Prepared for

Cortese Landfill Technical Committee
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OPERATION, MAINTENANCE AND MONITORING PLAN
Revision 1

Operable Unit 4, Source Areas

CORTESE LANDFILL SITE
NARROWSBURG, NEW YORK

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Project Number MR0562F
Document Number MD14196

JULY 2014

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1. INTRODUCTION

1.1 Purpose

On behalf of the Cortese Landfill PRP Group (the Group), Geosyntec Consultants (Geosyntec) has prepared this Operations, Maintenance, and Monitoring Plan (OM&M Plan) for Operable Unit 4 (OU4), Source Areas, to guide the operation and maintenance (O&M) of the Source Area Remedial Action (OU4 Remedy) at the Cortese Landfill Site (Site) located in Narrowsburg, New York (**Figure 1**). The OU4 Remedy, selected in the 2010 Record of Decision (ROD)/ROD Amendment (USEPA, 2010) to the earlier 1994 ROD (USEPA, 1994), addresses the remaining source contamination present below the water table beneath former source areas. The OU4 Remedy is being conducted in accordance with the 1996 Consent Decree, Civil Action No. 96-CV-1513, for the Cortese Landfill Site in Narrowsburg, New York as modified by the Amendment to the Consent Decree dated August 3, 2012 (Consent Decree, USEPA, 2012). This OM&M Plan is intended to guide in-situ source treatment operations, provide inspection and maintenance procedures and schedules for proper operation, and provide a groundwater monitoring program to evaluate remedy performance.

1.2 Background

Three former sources areas were identified at the Site as OU4 in the ROD/ROD Amendment. These former source areas include the former intact drum disposal area (IDDA) 1b, former IDDA 2, and the former eastern Septage Lagoon as shown on **Figure 2**. In-situ source treatment was selected as the OU4 Remedy to remove constituents of concern (COCs) from groundwater at or beneath the former source areas and thereby enhance the rate of dissolution of residual source material. The enhanced dissolution will reduce or eliminate the potential for releases from the former source areas and for contaminant migration. The reduction or elimination of the mass discharge from the former source areas will ultimately promote the restoration of the aquifer downgradient of the landfill, Operable Unit 3 (OU3). The OU4 Remedy presented in the Final Remedial Design Report for OU4, Source Areas ([Final OU4 RD], Geosyntec, 2012a) consists of in-situ treatment via air sparging (AS) at the former source areas, including amendment addition (such as ozone) during the final phase of AS, and soil vapor extraction (SVE) with aboveground treatment followed by a stabilization period of up to five years and a post-stabilization in-situ chemical oxidation (ISCO) application, if necessary, to treat recalcitrant source materials.

Monitored Natural Attenuation (MNA) was chosen as the remedy for OU3, downgradient groundwater. Details specifying the monitoring requirements for downgradient groundwater are contained in the MNA Remedial Design for OU3 ([MNA Plan], Geosyntec, 2013a). Although the MNA Plan addressing downgradient groundwater monitoring is separate from this OM&M Plan for the source areas, there are similarities and overlap between the two plans.

The final OU4 RD separated the former source areas into two treatment areas due to their location and source characterization history: the IDDA 1b treatment area, and the IDDA 2 and Septage Lagoon treatment area. The IDDA 1b treatment area is defined by the source characterization of the residual material beneath the former IDDA 1b (Golder 2004 and Golder 2008). The IDDA 2 and Septage Lagoon treatment area was defined in the Final OU4 RD by the footprint of the former source areas but limited source characterization data were available for the final OU4 RD. Source characterization of the IDDA 2 and Septage Lagoon treatment area was conducted during Source Area RA construction (Geosyntec, 2013a). It was found that the small amount of residual source material in this area does not contribute significantly to the mass discharge of COCs to the downgradient aquifer. In February 2013, the U.S. Environmental Protection Agency (USEPA) approved the request for no active treatment beneath the former IDDA 2 and Septage Lagoon source areas with COCs in groundwater to be addressed through MNA. Therefore, this OM&M Plan addresses in-situ source treatment in the IDDA 1b treatment area only.

1.3 OM&M Plan Organization

The document contains the following additional sections:

- Section 2 provides the project organization and emergency contact list;
- Section 3 provides an overview of the in-situ source treatment approach, a description of the major components and remedy implementation;
- Section 4 provides information regarding start up and operation of the source area treatment system;
- Section 5 describes periodic inspection and maintenance that is to be performed for the source area treatment system;
- Section 6 presents the source area performance groundwater monitoring program during various stages of the remedy;
- Section 7 discusses other Site OM&M activities;
- Section 8 lists OM&M reporting requirements;
- Section 9 discusses contingency procedures that may need to be implemented;
- Section 10 addresses the need for potential future revisions to this OM&M Plan; and
- Section 11 lists references used throughout this OM&M Plan.

2. PROJECT ORGANIZATION

This section summarizes the various stakeholders and their roles with regard to operation, maintenance, and monitoring (OM&M) for the OU4 Remedy. The list of stakeholders and their contact information are provided in **Table 1.** Emergency contact information for personnel responsible for OM&M for the OU4 Remedy should be posted at the Site.

2.1 USEPA

The USEPA is responsible for ensuring that OM&M are performed by the Group in accordance with the Consent Decree. USEPA responsibilities may include ensuring that required deliverables are submitted, reviewing deliverables for required elements, reviewing OM&M data, performing inspections and fulfilling five-year review requirements.

2.2 NYSDEC

The New York State Department of Environmental Conservation (NYSDEC) is a supporting agency with respect to ensuring that OM&M are performed by the Group in accordance with the Consent Decree. NYSDEC responsibilities may include providing input to USEPA, monitoring the progress of the remedy, reviewing deliverables including those required by State permits.

2.3 Cortese Landfill PRP Group

The Group is the overall responsible party for implementing the OU4 Remedy. They will retain contractors, engineers, and specialists as necessary to perform the OU4 Remedy and will be the primary point of contact with USEPA. Mr. Mark Snyder of SCA Services will serve as the Project Coordinator for the Group. The Group will participate in key negotiations with USEPA and prepare monthly progress reports to USEPA. The Group is responsible for retaining an O&M Contractor for the O&M of the OU4 Remedy.

2.4 Supervising Contractor

The Supervising Contractor is a qualified licensed professional engineering firm retained by the Group to direct and supervise the performance of the RA pursuant to the Consent Decree and the requirements of applicable federal, state, and local laws. The Supervising Contractor is responsible for monitoring compliance with both project and data quality requirements and progress of the work. The Supervising Contractor will prepare project deliverables for review by the Group and submit them to the agencies as required by the Consent Decree and this OM&M Plan.

2.5 O&M Contractor

The O&M Contractor will be retained by the Group to perform O&M of the Source Area RA in accordance with the Consent Decree and this OM&M Plan. The O&M Contractor will be responsible for operation, inspection and maintenance of the in-situ source treatment system and for maintaining O&M records.

2.5.1 Qualifications

Only qualified, trained, and experienced personnel can operate or perform maintenance on the in-situ source area treatment system. All O&M personnel shall have the necessary education and training to carry out the necessary operation and maintenance tasks presented herein. At a minimum, personnel adjusting operations or performing basic inspections and routine or non-routine maintenance will be required to possess the Occupational Health and Safety Administration (OSHA) Hazardous Waste Operator and Emergency Response (HAZWOPER) certification (40-hour and 8-hour annual refresher) such that they are in compliance with OSHA 29 CFR 1910.120.

2.5.2 Training

O&M Personnel will be trained by the RA construction contractor and/or other appropriate designee familiar with the treatment system components. O&M personnel should be trained such that they can perform routine O&M activities adequately with little or no direction. All O&M personnel shall be made familiar with this OM&M Plan and various equipment manuals. O&M personnel should contact the RA construction contractor, equipment manufacturers, or other appropriate authority for procedures to be used to complete non-routine maintenance, repairs, or other troubleshooting activities not specified herein. **Table 1** lists project contact information.

2.6 Health and Safety

Health and safety (H&S) procedures to be used during O&M are detailed in the Site Health and Safety Contingency Plan (HSCP) developed by the O&M Contractor in accordance with the HSCP specification provided in **Appendix A**. A copy of the Site HSCP will be kept at the Site and be available to O&M personnel. The HSCP includes applicable Site-wide H&S procedures and requirements as well as contact information and directions to the hospital in case of an emergency. All on-site O&M personnel shall have received, reviewed, and signed a copy of the project HSCP to confirm that they are familiar with site hazards and required site health and safety procedures.

3. OVERVIEW OF TREATMENT AND MAJOR COMPONENTS

3.1 Overview of In-Situ Source Treatment

This section presents an overview of the in-situ source treatment for the IDDA 1b treatment area. The in-situ source treatment at OU4 has been designed to remove COCs from groundwater at or beneath the former source areas and thereby enhance the rate of dissolution of residual source material. The Performance Criterion for OU4 in-situ source treatment is based on a reduction in the groundwater mass discharge of COCs from the source areas (ITRC, 2010). The remedial components for in-situ source treatment at OU4 are:

- Air sparging;
- Soil vapor extraction and off-gas treatment;
- Amendment additions (e.g., ozone) during air sparging or other amendment additions without air sparging;
- Stabilization; and
- Post-stabilization ISCO application, if necessary.

