	1,661,136	1,973,492	1,562,130	1,608,200	1,592,100	1,165,900	537,554	726,839
March	-	1,570,828	2,782,069	3,397,280	2,581,039	3,032,627	1,433,444	1,505,083	1,726,705	1,797,869	1,872,515	2,109,251	2,144,107	1,677,100	1,545,800	1,213,400	828,412	818,456
April	-	1,986,297	2,625,243	3,325,592	3,015,136	2,956,081	1,621,998	1,888,648	1,860,726	1,651,491	1,922,613	2,164,940	1,972,606	1,807,700	976,300	1,213,400	1,311,895	829,691
May	-	1,876,550	2,689,205	3,507,403	2,827,722	2,279,599	1,511,813	1,679,210	2,038,414	1,595,631	1,496,402	2,086,536	1,692,254	1,869,800	1,050,200	1,024,000	1,181,124	918,585
June	-	1,810,328	2,515,671	3,241,052	3,087,176	2,817,292	1,378,343	1,635,094	2,225,379	1,567,880	1,519,804	2,069,749	1,657,835	1,617,700	655,200	560,000	1,036,409	1,174,145
July	-	1,880,672	2,845,066	2,846,350	3,109,504	2,828,580	1,829,427	1,679,658	1,700,523	1,656,624	1,344,964	2,413,904	1,710,898	1,626,100	435,000	-	1,101,365	1,364,309
August	1,845,307	2,865,086	2,656,221	3,323,930	2,969,001	2,862,294	2,488,132	1,675,021	1,505,840	1,680,981	2,366,862	1,461,639	1,814,591	1,676,400	1,572,000	368,300	968,790	1,069,571
September	2,326,580	2,849,292	2,790,754	3,116,812	2,826,453	2,805,159	2,214,838	1,668,387	1,573,918	1,559,100	2,053,268	1,572,872	1,502,900	1,764,200	1,098,900	282,600	516,422	1,424,510
October	2,000,099	2,967,620	3,191,008	3,172,179	3,126,848	2,889,540	2,016,922	1,048,462	2,365,602	1,624,903	2,649,688	1,962,537	1,736,300	1,646,400	1,363,800	1,133,000	771,419	890,175
November	1,387,734	2,840,040	2,906,470	2,668,748	3,151,070	2,703,444	2,147,628	1,753,165	2,542,691	1,628,116	2,172,569	1,782,527	1,505,900	1,806,000	1,223,500	1,240,188	643,451	-
December	1,515,814	2,996,042	3,089,535	2,676,774	3,043,354	1,743,574	2,218,612	1,804,582	1,570,319	1,779,807	2,466,153	2,171,560	1,799,400	1,966,500	1,351,200	950,031	804,076	251,416
Total for Calendar Year	9,075,534	27,916,561	32,108,873	37,632,758	34,781,770	32,670,433	21,636,896	19,933,990	22,685,708	19,887,699	23,147,883	23,778,306	20,814,061	20,726,500	14,481,600	10,438,419	10,306,785	10,523,141
Cumulative Total Throughput	9,075,534	36,992,095	69,100,968	106,733,726	141,515,496	174,185,929	195,822,825	215,756,815	238,442,523	258,330,222	281,478,105	305,256,411	326,070,472	346,796,972	361,278,572	371,716,991	382,023,776	392,546,917

Note:
Plant modifications resulted in plant shut down during the month of July 2013.

Table 2.4: Total VOCs in Extracted Groundwater (lbs)

Month	Calendar Year																	
	1998	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
January	-	26.547	57.54	42.672	28.117	38.179	29.749	39.406	33.807	32.255	23.890	22.972	18.965	18.200	18.455	21.813	7.483	14.057
February	-	49.301	47.21	42.605	26.007	37.345	31.262	33.006	28.487	19.820	24.329	18.528	19.424	15.900	18.601	27.900	11.007	6.390
March	-	43.653	62.34	50.466	28.325	43.763	39.237	20.536	27.235	28.815	33.988	20.016	30.648	35.500	17.996	30.227	25.057	6.079
April	-	39.195	58.72	44.072	43.405	44.775	42.029	21.829	28.960	34.400	30.646	20.958	23.623	26.300	18.845	18.733	18.064	15.547
May	-	26.740	43.74	54.385	42.536	34.148	34.569	29.639	40.240	19.761	22.666	23.794	15.111	25.100	23.970	18.629	26.121	15.485
June	-	30.986	50.03	45.548	44.777	45.541	32.553	23.565	44.068	18.688	14.655	19.364	13.900	22.900	5.361	13.062	15.612	16.756
July	-	23.904	40.78	34.740	40.495	32.693	32.137	24.313	13.113	20.233	11.835	25.282	12.000	19.500	27.464	-	12.960	16.851
August	104.719	47.342	41.47	41.207	38.492	42.041	31.562	14.295	14.138	16.364	24.690	15.771	9.767	19.800	39.570	20.000	40.262	14.152
September	24.464	38.997	33.93	29.549	37.269	51.853	26.930	17.543	24.368	15.827	21.762	14.767	13.702	24.955	12.839	10.441	6.982	17.416
October	42.447	63.240	34.55	71.511	36.924	49.313	36.012	15.225	40.066	15.752	24.788	16.869	21.800	22.464	29.193	17.114	8.948	10.515
November	26.596	58.068	42.71	23.909	42.338	35.082	26.830	31.756	40.442	20.156	24.114	19.863	18.030	19.819	23.936	18.526	13.961	-
December	34.952	66.933	49.90	27.912	42.795	34.424	34.253	31.339	23.086	21.882	25.265	26.499	30.390	22.483	16.971	14.100	10.706	8.854
Total for Calendar Year (lbs)	233	515	563	509	451	489	397	302	358	264	283	245	227	273	253	211	197	142
Cumulative Total VOCs (lbs)	233	748	1,311	1,820	2,271	2,760	3,157	3,460	3,818	4,082	4,364	4,609	4,836	5,109	5,363	5,573	5,770	5,912