The Performance Criterion for the OU4 4 remedy will be to achieve a 90% reduction in the baseline groundwater mass discharge of total target compound list (TCL) VOCs from the treatment area. Monitoring wells form two mass discharge transects downgradient of the in-situ source treatment area. One transect (A-A') is located near the source areas and the other transect (B-B') is located farther downgradient as shown in **Figure 3**. Interpreted geologic cross-sections for those transects are shown in **Figures 4 and 5**. A baseline mass discharge estimate was developed for each transect and is summarized in **Tables 2A and 2B**. The estimated baseline mass discharge from the source area transect is 380 milligrams per day (mg/day). An estimated 24 mg/day are discharged through the downgradient transect. Further details of the mass discharge calculations are provided in **Appendix B**. These data indicate that the aquifer between the two transects is naturally attenuating VOCs at an estimated rate of 356 mg/day or approximately 94% of the VOCs before active treatment. Additional geologic cross-sections, one along the groundwater flow direction (C-C') and one along the downgradient transect but passing through the MW-6A/6B well pair (D-D'), that are not used in the mass discharge calculations are provided for reference in **Figures 6 and 7**, respectively. During OU4 remedy implementation, groundwater performance monitoring will be periodically conducted at the source area transect wells as outlined in Section 6. The TCL VOC results from source area transect wells will be compared against the baseline mass discharge (380 mg/day) to evaluate if the Performance Criterion has been achieved.

As summarized in **Table 3**, implementation will be guided by the Performance Criterion that will determine the transition between remedial components set out in the 2010 ROD/ROD Amendment and other steps, if necessary, to improve their performance. The technical approach for MNA of downgradient groundwater at OU3 is presented separately in the MNA Plan (Geosyntec, 2013b).

3.1.1 Air Sparging

AS will be used throughout the source area to remove a significant component of the petroleum hydrocarbons and other VOCs by volatilization. AS consists of injecting air below the water table in order to volatilize dissolved VOCs and partition them into soil gas in the vadose zone. AS will also introduce oxygen into the groundwater at the source area which should promote aerobic biodegradation processes, although biodegradation is not being relied upon as the primary removal mechanism.

3.1.2 Soil Vapor Extraction and Treatment

SVE wells are installed in the vadose zone to collect the VOC vapors coming off the water table due to AS. In addition, the vacuum applied above the water table is expected to volatilize residual VOCs sorbed in the vadose zone and capillary fringe even though these materials are contained by the landfill cap and are not targeted for treatment.

It is expected that the VOC concentrations in the SVE air stream will initially require treatment based on the pilot test results (Geosyntec, 2012). VOC concentrations are expected to decrease over time, and that the relative proportion of various VOCs to each other will also change because reductive dechlorination reactions will be inhibited during AS and hence daughter products such as vinyl chloride will not be produced or will be present in much lower concentrations. Therefore it is possible that treatment of the SVE off-gas may not be necessary as the AS/SVE operation continues.

3.1.3 Amendment Addition

It is expected that AS will preferentially remove the VOCs that are more volatile and/or amenable to aerobic biodegradation, possibly decreasing the mass discharge of these VOCs to the levels necessary to achieve the OU4 Performance Criterion. Conversely, some of the petroleum hydrocarbons and chlorinated VOCs may not be adequately treated by AS alone due to limited volatility or treatability by aerobic biodegradation. It is currently planned that ozone will be added as an AS amendment for the final phase of the AS program if the decreases in the mass discharge of the less volatile or less aerobically biodegradable constituents are not showing adequate progress toward achieving the Performance Criterion.

It is also possible that the concentrations of VOCs in the downgradient aquifer and in the SVE off-gas will decrease over time to an asymptotic limit as the AS/SVE removal rate becomes limited by the rate of dissolution but the mass discharge will remain above the Performance Criterion. This would be determined by evaluation of the downgradient groundwater and SVE off-gas monitoring data. If the AS/SVE removal rates become mass-transfer limited, then ozone may be applied. The timing of the addition of ozone to the AS program will be determined by the performance monitoring data.

If monitoring data indicate that use of other suitable amendments besides ozone are appropriate, they will be proposed by the Group and discussed with the agencies prior to application. Other amendments that may be considered will depend upon the types of COCs that require treatment. The specific amendment program would be developed and proposed to the agencies at that time and might include ISCO, biostimulation, bioaugmentation, or other technologies that may emerge during the OM&M period. The amendment program will discuss whether more than one amendment application should be considered and the appropriate timeframe to achieve the Performance Criterion. Other suitable amendments may or may not be compatible with air sparging. Hence air sparging might cease prior to introduction of other suitable amendments. Upon agency approval, the Group will proceed with the amendment application(s).

3.1.4 Stabilization

Active treatment will not extend for more than ten years from AS startup without written approval of USEPA. When the OU4 Performance Criterion has been achieved, the Group may request that active treatment be suspended and that the stabilization period begin. The stabilization period may last up to five years to allow the active treatment components to subside and for groundwater redox conditions to re-equilibrate. During the stabilization period, performance monitoring will continue in order to assess groundwater quality downgradient of the source treatment systems. It is possible that concentrations might increase temporarily during stabilization, but stable or decreasing concentrations should be established within five years.

3.1.5 Post-Stabilization ISCO Application (If Necessary)

If the OU4 Performance Criterion described above is not maintained by the end of the stabilization period, or if site-specific MNA performance monitoring criteria established consistent with *Performance Monitoring for MNA Remedies for VOCs in Groundwater* (EPA/600/R-04/027, USEPA, 2004) are not achieved, then the post-stabilization ISCO application, potentially including a surfactant enhancement, will be applied to address the remaining more recalcitrant source materials and monitoring of downgradient groundwater will continue. Multiple applications of the post-stabilization ISCO amendment may be considered if the Performance Criterion is not achieved after the first application. The Group may also petition the agencies for permission to apply other amendments after the post-stabilization ISCO, if appropriate.

If the post-stabilization ISCO application achieves the Performance Criterion, downgradient groundwater will continue to be monitored pursuant to the MNA Plan and then compliance demonstration monitoring will be performed. Otherwise, the contingent remedy will be evaluated.

3.2 Major Remedial Components

3.2.1 Air Sparging System

A network of thirty-seven (37) AS wells (ASW-1 to ASW-37) have been installed in the IDDA 1b treatment area based on a design radius of influence (ROI) for AS of 15 feet to deliver atmospheric air (or other amendments if determined necessary) below the groundwater surface. The AS wells are constructed using a two-foot long two-inch diameter wire-wrapped stainless steel screen and two-inch diameter Schedule 80 chlorinated polyvinyl chloride (CPVC) riser with a transition to stainless steel at least six inches below ground surface (bgs). The target screened interval is between 35 and 40 feet (ft) bgs. AS well locations and construction details are provided in **Appendix C**.

Compressed air is delivered by a 75-horsepower (hp) rotary screw air compressor (C-201) to a 400-gallon air receiver tank (T-701) after passing through a refrigerated dryer (H-501) to remove moisture and cool the air. It then passes through a fine coalescing filter (F-401) and activated carbon filter (F-402) to remove oil droplets and oil vapors, respectively. Each AS well can be operated independently, so there is flexibility for air injection cycles and injection pressures and rates to optimize system performance. Each AS well is connected to the air injection system individually through one-inch diameter high density polyethylene (HDPE) piping installed in shallow trenches. Controls for each AS well are located in the AS/SVE process trailer. A dedicated pressure regulator and a needle valve control pressure and air flow to each AS well. A dedicated solenoid valve controls AS well operation. A ball valve is located at each AS wellhead for shutoff. Each AS wellhead is also fitted with a tee for future connection to an ozone amendment system (Section 3.5).

The operating air injection flow rate at each AS well is 15 standard cubic feet per minute (scfm) with an operating injection pressure of 13.5 pounds per square inch gauge (psig). Air injection into the AS wells will be conducted in cycles as recommended in the *Air Sparging Paradigm* (Leeson et al., 2002). Air injection will be conducted in each AS well for a maximum of four hours per cycle with a planned four hour recovery period between sparging cycles such that each individual sparge well will operate for three cycles per day. Up to 19 AS wells can be operated simultaneously at the operating air injection flow rate based on the capacity of compressor C-201. Equipment details are provided in **Table 4.**

During the first three months of operation, the air injection rate will be increased in steps to the operating flow rate of 15 scfm at each AS well. This will reduce the potential for increases in groundwater COC concentrations downgradient from the treatment areas due to physical disturbance of mixed non-aqueous phase liquid (NAPL) in the source area by AS operation. During the first month of AS operation, the injection rate will be approximately 7.5 scfm per AS well, or 50% of the operating rate. In the second month, the injection rate per well will be increased to approximately 11 scfm. In the third month, the injection will be increased to 15 scfm and remain there for duration of treatment unless performance monitoring data indicate that it should be reduced (Section 6.2.1). The air sparging rate for wells on the same header should be approximately equal and periodically balanced as described in Section 5.1.

As described in Section 6.1, different group configurations, cycling intervals and injection pressures may also be necessary if groundwater performance monitoring data indicate that AS is causing VOC or SVOC concentration increases above the maximum levels previously detected at the Site.

3.2.2 Soil Vapor Extraction and Off-Gas Treatment Systems

A network of thirteen (13) SVE wells have been installed in the IDDA 1b treatment area based on a design ROI for SVE of 37.5 feet to collect VOC vapors coming off the water table resulting from AS. The SVE wells are constructed using a four-inch diameter flush threaded Schedule 80 CPVC casing and four-inch diameter wire-wrapped stainless steel screen. The screen is five feet long with wire wrapped 0.010-inch openings. The target depth of each SVE well is two feet below the seasonal high water table (approximately 18 to 23 ft bgs). This will allow for the SVE wells to be used potentially for the post-stabilization ISCO application, if necessary. In addition, the SVE wells are flanged at the top in order to allow for the mounting of an ISCO injection manifold as described in Section 3.2.4. SVE well locations and construction details are provided in **Appendix C**.

Because of the difference in air permeability between the compacted backfill and the surrounding sand/waste layer in the former IDDA 1b treatment area, the SVE wells are grouped according to the lithology in which they were completed. Two vacuum blowers (C-203 and C-204) provide the vacuum for SVE and are connected to the SVE wells by common header pipes. Four (4) SVE wells (SVE-9, SVE-12, SVE-13, and SVE-14) are connected to blower C-203, a 7.5-hp regenerative blower, for SVE from the compacted backfill. The remaining nine (9) SVE wells (SVE-2 through SVE-8 and SVE-10) are connected to C-204, a 15-hp regenerative blower for SVE from the sand/waste layer. The common headers are insulated, four- or six-inch diameter HDPE pipes installed aboveground on pipe supports. Two-inch diameter CPVC lateral pipes connect each SVE well to the header. Applied vacuum and flow are controlled locally at each SVE wellhead. The operating SVE flow rate is 50 scfm for each SVE well. The operating vacuum varies with lithology. For the SVE wells screened in the compacted backfill and connected to blower C-203, the operating vacuum is 55 inches of water vacuum (in H2O). For the SVE wells screened in the surrounding sand/waste and connected to blower C-204, the operating vacuum is 9 in H2O.

Extracted soil vapors pass through a moisture separator (T-703 or T-704) to capture any entrained liquids prior to discharge through the vacuum blower (C-203 or C-204). SVE condensate collected in the moisture separator (T-703 or T-704) is transferred to a 250-gallon polyethylene tank (T-705) by transfer pumps (P-601 or P-602). Dilution air from the atmosphere is used to maintain the volumetric flow through the blower. The discharge from blowers C-203 and C-204 are combined to pass through an air-cooled heat exchanger (H-503), located outside of the IDDA 1b process trailer, in order to cool the off-gas prior to treatment by three 5,000-pound vapor-phase granular activated carbon (VGAC) units (T-706A/B/C) connected in series and discharge to the atmosphere. Equipment details are provided in **Table 4**.

The SVE system at each area will operate constantly while AS is being implemented. The AS side of the system cannot be operated without SVE due to pressurization of the vadose zone underneath the geosynthetic cap and risks associated with damaging the engineered cap and gas migration outside the treatment areas.

The air sparging rate will not exceed 75% of the SVE rate in any area at any time. A positive net extraction rate is necessary to prevent gas migration beyond the treatment areas. Extraction rates in excess of 50 cfm may be achievable depending on the air permeability of the geologic material surrounding the well. If it is determined that additional extraction is needed to control the AS vapors, the SVE rate may be increased above 50 cfm. The SVE rate for wells on the same header should be approximately equal and periodically balanced as described in Section 5.1.

3.2.3 Instrumentation and Controls

Monitoring and control of in-situ source treatment system is performed using instrumentation and controls installed in the AS/SVE trailer. Instrumentation includes local gauges and transmitters. The list of instrumentation is provided in **Table 5**. Controls include valves and switches for automated operation. The list of valves is provided in **Table 6**. The transmitters and switches are connected to the main control panel (MCP) that is also installed in the AS/SVE trailer. The MCP also houses the electrical connections to power the motors, heating, ventilation, lights and other electrical devices in the AS/SVE trailer. A programmable logic controller (PLC) is installed in the MCP to monitor system inputs, control automated operations, indicate and communicate alarm conditions and log operational data. A touch screen display is mounted on the exterior of the MCP for local access to the PLC. The PLC can be also be accessed remotely. Schematics of the MCP are included in **Appendix D**.

Several alarm conditions are built into the PLC logic to ensure that the system only operates under the specified conditions. The list of alarm conditions, set points and system responses are presented in **Table 7.** If for some reason the system is not operating within boundary conditions the system will automatically shut down, if appropriate, to prevent potential damage to the system components, well networks, and/or landfill cover system. Upon an alarm condition, the

PLC will send a message to the appropriate personnel as listed in **Appendix E** to notify them of the problem.

3.2.4 Amendment Additions

If ozone is utilized as an amendment, a separate process trailer will house the ozone generation equipment in the IDDA 1b treatment area. The ozone trailer will be constructed and delivered to the Site after performance monitoring indicates that ozone is needed to supplement AS in order to remove the chlorinated solvents that are not amenable to volatilization and/or aerobic biodegradation. The ozone trailer will be located adjacent to the AS/SVE process trailer and will likely contain an air compressor, oxygen concentrator, an ozone generator and a manifold to deliver ozone to each AS well as needed. The required dosing of ozone will be determined based on the groundwater quality at the time of ozone generator installation. Dedicated Teflon tubing will be used to connect the ozone lines in the ozone trailer to the appropriate AS wellheads.

Other amendments may be considered depending upon the types of COCs that require treatment. The specific amendment program would be developed and proposed to the agencies at that time and might include ISCO, biostimulation, bioaugmentation, or other technologies that may emerge during the OM&M period. Existing remedial infrastructure (e.g. existing AS and/or SVE wells) will be used for the amendment program as appropriate.

3.2.5 Post-Stabilization In-Situ Chemical Oxidation

The post-stabilization ISCO application, if necessary, will make use of the existing SVE well network to deliver an oxidant to address the recalcitrant VOCs and SVOCs. The oxidant will be selected based on the groundwater conditions at the time and might include a surfactant, if appropriate. An ISCO injection manifold presented in the Final OU4 RD will be attached to the flange at the top of a SVE well for oxidant delivery. The SVE wells to be used for the post-stabilization ISCO application will be determined based on groundwater conditions at the time.

3.3 OU4 Remedy Implementation

The Performance Criterion described in Section 3.1 has been established to evaluate the effectiveness of the OU4 Remedy. This Performance Criterion will guide the operation of the AS/SVE treatment system, inform the need to supplement the basic AS/SVE technology with ozone or other potential amendments, and inform the need for a potential post-stabilization ISCO application.

The implementation of the OU4 remedy components and associated groundwater performance guidelines are summarized in the sections below. Specific groundwater monitoring requirements during implementation of each remedy component are detailed in Section 6. Transitions through the various remedial components and applicable decision points and action levels for different phases of the remedy are summarized in **Table 3**.

3.3.1 Air Sparging and Soil Vapor Extraction

AS/SVE operations will begin at the outset of OU4 O&M. Initial start-up procedures are presented in Section 4.3.1. It is anticipated that methane and VOCs have accumulated under the landfill cap. Accordingly, SVE will be operated prior to the start of AS operations in order to remove the accumulated gases. Based upon the age and thickness of the waste, and the design flow rate for the SVE system, the methane concentrations are expected to decline. Initial SVE operations will be started slowly (step increase in extraction rate) in order to allow for removal of accumulated methane and VOCs without overwhelming the off-gas treatment or creating potentially explosive conditions.

Once the design SVE flow rate of 50 cfm has been achieved in all of the SVE wells and the inlet methane concentration at each SVE blower is below 50% of the lower explosive limit (LEL), AS operations will commence. Initial AS operations will be started slowly (lower pressure, lower air flow rate, fewer wells operating at one time and for fewer hours per day than the designed long-term operating conditions) to limit the potential for COC concentration increases downgradient from the former source areas. Such increases might occur due to physical disturbance of mixed NAPL in the source area by the AS operation. The potential for such increases should be mitigated by recovery of free-phase LNAPL from existing monitoring wells (MW-13 and S-2) during construction.

It is anticipated that the AS/SVE system will actively operate for approximately seven years, but may be shorter or longer depending on the ability of the system to reduce COC concentrations to meet the Performance Criterion described in Section 3.1. Active AS/SVE treatment will not exceed ten years without written approval of USEPA. Groundwater monitoring will be performed at varying frequencies as specified in Section 6 during active AS/SVE operations.

Concentration increases in the OU4 performance monitoring wells during system start-up will be acceptable as long as the concentrations are not greater than the maximum pre-remedial concentrations detected at the Site. If maximum pre-remedial concentrations are exceeded, then AS operations (Section 4.3.1) may be modified to mitigate the increase by reducing the air injection flow rate, reducing the number of AS wells operating at a given time, reducing the daily duration of sparging, or other appropriate measures. If concentrations exceed twice the maximum pre-remedial concentration, then the system will be shut-down and the Group and the agencies will be consulted to discuss a plan for system modifications. Otherwise, operation of the system will be slowly transitioned to the design operating conditions as specified in Section 4.3.1. Maximum pre-remedial concentrations observed at performance monitoring wells for both OU4 and OU3 are provided in **Table 8**.

Groundwater monitoring data will be used to evaluate changes in the geochemical environment in the treatment zone. Based upon the field-measured dissolved oxygen (DO) and oxidation-reduction potential (ORP) responses during the AS/SVE pilot test (Geosyntec, 2012), it is expected that the AS systems will be able to modify the existing geochemical environment in the source area from anaerobic to aerobic. Such a change should arrest the redox-based dissolution of iron and manganese oxides from the aquifer solids that produces the high dissolved iron and manganese concentrations in groundwater. In this manner, iron and manganese oxides should precipitate out of solution in the source area during system start up but no further iron and manganese oxide precipitation would occur and iron fouling of the sparge points would be of less concern. Field geochemical parameters (pH, DO and ORP) and groundwater samples for iron analyses will be collected from monitoring wells EX-1, MW-13 and MW-16 for the first six months of AS operations. In addition, groundwater samples will be collected from EX-1 for VOC analyses in order to detect potential large increases in VOC concentrations relative to pre-remedial concentrations listed in **Table 8**.