Note:
Total VOCs in Extracted Groundwater = Average of GWETS Influent Total VOCs Concentrations per month multiplied by the Monthly Flow Rate and the Monthly System Operating Duration.
Values are in pounds (lbs).
July 2013/November 2015 - system down for plant modifications.

Table 2.5: System Performance Sampling Results

			Parameter		1,2-DCE (total)	PCE	TCE	Vinyl Chloride	Barium	Iron	Total Dissolved Solids
			ACG		1,984,204	31,505	15,748	3,465			
			GA Std		5 ug/l	5 ug/l	5 ug/l	2 ug/l	NS	NS	500 mg/l
			AWQ Criteria		-	1 ug/l	40 ug/l	-		300 ug/l	
Location	**Matrix**	**Date**	**Field Sample ID**	**Units**							mg/L
PS-Influent	L	1/14/2015	PS-INFLUENT	ug/l	**400**	**800**	**390**	**5.1**	45.1	57.4	364
PS-Influent	L	2/5/2015	PS-INFLUENT	ug/l	**340**	**620**	**150**	**2.9**	51	95.6	393
PS-Influent	L	3/5/2015	PS-AS-INFLUENT	ug/l	**350**	**420**	**120**	10 U	50.1	88	419
PS-Influent	L	4/14/2015	PS-AS-INFLUENT	ug/l	**820**	**1,100**	**570**	**4**	55.2	90.5	348
PS-Influent	L	5/4/2015	PS-AS-INFLUENT	ug/l	**590**	**920**	**510**	20 U	41.2	250	336
PS-Influent	L	6/5/2015	PS-AS-INFLUENT	ug/l	**460**	**890**	**360**	20 U	57.5	**434**	385
PS-Influent	L	7/7/2015	PS-INFLUENT	ug/l	**390**	**780 F1**	**310**	20 U	56.7	202	339
PS-Influent	L	8/3/2015	PS-INFLUENT	ug/l	**390**	**990**	**200**	**5.5**	57.2	50.9	351
PS-Influent	L	10/5/2015	PS-INFLUENT	ug/l	**430**	**790 J**	**260**	**4.2**	58.7	**373**	357
PS-Influent	L	12/10/2015	PS-AS-INFLUENT	ug/l	**1600 F1**	**1,900 F1**	**720 F1**	20 U	104	159	447
Air Stripper Eff	L	1/14/2015	PS-AS-EFFLUENT	ug/l	2 U	1 U	1 U	1 U	47.8	58.8	363 J
Air Stripper Eff	L	2/5/2015	PS-AS-EFFLUENT	ug/l	2 U	**1** U	1 U	1 U	50	83	328
Air Stripper Eff	L	3/5/2015	PS-AS-EFFLUENT	ug/l	2 U	1 U	1 U	1 U	46.9	54	363
Air Stripper Eff	L	4/14/2015	PS-AS-EFFLUENT	ug/l	2 U	1 U	1 U	1 U	56.2	129	333
Air Stripper Eff	L	5/4/2015	PS-AS-EFFLUENT	ug/l	2 U	1 U	1 U	1 U	42.7	263	360
Air Stripper Eff	L	6/5/2015	PS-AS-EFFLUENT	ug/l	2 U	1 U	1 U	1 U	58.1	**354**	375
Air Stripper Eff	L	7/7/2015	PS-AS EFFLUENT	ug/l	2 U	1 U	1 U	1 U	55.4	149	339
Air Stripper Eff	L	8/3/2015	PS-AS EFFLUENT	ug/l	2 U	1 U	1 U	1 U	56.1	132	338
Air Stripper Eff	L	10/5/2015	PS-AS EFFLUENT	ug/l	2 U	1 U	1 U	1 U	53.8	50 U	339
Air Stripper Eff	L	12/10/2015	PS-AS-EFFLUENT	ug/l	2 U	1 U	1 U	1 U	101	136	440
Air Stripper Eff	G	1/14/2015	PS-AS DISCHARGE	ug/m3	2,000	6,000	1,900	23			
Air Stripper Eff	G	2/5/2015	PS-AS DISCHARGE	ug/m3	2,300	4,700	960	22			
Air Stripper Eff	G	3/5/2015	PS-AS DISCHARGE	ug/m3	2,200	2,600	680	18 U			
Air Stripper Eff	G	4/14/2015	PS-AS DISCHARGE	ug/m3	5,200	9,500	4,100	44 U			
Air Stripper Eff	G	5/4/2015	PS-AS DISCHARGE	ug/m3	2,800	4,000	2,100	26			
Air Stripper Eff	G	6/5/2015	PS-AS DISCHARGE	ug/m3	2,200	4,600	1,600	32			
Air Stripper Eff	G	7/7/2015	PS-AS DISCHARGE	ug/m3	2,000	4,200	1,500	28			
Air Stripper Eff	G	8/3/2015	PS-AS DISCHARGE	ug/m3	2,200	4,100	1,300	24			
Air Stripper Eff	G	10/16/2015	PS-AS DISCHARGE	ug/m3	3,000	6,900	1,900	34			
Air Stripper Eff	G	12/10/2015	PS-AS DISCHARGE	ug/m3	8,300	10,000	3,700	44			

Notes:
ug/l = Micrograms per liter
mg/l = Milligrams per liter
FS = Field Sample
FD = Field Duplicate

Table 2.6: Residential Treatment System Sampling Results

Location	Sample Date	Description	Parameter	1,2-Dichloroethene (total)	Cis-1,2-Dichloroethene	trans-1,2-Dichloroethene	Tetrachloroethene	Trichloroethene	Vinyl chloride
			Units	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
			GA	5	5	5	5	5	2
KLINKE	1/14/2015	Between Filters		0.81 J	0.81 J	1 U	1 U	1 U	1 U
KLINKE	4/9/2015	Between Filters		1.5 J	1.5	1 U	1 U	1 U	1 U
KLINKE	7/7/2015	Between Filters		2	2	1 U	1 U	1 U	1 U
KLINKE	10/5/2015	Between Filters		2 U	1 U	1 U	1 U	1 U	1 U
VIELLA	1/16/2015	Between Filters		2 U	1 U	1 U	1 U	1 U	1 U
VIELLA	4/9/2015	Between Filters		2 U	1 U	1 U	1 U	1 U	1 U
VIELLA	7/7/2015	Between Filters		2 U	1 U	1 U	0.39 J	1 U	1 U
VIELLA	10/5/2015	Between Filters		2 U	1 U	1 U	1 U	1 U	1 U
KUBLER	1/14/2015	Between Filters		2 U	1 U	1 U	1 U	1 U	1 U
KUBLER	4/9/2015	Between Filters		2 U	1 U	1 U	1 U	1 U	1 U
KUBLER	7/7/2015	Between Filters		2 U	1 U	1 U	0.73 J	1 U	1 U
KUBLER	10/5/2015	Between Filters		2 U	1 U	1 U	1 U	1 U	1 U