If AS alone cannot change the geochemical environment to aerobic conditions, then there is a possibility of ongoing iron floc formation around the sparge wells with associated reduction in system performance and increased O&M costs. There is not a definitive concentration of DO, ORP, or dissolved concentration of iron above or below which these processes would be problematic. However, there should be detectable DO in the treatment zone groundwater, the ORP should increase to greater than +100 millivolts (mV), and filtered iron concentrations should be less than 10 milligrams per liter (mg/L). If these target geochemical conditions are not achieved, then injection of a strong oxidant such as hydrogen peroxide or persulfate will be considered in order to "shock" the system and temporarily establish an aerobic geochemical environment around the AS well screens with the expectation that AS will be able to maintain an aerobic condition around the well screens from that point forward. Once injected, monitoring data should be reviewed to evaluate whether AS is able to maintain the targeted geochemical environment once established by the amendment injection.

During SVE operations, the SVE discharge will be monitored at the influent to the first VGAC unit and between the second and third VGAC units and the monitoring data will be compared to the Guidelines for the Control of Toxic Ambient Air Contaminants ([DAR-1] NYSDEC, 1997) presented in **Table 9**. If off-gas concentrations (i.e., VGAC influent concentrations) fall below these targets, off-gas treatment may be discontinued but off-gas monitoring would continue. If off-gas concentrations subsequently increase above DAR-1 guidelines, off-gas treatment would resume.

3.3.2 Amendment Addition

The timing of amendment addition to the AS program will be determined by the performance monitoring data. It is currently planned that amendments will be used for the final phase of the AS program when the decreases in the mass discharge of the less volatile or less aerobically biodegradable constituents may not show adequate progress toward achieving the Performance Criterion. It is also possible that the concentrations of VOCs in the downgradient aquifer and in the SVE off-gas will decrease over time to an asymptotic limit as the AS/SVE removal rate becomes limited by the rate of dissolution but the mass discharge will remain above the Performance Criterion. The decision to apply ozone, and/or other amendments, will be proposed to the agencies by the Group based upon groundwater performance monitoring data, in particular the types of constituents requiring additional treatment and the ability of amendments to effectively and efficiently treat those constituents. Upon agency approval, the Group will proceed with the amendment application(s).

3.3.3 Stabilization

Active treatment will be discontinued when the Performance Criterion has been achieved. The monitoring frequency will increase from two times per year (semi-annual) to three times per year because it is possible that concentrations of one or more COCs in groundwater downgradient from the treatment zone might increase (i.e. rebound) in one or more wells. If the concentration of any COC in any well rebounds by 20 percent or more compared to the reduction that had been achieved through treatment, then the data will be evaluated to decide whether AS should be restarted. During evaluation of the data after active treatment shutdown, the mass discharge in the aquifer near the source area treatment system will be calculated for the last two consecutive monitoring events. If the mass discharge has rebounded by an amount that is more than 20 percent of the overall mass discharge decline that had been achieved by treatment for both consecutive monitoring events, and if it exceeds the natural attenuation capacity of the downgradient aquifer, then the well(s) in question will be resampled to confirm the increased concentration. If the increase is confirmed, then the active sparging treatment may be resumed, if appropriate. Resumed air sparging operation, if appropriate, would continue and cessation of air sparging operation would be evaluated as described above. Pursuant to Section 3.2.3 above, the Group may also evaluate whether addition of one or more amendments is appropriate in addition to, or in lieu of, restarting the AS/SVE system.

If COC concentrations do not rebound by 20 percent or more, or if the mass discharge does not rebound by 20 percent or more, for two consecutive events, then the Group may propose to the agencies that the stabilization period begin and that active treatment be suspended. However, active treatment will not extend for more than ten years from air sparging startup without written approval of USEPA. The stabilization period may last up to five years to allow the active treatment components to subside and for groundwater redox conditions to re-equilibrate. During the stabilization period, performance monitoring will continue in order to assess source area groundwater quality and natural attenuation capacity of the aquifer near the source areas. While MNA has been specified as a remedial component for downgradient groundwater (OU3) as presented in the MNA Plan, it is likely that natural attenuation processes will also function as a final polishing step in the source areas (OU4) after active in-situ treatment. It is possible that concentrations might increase temporarily during stabilization, but stable or decreasing concentrations should be established within five years.

3.3.4 Post-Stabilization ISCO Application (If Necessary)

If the OU4 Performance Criterion described in Section 3.1 is not achieved by the end of the stabilization period, or if site-specific MNA performance monitoring criteria downgradient are not achieved as detailed in the MNA Plan, then a post-stabilization ISCO application, potentially including a surfactant enhancement, will be applied to address the remaining more recalcitrant source materials and monitoring of downgradient groundwater will continue. Multiple applications of the post-stabilization ISCO amendment might be considered if the Performance Criterion is not achieved after the first application. The Group may also petition the agencies for permission to apply other amendments after the post-stabilization ISCO, if appropriate.

If the post-stabilization ISCO application achieves the Performance Criterion, downgradient groundwater will continue to be monitored pursuant to the MNA Plan and then compliance demonstration monitoring will be performed. Otherwise, contingency measures will be evaluated.

4. START-UP AND SHUTDOWN OPERATING PROCEDURES

The procedures outlined herein regarding operation of the IDDA 1b in-situ source area treatment system are intended to guide the operation of the AS and SVE systems during initial start-up and shutdown. Normal operating procedures are discussed Section 5. Monitoring procedures for groundwater and SVE off-gas are addressed in Section 6 and in the Quality Assurance Project Plan (QAPP) for O&M (Geosyntec, 2013c). These operating procedures are applicable during active AS/SVE treatment only and do not address amendment additions during later phase of AS/SVE operations or subsequent remedy components. Operating procedures for amendment additions will be developed during construction of the associated systems. The OM&M Plan will then be revised in accordance with Section 10 and submitted for review and approval.

4.1 Required Equipment

The following equipment is required to complete system start-up and routine O&M of each the AS/SVE system;

- Air Velocity Meter;
- Photoionization Detector (PID) with 11.7 eV lamp;
- Landfill Gas (LFG) Meter;
- 1 liter (L) Tedlar™ Bags;
- Vacuum Box;
- Magnehelic Pressure Gauges; and
- Various Hand Tools.

4.2 PLC Operation

The PLC is operated through the touch screen display mounted on the front of the MCP. The touch screen display consists of five screens:

1. SVE Overview;
2. Sparge Overview;
3. Set Points and Data;

4. Valve Sequence; and

5. Alarms.

Screenshots are provided in **Appendix D**.

4.3 Source Area Treatment System Start-up

This section guides general AS/SVE treatment system operating procedures for start-up.

4.3.1 Initial Start Up Procedures

Prior to initial start-up of the AS/SVE treatment system, the system must be completely assembled, have passed all final inspections, and be approved for operation. Several additional precautions and procedures must be taken during the initial start-up period or after extended shutdown (> 30 days) to ensure safety and evaluate the soil gas extraction and air injection rates that can be achieved by the system. These procedures are outlined in the section below.

4.3.1.1 Initial SVE Start-up

In order to prevent disturbance of the landfill cap by the injection of air under the cap during AS, the SVE system should always be in operation prior to the start of AS operations. In addition, the closed landfill continues to generate methane which may accumulate beneath the landfill cap. A landfill gas venting system was installed during the capping of the landfill in 1997. However, methane concentrations above the LEL were observed during the AS/SVE pilot test (Geosyntec, 2011a). The methane concentration in the SVE blower inlet (AIT-203 and AIT-204) should be monitored during SVE start-up so that methane concentrations do not exceed 90% of the LEL at any time, or exceed 50% of the LEL for a sustained (over one hour) period. This may require that the SVE system be run without AS for a period of time until methane concentrations decrease to below 50% of the LEL as the accumulated methane beneath the landfill cap is purged at a rate greater than the methane generation rate.

Procedures for SVE start-up and balancing the flow across the network are as follows:

A. <u>Verify valve positions and connections for SVE start-up:</u>

1. Verify that the valves to the SVE wells (V-302 to V-314) are closed;

2. Verify that the inlet valves (V-3001 and V-3002) to moisture separators (T-703 and T-704) are closed and that the dilution air valves (V-1001 and V-2001) are open;

3. Verify that the discharge valves (V-09 and V-10) from the SVE blowers (C-203 and C-204) are open;

4. Verify heat exchanger (H-503) inlet valve (V-11) and discharge valve (V-13) are open and that bypass valve (V-12) is closed; and

5. Verify the eight-inch flexible hoses are connected to the VGAC vessels (T-706A T-706B, and T-706C):

   a. Heat exchanger H-503 to T-706-A;

   b. T-706A to T-706B;

   c. T-706B to T-706C; and

   d. T-706C to the discharge stack.

B. Start Heat Exchanger H-503:

1. Set H-503 on automatic from the MCP. It will run if the temperature at TIT-203, TIT-204 or TIT-503 is above the set point; and

2. Record the temperatures at TIT-203, TIT-204 and TIT-503.

C. Start SVE Blower C-203 and Set SVE Extraction Rates at SVE-09, SVE-12, SVE-13 and SVE-14:

1. Start SVE blower C-203 in automatic from the MCP. Verify that C-203 is running;

2. Open the inlet valve (V-3001) to moisture separator T-703. Monitor the pressures at PI-021 and PI-023;

3. Slowly close the dilution air valve (V-1001) until the pressure at PI-021 is 63 in H2O vacuum; and

4. At each SVE well SVE- XX (XX =09, 12, 13 or 14):

   a. Turn on the air velocity meter in order to allow it to warm up for five minutes;

   b. Remove the plug on the flow measurement port on the SVE wellhead;

   c. Insert the air velocity probe into the flow measurement port so that the tip is in the center of the pipe. Verify that the meter is set for measuring flow in a two-inch diameter pipe;

   d. Verify that there is a good seal around the probe;

e. Open the gate valve V-3XX on the SVE wellhead until the SVE flow rate is 20 cfm as measured using the air velocity meter. Monitor and record the pressure at the SVE wellhead using the pressure gauge PI-3XX. If the desired flow rate cannot be achieved, close the dilution air valve V-1001 so that the pressure at PI-021 is 63 in H2O vacuum;

f. Monitor the inlet methane concentration at the SVE blower inlet using the inline methane (LEL) monitor (AIT-203) or the control screen (AI-203). If the methane concentration is above 90% of the LEL at any time or above 50% of the LEL for more than one hour, the dilution air valve V-1001 should be opened to increase the flow rate of air from the atmosphere. Continue to monitor the SVE flow rate using the air velocity meter and the SVE wellhead vacuum at PI-3XX;

5. Repeat steps 4 (a) to (f) at each SVE well SVE-XX as necessary until the SVE flow rate at each well is 20 cfm. Operate at 20 cfm until the methane concentration is continuously less than or equal to 50% of the LEL. Record the SVE operating conditions as described in (E) below;

6. Repeat steps 4 (a) to (f) to increase the SVE flow rate at each well to 40 cfm. Operate at 40 cfm until the methane concentration is continuously less than or equal to 50% of the LEL. Record the SVE operating conditions as described in (E) below; and

7. Repeat step 4 (a) to (f) to increase the SVE flow rate at each well to 50 cfm. Operate at 50 cfm until the methane concentration is continuously less than or equal to 50% of the LEL. Record the SVE operating conditions as described in (E) below.

D. <u>Start SVE Blower C-204 and Set SVE Extraction Rates at SVE-02, SVE-03, SVE-04, SVE-05, SVE-06, SVE-07, SVE-08, SVE-10 and SVE-11:</u>

1. Start SVE blower C-204 in automatic from the MCP. Verify that C-204 is running;

2. Open the inlet valve (V-3002) to moisture separator T-704. Monitor the pressures at PI-024 and PI-026.

3. Slowly close the dilution air valve (V-2001) until the pressure at PI-024 is 14 in H2O vacuum;

4. At SVE well SVE-XX (XX = 02, 03, 04, 05, 06, 07, 08, 10 or 11):

a. Turn on the air velocity meter in order to allow it to warm up for five minutes;

b. Remove the plug on the flow measurement port on the SVE wellhead;

c. Insert the air velocity probe into the flow measurement port so that the tip is in the center of the pipe. Verify that the meter is set for measuring flow in a two-inch diameter pipe;

d. Verify that there is a good seal around the probe;

e. Open the gate valve V-3XX on the SVE wellhead until the SVE flow rate is 20 cfm as measured using the air velocity meter. Monitor and record the pressure at the SVE wellhead using the pressure gauge PI-3XX. If the desired flow rate cannot be achieved, close the dilution air valve V-1001 so that the pressure at PI-024 is 14 in H2O vacuum;

f. Monitor the methane concentration in the off-gas using the inline methane (LEL) monitor (AIT-204) or the control screen (AI-204). If the methane concentration is above 90% of the LEL at any time or above 50% of the LEL for more than one hour, the SVE flow rate should be decreased. Continue to monitor the SVE flow rate using the air velocity meter and the SVE wellhead vacuum at PI-3XX;

5. Repeat steps 4 (a) to (f) at each SVE well SVE-XX as necessary until the SVE flow rate at each well is 20 cfm. Operate at 20 cfm until the methane concentration is continuously less than or equal to 50% of the LEL. Record the SVE operating conditions as described in (E) below;

6. Repeat steps 4 (a) to (f) to increase the SVE flow rate at each well to 40 cfm. Operate at 40 cfm until the methane concentration is continuously less than or equal to 50% of the LEL. Record the SVE operating conditions as described in (E) below; and

7. Repeat step 4 (a) to (f) to increase the SVE flow rate at each well to 50 cfm. Operate at 50 cfm until the methane concentration is continuously less than or equal to 50% of the LEL. Record the SVE operating conditions as described in (E) below.

E. <u>Record SVE System Operating Conditions:</u>

1. SVE operating conditions shall be recorded following each adjustment to achieve the target SVE flow rates. The following measurements should be recorded to document SVE system operating conditions:

a. Flow rate and pressure at each SVE well;

b. Pressure at PI-021, PI-022, PI-023, PI-024, PI-026, PI-027, PI-032 and PI-033;

c. Methane concentration at AIT-203 and AIT-204;

d. Liquid level at LI-703, LI-704 and LI-705; and

e. VOCs, methane, oxygen and carbon dioxide at SP-021, SP-022, SP-024, SP-025, SP-503 and SP-504. Collect samples of SVE off-gas in Tedlar bags and screen the samples for VOCs using a PID and for methane, oxygen and carbon dioxide using a LFG METER in accordance with the procedure presented in Appendix F.

4.3.1.2 Initial Air Sparging Start-up

AS operations shall be started after the SVE system has been started and the inlet methane concentrations at the SVE blowers have decreased to less than or equal to 50% of the LEL. Procedures for initial AS start-up and balancing the flow across the network are as follows:

A. <u>Verify valve positions for AS start-up:</u>

1. Verify that the ball valves on the AS wellheads (V-1101 to V-1137 and V-1201 to V-1237) are open and that the ball valves for AS amendment (V-1501 to V-1537) are closed;

2. Verify that the ball valves to the individual AS lines (V-901 to V-937) are open;

3. Verify that the needle valves on the rotameters (FI-101 to FI-137) are closed and that the flow measurement is 0 scfm;

4. Verify that the solenoid valves (V-801 to V-837) are closed by starting Valve Sequence 0 on the MCP;

5. Verify that the pressure regulators (V-4101 to V-4137) are set to 0 psig; and

6. Verify that the valves between compressor C-201 and the sparge manifolds (V-101 to V-104) are open.

B. <u>Start Compressor C-201:</u>

1. Start C-201 from the LCP; and

2. Verify that tank T-701 is pressurized to 125 psig by monitoring PI-203.

C. Set the Air Injection Rates at the AS Wells (ASW-01 to ASW-37):

1. For AS well ASW-XX (XX = 01 to 37):

a. From the Sparge Overview Screen on the MCP, toggle solenoid valve V-81XX to open.

b. Open pressure regulator V-41XX to set the line pressure to the injection pressure listed in the table below. Monitor the pressure at PI-1XX.

c. Open the needle valve on FI-1XX to set the air injection flow rate to the target flow rate listed in the table below.

Operating Period	Flow Rate per AS Well (scfm)	Injection Pressure (psig)
Month 1	7.5	11.5
Month 2	11	12.5
Month 3 and after	15	14

d. If more pressure is required to achieve the target flow rate, increase the pressure by opening the pressure regulator V-41XX and monitoring the flow rate at FI-1XX. Monitor the pressure at PI-1XX. Do not exceed a pressure of 22.5 psig, the overburden fracturing pressure.

e. Record the flow rate at FI-1XX and the pressure in the line at PI-1XX and at the AS wellhead at PI-1XX.

f. Close solenoid valve V-81XX from the MCP.

2. Repeat steps (a) to (f) above for each AS well.

D. Set the Air Injection Cycles:

1. From the Valve Sequencing screen on the MCP, assign solenoid valve V-8101 to V-8137 to the appropriate sequence, starting with Sequence 1 (Sequence 0 is reserved to close all of the solenoid valves.). Up to nineteen (19) valves can be included in one sequence; and

2. From the Valve Sequencing screen on the MCP, set the duration of each sequence (in minutes) to which solenoid valves have been assigned. The minimum duration is four hours (480 minutes).

a. Sequence 1: ASW01, ASW03, ASW05, ASW08, ASW10, ASW12, ASW14, ASW16, ASW18, ASW20, ASW22, ASW24, ASW26, ASW28, ASW30, ASW32, ASW34, ASW36, and ASW37.

b. Sequence 2: ASW02, ASW04, ASW06, ASW07, ASW09, ASW11, ASW13, ASW15, ASW17, ASW19, ASW21, ASW23, ASW25, ASW27, ASW29, ASW31, ASW33, and ASW35.

E. Start the Air Injection Cycle:

1. Verify that compressor C-201 is running. If not, start the compressor from the LCP;

2. Start the air sparging sequence by pressing the Sequence On button on the Sparge Overview screen on the MCP; and

3. Verify that the first sequence has started with valves assigned using the steps above.

4. Verify the air injection rate to all AS wells in the injection cycle. Adjust the flow rate and pressure as necessary using the pressure regulator and needle valve.

5. Continue with normal AS operations as described in Section 5 for the operating period listed above.

F. Increase the AS flow rates in steps:

1. Repeat (C) to increase the AS flow rates after the first and second months of AS operations to the target flow rates listed above.

2. Repeat (E) to restart the air injection cycle after completing the AS flow rate adjustments.

4.3.2 Normal Start-up Procedures

After initial start-up, restarting of the AS/SVE system will be necessary after the system has been shut-down for routine maintenance, an alarm condition triggered by the PLC, non-routine maintenance, a power outage, or other event that results in the need for a manual start of the system. Depending on the nature of the shut-down, the system can either be restarted via on-site access or remotely via access to the PLC. These procedures assume that the SVE and AS flow rates have been established and that the system is being restarted under the same conditions. If the system has been shut down for a prolonged period (>30 days) as described in Section 4.4.3, the procedures for initial start-up as described in Section 4.3.1 should be used.