APPENDIX A

GWETS COMPONENT PERFORMANCE

Chart A-1

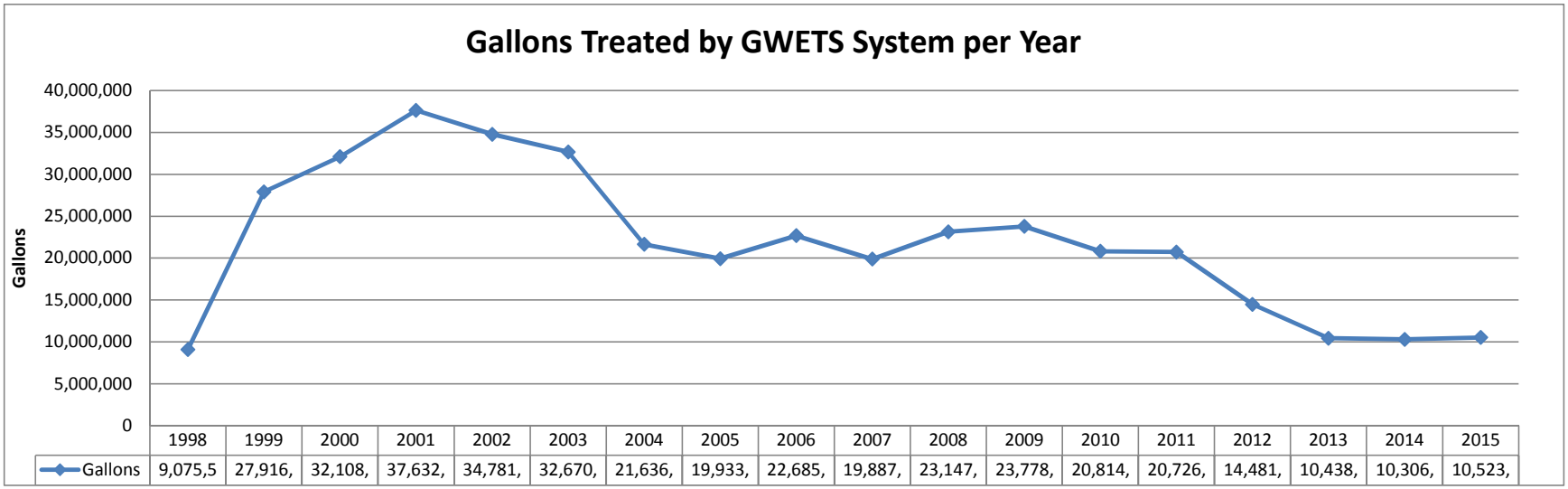
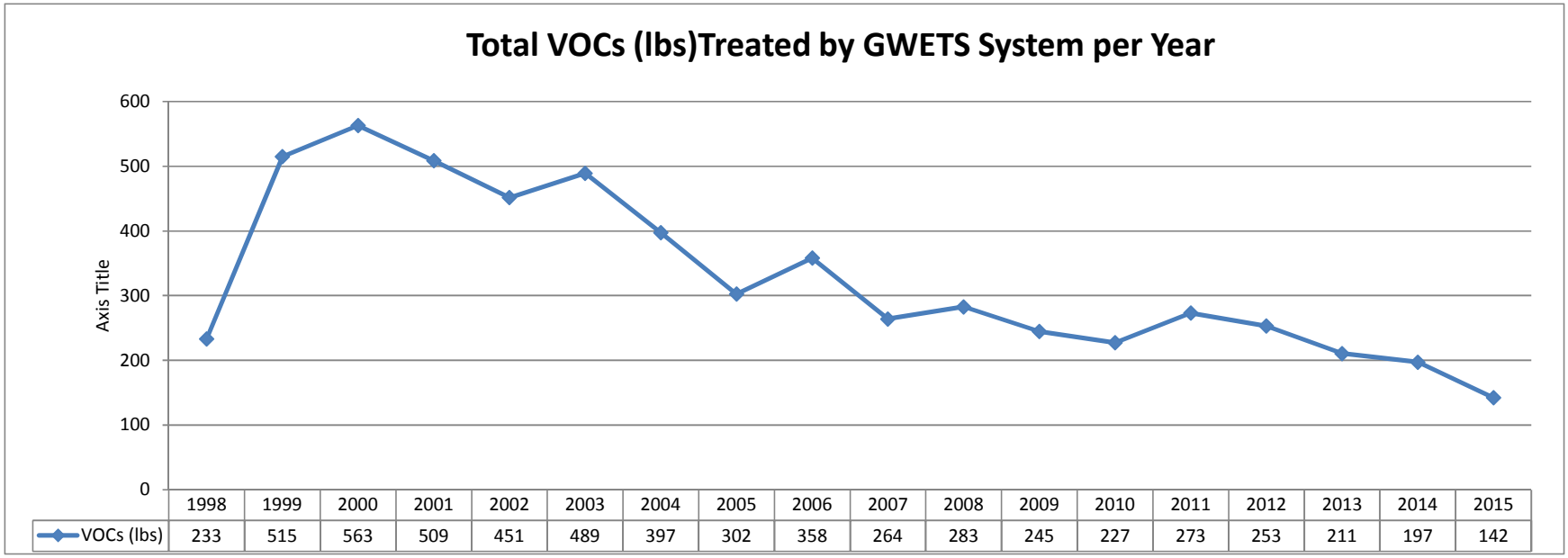

Gallons Treated by GWETS System per Year
Gallons
40,000,000
35,000,000
30,000,000
25,000,000
20,000,000
15,000,000
10,000,000
5,000,000
0
1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015
Gallons 9,075,5 27,916, 32,108, 37,632, 34,781, 32,670, 21,636, 19,933, 22,685, 19,887, 23,147, 23,778, 20,814, 20,726, 14,481, 10,438, 10,306, 10,523,

Chart A-2


Total VOCs (lbs)Treated by GWETS System per Year
Axis Title
600
500
400
300
200
100
0
1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015
VOCs (lbs) 233 515 563 509 451 489 397 302 358 264 283 245 227 273 253 211 197 142