4.3.2.1 Normal SVE Start-up

A. Verify valve positions and connections for SVE start-up:

1. Verify that the inlet valves (V-3001 and V-3002) to moisture separators (T-703 and T-704) are open;

2. Verify that the discharge valves (V-09 and V-10) from the SVE blowers (C-203 and C-204) are open;

3. Verify that the inlet valve (V-11) and the discharge valve (V-13) for heat exchanger H-503 are open and that the bypass valve (V-12) is closed; and

4. Verify that the eight-inch flexible hoses are connected to the VGAC vessels (T-706A, T-706B, and T-706C) and to the discharge stack.

B. Start Heat Exchanger H-503 (required if using VGAC for off-gas treatment):

1. Set H-503 on automatic from the MCP. It will run if the temperature at TIT-203, TIT-204 or TIT-503 is above the set point; and

2. Record the temperatures at TIT-203, TIT-204 and TIT-503.

C. Start SVE Blower C-203 and Monitor SVE Extraction Rates at SVE-09, SVE-12, SVE-13 and SVE-14:

1. Start SVE blower C-203 in automatic from the MCP. Verify that C-203 is running;

2. At SVE well SVE-XX (XX = 09, 12, 13 or 14):

   a. Turn on the air velocity meter in order to allow it to warm up for five minutes;

   b. Remove the plug on the flow measurement port on the SVE wellhead;

   c. Insert the air velocity probe into the flow measurement port so that the tip is in the center of the pipe. Verify that the meter is set for measuring flow in a two-inch diameter pipe;

   d. Verify that there is a good seal around the probe;

   e. Measure the SVE flow rate using the air velocity meter. Adjust the gate valve V-3XX on the SVE wellhead until the SVE flow rate is 50 cfm. Monitor and record the pressure at the SVE wellhead using the pressure gauge PI-3XX. If the desired flow rate cannot be achieved, adjust the dilution air valve V-1001 so that the pressure at PI-021 is 63 in H2O vacuum; and

3. Repeat steps 2 (a) to (e) at each SVE well SVE-XX as necessary until the target SVE flow rate is achieved at each well. Record the SVE operating conditions as described in (E) below;

D. Start SVE Blower C-204 and Monitor SVE Extraction Rates at SVE-02, SVE-03, SVE-04, SVE-05, SVE-06, SVE-07, SVE-08, SVE-10 and SVE-11:

1. Start SVE blower C-204 in automatic from the MCP. Verify that C-204 is running;

2. At SVE well SVE-XX (XX = 02, 03, 04, 05, 06, 07, 08, 10 or 11):

   a. Turn on the air velocity meter in order to allow it to warm up for five minutes;

   b. Remove the plug on the flow measurement port on the SVE wellhead;

   c. Insert the air velocity probe into the flow measurement port so that the tip is in the center of the pipe. Verify that the meter is set for measuring flow in a two-inch diameter pipe;

   d. Verify that there is a good seal around the probe;

   e. Measure the SVE flow rate using the air velocity meter. Adjust the gate valve V-3XX on the SVE wellhead until the SVE flow rate is 50 cfm. Monitor and record the pressure at the SVE wellhead using the pressure gauge PI-3XX. If the desired flow rate cannot be achieved, adjust the dilution air valve V-1001 so that the pressure at PI-021 is 63 in H2O vacuum; and

3. Repeat steps 2 (a) to (e) at each SVE well SVE-XX as necessary until the target SVE flow rate is achieved at each well. Record the SVE operating conditions as described in (E) below;

E. Record SVE System Operating Conditions:

1. SVE operating conditions shall be recorded following each adjustment to achieve the target SVE flow rates. The following measurements should be recorded to document SVE system operating conditions:

   a. Flow rate and pressure at each SVE well;

b. Pressure at PI-021, PI-022, PI-023, PI-024, PI-026, PI-027, PI-032 and PI-033;

c. Methane concentration at AIT-203 and AIT-204;

d. Liquid level at LI-703, LI-704 and LI-705; and

e. VOCs, methane, oxygen and carbon dioxide at SP-021, SP-022, SP-024, SP-025, SP-503 and SP-504. Collect samples of SVE off-gas in Tedlar bags and screen the samples for VOCs using a PID and for methane, oxygen and carbon dioxide using a LFG METER in accordance with the procedure presented in Appendix F.

4.3.2.2 Normal Air Sparging Start-up

AS operations should be started after the SVE system has been started and the inlet methane concentrations at the SVE blowers have decreased to less than or equal to 50% of the LEL. Procedures for AS start-up and balancing the flow across the network are as follows:

A. Verify valve positions for AS start-up:

1. Verify that the ball valves on the AS wellheads (V-1101 to V-1137 and V-1201 to V-1237) are open and that the ball valves for AS amendment (V-1501 to V-1537) are closed;

2. Verify that the ball valves to the AS wells in the AS/SVE trailer (V-901 to V-937) are open;

3. Verify that all of the solenoid valves (V-801 to V-837) are assigned to Valve Sequence 0 at the MCP;

4. Verify that the valve sequences are off at the MCP; and

5. Verify that the valves between compressor C-201 and the sparge manifolds (V-101 to V-104) are open.

B. Start Compressor C-201:

1. Start C-201 from the LCP; and

2. Verify that tank T-701 is pressurized to 125 psig by monitoring PI-203.

C. Set the Air Injection Rates at the AS Wells (ASW-01 to ASW-37):

1. For AS well ASW-XX (XX = 01 to 37):

   a. From the Sparge Overview Screen on the MCP, toggle solenoid valve V-81XX f to open.

   b. Open pressure regulator V-41XX to set the line pressure to the injection pressure listed in the table below. Monitor the pressure at PI-1XX;

   c. Open the needle valve on FI-1XX to set the air injection flow rate to the target flow rate listed in the table below;

Operating Period	Flow Rate per AS Well (scfm)	Injection Pressure (psig)
Month 1	7.5	11.5
Month 2	11	12.5
Month 3 and after	15	14

   d. If more pressure is required to achieve the target flow rate, increase the pressure by opening the pressure regulator V-41XX and monitoring the flow rate at FI-1XX. Monitor the pressure at PI-1XX. Do not exceed a pressure of 22.5 psig, the overburden fracturing pressure;

   e. Record the flow rate at FI-1XX and the pressure in the line at PI-1XX and at the AS wellhead at PI-1XX; and

   f. Close solenoid valve V-81XX from the MCP.

2. After the target injection flow rate is set, set the air injection rate at each of the remaining AS wells, repeat steps (a) to (f) above for each AS well.

D. Verify the Air Injection Cycles:

1. From the Valve Sequencing screen on the MCP, verify the sequence assignments of solenoid valves V-8101 to V-8137. Up to nineteen (19) valves can be included in one sequence; and

2. From the Valve Sequencing screen on the MCP, verify the duration of each sequence (in minutes) to which solenoid valves have been assigned. The minimum duration is four hours (480 minutes).

E. Start the Air Injection Cycle:

1. Verify that compressor C-201 is running. If not, start the compressor from the LCP;

2. Start the air sparging sequence by pressing the Sequence On button on the Sparge Overview screen on the MCP; and

3. Verify that the first sequence has started with valves assigned using the steps above.

4. Continue with normal AS operations as described in Section 5 for the operating period listed above.

4.4 Source Area Treatment System Shutdown

This section guides general AS/SVE treatment system operating procedures for shutdown.

4.4.1 Emergency Shut Down Procedures

In the case of an emergency that requires an immediate shut down of all systems, the operator will press any of three E-stop buttons. The E-stop buttons are located near the doorways in the general purpose AS section of the trailer and the classified SVE section of the trailer and on the LCP of compressor C-201. Pressing of any E-Stop button will cause the PLC to stop compressor C-201, SVE blowers C-203 and C-204, heat exchanger H-503 and transfer pumps TP-601 and TP-602. All of the solenoid valves (V-801 to V-837) will be closed.

4.4.2 Normal Shut Down Procedures

As part of regular O&M, it will be necessary to shut down the AS and SVE systems for scheduled maintenance, troubleshooting and unscheduled maintenance. Following a normal shutdown, the AS and SVE systems will be restarted using the normal start-up procedures presented in Section 4.3.2.

4.4.2.1 Normal Air Sparging Shutdown

The AS system should only be in operation when the SVE system is in operation with both SVE blowers running. Any maintenance that requires a shutdown of the SVE system will also require shutdown of the AS system. The following presents the procedures for normal AS shutdown.

A. Stop the Air Injection Cycles:

1. Stop the valve sequences from the MCP; and

2. Close all solenoid valves (V-801 to V-837).

B. Stop Compressor C-201:

1. Stop compressor C-201 at the LCP; and

2. Close the valves between compressor C-201 and the sparge manifolds (V-101 to V-104).

C. Isolate and De-energize Pressurized Lines:

1. Before performing any maintenance on any section of the AS system, verify that that section has been isolated and de-energized;

2. For an individual AS line to AS well ASW-XX (XX = 01 to 37):

   a. Close the ball valve V-9XX to the AS line;

   b. Vent the AS line by opening SP-1XX at the AS wellhead; and

   c. Close the ball valves at the AS wellhead (V-11XX and V-12XX).

3. For an AS headers to Zone 1 or Zone 2:

   a. Close all ball valves V-901 to V-937 to the individual AS lines;

   b. Vent air receiver tank T-701 using PSV-201; and

   c. Close the ball valves to the AS header (V-103 or V-104).

4. For filters F-401 and F-402:

   a. Close ball valve V-102;

   b. Vent air receiver tank T-701 using PSV-201; and

   c. Close gate valve V-101.

5. For compressor C-201 and air receiving tank T-701:

   a. Close ball valve V-101;

   b. Vent air receiver tank T-701 using PSV-201; and

   c. Close gate valve V-101.

4.4.2.2 Normal SVE Shutdown

1. Prior to starting the SVE shutdown procedure, the AS system **MUST BE SHUTDOWN and DENERGIZED;**

2. To shut down the SVE system first start by opening the dilution air valves V-1001 and V-2001 to the full position and then closing butterfly valves V-3000 and V-3001. Allow the SVE blower to clear the lines of soil vapor for several minutes;

3. Stop SVE blowers C-203 and C-204 at the MCP;

4. Isolate SVE system from SVE wells by closing butterfly valve V-3000 and V-3001;

5. Isolate SVE system from VGAC vessels by closing butterfly valves V-09 and V-10;

6. Drain moisture separators: T-703, T-704, and T-705; and

7. Close dilution air valve.

4.4.3 Extended Shutdown Procedures

4.4.3.1 Extended Air Sparging Shutdown

1. Shut down the air sparge system as discussed in Section 4.4.4.1**;**

2. Conduct storage maintenance of air compressor as outlined in manufacturer O&M manual;

3. Remove drain plug from air compressor reservoir tank;

4. Remove Air filters: F-401 and F-402;

5. Close ball valves: V-102, V-103, and V-104; and

6. Close ball valves: V-901 through V-937.

4.4.3.2 Extended SVE Shutdown

1. Shut down the SVE treatment systems as discussed in Section 4.4.4.2;

2. Remove dilution air filters: F-405 and F-406:

    a. Install threaded metal caps over air filter ports.

3. Vent SVE wells by opening the piping union inside the well vault;

4. Open the cleanout port on moisture separators: T-703, T-704, and T-705, to prevent buildup of condensation;

5. Close heat exchanger valves: V-11, V-12, and V-13;

6. Empty VGAC vessels T-706A, T-706B and T-706C as outlined in Section 5.3.2; and

7. Remove flexible hosing from VGAC vessels and store inside the treatment building.

    a. Install cam-lock blanks in the flexible hosing connection points.

4.5 Project Communication

4.5.1 Emergency Communication

In cases of an emergency, call 911 and follow the emergency response procedures in the HSCP. Notification to the EPA project manager must be made within 72-hours of the emergency via electronic mail. After the emergency is under control and/or in all other non-emergency cases follow the communication schedule described in Section 4.5.2.

4.5.2 Alarm Condition Shutdown and Notification

When the source area treatment system shuts down due to an alarm condition, the PLC will notify the O&M Contractor and the Supervising Contractor and relay the alarm condition. The O&M Contractor shall respond to the alarm conditions within 48-hours of first receiving notification that the treatment system has shut down. If the treatment system cannot be restarted within 24-hours of the O&M Contractor's arrival at the Site, the O&M Contractor shall notify the Supervising Contractor. After receiving notification from the O&M Contractor, the Supervising Contractor shall notify the Group. Notification to the EPA project manager of alarm conditions and shutdowns will be communicated in the progress reports following the event(s). A list of the project contacts is provided in **Table 1**. A list of emergency contacts is presented in **Appendix E** and shall be posted on the outside and inside of the process equipment trailer.

5. NORMAL OPERATIONS, GENERAL, AND PREVENTATIVE MAINTENANCE

5.1 Normal Operations

Normal operations will consist of maintaining the flow and injection rates established in Section 4.3.2.1 and Section 4.3.2.2. Normal operations will be monitored during weekly O&M inspections (Section 5.2) and remote monitoring of the PLC. To maintain these rates, minimal adjustments will be made to the gate valves (V-301 to V-314) on the SVE system and the pressure regulators (V-4101 to V-4137) on the AS system during routine O&M inspections. The procedures to adjust the specified flow and injection rates for the SVE and AS systems are detailed in Section 4.3.2.1 and Section 4.3.2.2, respectively. These adjustments will be noted on the O&M sheets. O&M sheets are provided in **Appendix G**.

During remote monitoring and routine O&M inspections, adjustments can be made to valve sequencing for air sparging (Valve Sequence) and system set points (Set points and Data). Remote shutdown of the AS and SVE systems is not recommended. Emergency and normal shutdown of the AS and SVE systems should be conducted on-Site using the procedures presented in Sections 4.3.3 and 4.3.4, respectively.

5.2 Operation and Maintenance Inspections

O&M inspections will be conducted to ensure the treatment system is operating as designed and to prevent unintentional releases to the environment. O&M frequency will be on a weekly basis for each remedial component. All data collected during the O&M visit will be recorded on treatment component specific O&M data sheets. O&M sheets are provided in **Appendix G**. The following sections describe the O&M inspections required for the SVE and AS systems.

5.2.1 SVE System Inspection

O&M inspection of the SVE system will consist of the following: (1) general inspection of the equipment, piping, and wellheads; (2) collecting system performance data; and (3) performing maintenance on soil vapor extraction equipment. O&M should be completed in the order presented below in order to collect accurate data. However, if major deficiencies are observed the order of the O&M inspection may be changed.

5.2.1.1 General Inspection of Equipment, Piping, and Wellheads

The SVE piping is run above ground and is exposed to the elements. Therefore, it is necessary that routine inspection of the piping is conducted. Inspection of the piping should include the overall condition of the pipe, any sagging, low points, or weathering observed and the condition of the pipe joints. Inspections of the wellhead should include the condition of the concrete pad (note any cracks) and condition of the wellhead (leaks observed and pressure indicators are properly working).

5.2.1.2 Collection of System Performance Data

System performance data will be collected after the general inspection has been completed. Data collection will begin by noting the run time on the SVE blower (this will be used to calculate the SVE discharge to the atmosphere), position of all SVE valves, moisture accumulated in the moisture separators, collect readings from all pressure/temperature/flow indicators starting at the moisture separator and working towards the VGAC vessels. After readings from inside the process equipment trailer are collected, readings will then be collected from SVE components outside the trailer. Flow and PID readings will be collected from each SVE leg at the wellhead. Data collection from the heat exchanger will include position of the valves. Data from the VGAC vessels will include PID readings collected from the influent, midpoints, and effluent (these data will be used to assess VGAC effectiveness and will be discussed in Section 5.3.1), and pressure data collected from the inlets to each VGAC vessel. Liquid levels in the condensate holding tank (T-705) should be noted and drained as necessary. Location ID's are listed on the O&M sheet provided as **Appendix G** and are shown in the as-built drawings provided in **Appendix C**.

5.2.1.3 Equipment Maintenance

Maintenance of SVE equipment should be conducted on the first visit of every month. Refer to **Table 10** for the suggested manufacturer maintenance frequency and **Appendix D** for the manufacturer's recommended maintenance procedures.

5.2.2 AS System Inspection

O&M inspection of the AS system will consist of the following: (1) general inspection of the equipment, piping, and wellheads; (2) collecting system performance data; and (3) performing maintenance on air sparge equipment. O&M should be completed in the order presented below in order to collect accurate data. However, if major deficiencies are observed the order of the O&M inspection may be changed.

5.2.2.1 General Inspection of Equipment, Piping, and Wellheads

The AS piping is operated under pressure and is partially run above ground. Therefore, it is necessary that routine inspection of the piping is conducted. Inspection of the piping should include the overall condition of the pipe, any weathering observed and condition of the pipe supports used to secure the pipe to the manifold at the process equipment trailer. Inspections of the wellhead should include: the condition of the concrete pad (note any cracking) and condition of the wellhead (leaks observed and pressure indicators are properly working).

5.2.2.2 Collection of System Performance Data

System performance data should be collected after the general inspection is completed. Data collection will begin by noting the position of all air sparge valves, condition of the inline air compressor filters, collect readings from all pressure/temperature/flow indicators starting at the air compressor and working towards the air sparge manifold. After readings from inside the process equipment trailer are collected, pressure measurements will then be collected from air sparge wellheads. Location ID's are listed on the O&M sheet provided as **Appendix G** and are shown in the as-built drawings provided in **Appendix D**.

5.2.2.3 Equipment Maintenance

Maintenance of AS equipment should be conducted on the first visit of every month. Refer to **Table 10** for the suggested manufacturer maintenance frequency and **Appendix D** for the manufacturer's recommended maintenance procedures.

5.3 Off-Gas Treatment Inspection

5.3.1 VGAC Monitoring

The approach to VGAC monitoring and triggers for VGAC change outs is presented as a flow diagram in **Figure 8**. VGAC monitoring will be conducted weekly at the influent to the first VGAC unit (SP-503) and between the second and third VGAC units (SP-504) with screening for VOCs and landfill gases using a PID and a landfill gas monitor, respectively, for the duration of system operation unless an alternative monitoring plan is approved by the agencies. Air samples will be collected periodically using Summa canisters for VOC analyses. The Summa canisters will be submitted to an accredited laboratory for VOC analysis via USEPA method TO-15 in accordance with the QAPP for O&M. During startup of the SVE and the AS systems, the initial sampling frequency will be twice per week for two weeks and weekly thereafter until enough monitoring has been completed under normal operating conditions to predict the VGAC change out frequency. At that time, a reduction in the sampling frequency may be proposed to the agency for approval. It is expected that the sampling frequency will decrease over time as the VOC concentration in the influent air is reduced, speciation changes, and the corresponding need for treatment is reduced.

The analytical results of the air sampling will be used to calculate the annual average concentration for each VOC COC using the following equation:

$$\overline{C_i} = \frac{\sum_n C_{i,n} \Delta t_n}{\sum_n \Delta t_n}$$

where

$\overline{C_i}$ = Annual average concentration of VOC i;

$C_{i,n}$ = Concentration of VOC i for the n^{th} VGAC sampling event of the year; and

Δt_n = Time period between the n^{th} VGAC sampling event and the previous (n-1) VGAC sampling event, or since initial SVE startup for n = 1.

For each VOC COC, the calculated annual average concentration between the second and third VGAC units will be compared to the Annual Guideline Concentration (AGC) presented in DAR-1 and listed in **Table 9**. It is anticipated that certain VOCs that adsorb less efficiently to VGAC, such as vinyl chloride, will initially drive the need for VGAC exchange as shown by the off-gas sampling results from the AS/SVE pilot test presented in **Table 9**. However, vinyl chloride concentrations may decrease as system operation continues. The Group may consider alternative VOC analyses of the SVE off-gas, such as portable gas chromatographs, that can target VOC indicators of the need for VGAC exchange. In addition, laboratory analytical results will be compared to field PID measurements to determine if PID measurements may be used to indicate the need for VGAC exchange. A proposal will be submitted to the USEPA for approval, prior to using PID data as a substitute for laboratory data to indicate the need for VGAC exchange.

5.3.2 VGAC Exchange

VGAC change out will be triggered when the calculated annual average concentration of any VOC COC exceeds its AGC between the second and third VGAC units as measured at SP-504. These trigger levels may be revised based on operational experience at the Site with the approval of the agencies.

The initial frequency of VGAC exchange is expected to be approximately twice a month for the first month of operation. VGAC usage may vary and is expected to decline as reductive dechlorination reactions in the source areas are suppressed by AS operations.

VGAC will be exchanged by a qualified subcontractor from VGAC units T-706A and T-706B. Prior to changing VGAC, the treatment system will be shut down in accordance to the normal shutdown procedures discussed in Section 4.4. After the treatment system has been shut down the VGAC will be replaced following the manufacturer's recommended procedures included in **Appendix D**.

After the VGAC exchange has been completed, the order of the VGAC units will be adjusted to move the third VGAC unit T-706C to the lead position as follows:

- The third VGAC unit (T-706C) will become T-706A;

- The lead VGAC unit (T-706A) will become T-706B; and
- The middle VGAC unit (T-706B) will become T-706C.

The eight-inch flexible hose connections will be relocated accordingly.

5.3.3 Modifications to Off-Gas Treatment

It is expected that VOC concentrations in SVE off-gas will decline over time to the point that SVE off-gas treatment via VGAC may no longer be necessary. When annual average concentrations of all VOC COCs at the influent to the first VGAC unit as measured at SP-503 are below the AGCs, the Group will cease SVE off gas treatment but SVE off-gas monitoring at SP-503 will continue. VGAC off gas treatment would resume if the calculated annual average concentration of any VOC COC at SP-503 exceeded its AGC. The Group reserves the right to petition for Site-specific alternative effluent limits during operation of the system.

5.4 O&M Recordkeeping and Reporting

A record of O&M activities shall be kept on site in the O&M files and electronic copies shall be maintained in the project database and by the O&M Contractor. After O&M events, the O&M Contractor shall copy the original O&M sheet, send copies to the Supervising Contractor and maintain a copy for themselves for electronic filing. After copies have been made and distributed, the original will be placed back into the O&M manual as permanent record of the O&M activities. Changes to O&M activities will be documented by the O&M Contractor in the O&M sheets and the Supervising Contractor shall be notified of the changes separate from the distribution of the O&M sheets. All notifications and discussion regarding O&M activity changes shall be saved in the project files by the Supervising Contractor and documented in the O&M manual.

5.5 Material Handling

5.5.1 Material Storage

Oil and lubricant will be stored inside the treatment system on the non-classified side of the treatment container in a flammable materials cabinet. Materials will be stored separate so that incompatible materials will not be stored on the same shelf as one another. All materials will be stored in the appropriate container and will be properly labeled. The location of the cabinet will be placed as far away from heat sources as possible.

Used oil, lubricants, and filters will be stored onsite in a grounded and vented 55-gallon DOT-approved steel drum. Once the drum is approximately half-full, an approved waste vendor will be contracted to remove the contents of the drum and dispose of the materials appropriately.

Liquids accumulated in moisture tank T-705 will be drained from the tank and stored in 55-gallon DOT drums. The drums will be stored onsite and will be appropriately disposed of by an approved waste handler.

Recovered LNAPL will be stored in 55-gallon DOT drums. The drums will be stored onsite and will be appropriately disposed of by an approved waste handler.

VGAC will be stored inside two 5,000-lbs carbon vessels. VGAC will be removed from the vessels and transported offsite by an approved VGAC vendor for recycling.

Materials generated during O&M including air filters, tubing, plastic pipe, empty plastic containers, etc. can be treated as general waste and disposed of in the municipal waste stream.

5.5.2 Off-Site Transport

The O&M Contractor shall coordinate the transport and off-site disposal of wastes generated during O&M of the in-situ source treatment system including, but not limited to, waste oil and lubricants, SVE condensate and recovered LNAPL. Transport and off-site disposal will be conducted by a waste handler approved by the Group. Transport and off-site disposal shall comply with the CERCLA Off-Site Rule (40 CFR 300.440).

As necessary, the O&M Contractor shall develop a waste profile for each waste stream and identify potential receiving facilities. Waste characterization samples shall be collected and submitted to a fixed laboratory for analyses, as necessary in order to develop a waste profile that is acceptable by potential receiving facilities. The O&M Contractor will employ handling, manifest, transport and disposal protocols in accordance with applicable Federal and State laws and regulations.

6. SOURCE AREA GROUNDWATER MONITORING PLAN

As outlined above in Section 3, groundwater near the source areas will be monitored during the OU4 remedy to evaluate remedy effectiveness and guide its implementation. The sections that follow describe the groundwater monitoring plan (GMP) for the duration of the OU4 remedy. The groundwater monitoring program for MNA of downgradient groundwater (OU3) is specified in the MNA Plan (Geosyntec, 2013b)

6.1 Groundwater Monitoring Location and Frequency

Monitoring wells form two mass discharge transects downgradient of the in-situ source treatment areas. One transect is located near the source areas and the other transect is located farther downgradient as shown in **Figure 3**. The transects that were proposed in the Final OU4 RD and the MNA Plan have been modified to have a more consistent alignment downgradient from the source areas. Interpreted geologic cross-sections for these new transects are shown in **Figures 4 and 5**. Additional geologic cross-sections, one along the groundwater flow direction (C-C') and one along the downgradient transect through the MW-6A/6B monitoring well pair (D-D'), are provided as **Figures 6 and 7**.

The GMP will include wells in the source area transect (A-A') shown in **Figure 3**. The sampling frequency is expected to change over the course of the GMP. Changes in the sampling frequency will be based on the treatment activities (summarized in Section 3.1) that are taking place in the source area. The following sections describe the anticipated stages of the GMP and their period of use. **Table 11** provides a summary of the stages and their intended use and **Figure 9** depicts how the GMP will transition between the stages. It should be noted that the stages are not necessarily sequential and can transition back and forth as described below and in **Table 3** and **Figure 9**.

6.1.1 Stage A – Prior to Source Area Treatment Implementation

Stage A is intended to represent collection of baseline data leading up to AS/SVE treatment system start-up. Except for the MW-20A/B cluster which was installed in December 2011, several rounds of data have been collected and the constituents present in the groundwater at the source area wells are generally considered adequately characterized for the baseline assessment. Adequate historic data already exist for some wells along transect A-A', e.g. MW-1B. Data collection prior to AS/SVE start-up will focus on the other source area wells along the A-A' transect: EX-1, MW-1B/C, MW-10, MW-11 and MW-20A/B. These wells will continue to be monitored on a semi-annual basis (spring and fall) in accordance with the approved RWE I Operation and Maintenance Addendum III (Geosyntec, 2013d) until AS/SVE treatment system start-up.

6.1.2 Stage B – Source Area Transition

Stage B of the GMP will cover periods immediately following the start of the source area treatment and subsequent changes in operation of the source area treatment (i.e. transitional periods of source area treatment). During these periods of time it is expected that source area groundwater conditions that had been in steady state will be altered before a new steady state condition is achieved. This cycle of potential changes to the source area groundwater geochemical environment may continue as operations progress in the source area treatment (i.e. start of ozone sparge, cycles of stopping, restarting, stopping at the end of the AS/ozone cycle, possible introduction of other amendments, possible ISCO injection, etc.) which are described in more detail in the Final OU4 RD (Geosyntec, 2012a). The Stage B monitoring program is defined on **Table 12**.

Monitoring during Stage B is at the highest frequency because the potential changes described above may occur within a short time period. Well locations that are more directly downgradient of the source areas and screened in the Upper Sand and Gravel Unit (EX-1, MW-1B, and MW-20B) will be sampled three times per year (spring, summer, and fall). Additionally, EX-1 will be sampled for VOCs on a monthly basis for the first six months following initial startup of air sparging operations to more closely monitor VOC concentrations during that period. Well locations that have historically had lower COC concentrations, are located more sidegradient of the source areas, or are screened in the underlying intermediate Silty Sand Unit (MW-10, MW-1C, and MW-20A) may be less affected by the source area treatment transitions and will be sampled semi-annually. Well locations that are not expected to be significantly affected by treatment due to their horizontal or vertical distance from the source areas (e.g., MW-11 and MW-1A) will be sampled annually (spring). MW-8A and MW-8B are not included in Stage B because they are not expected to be affected by the source area treatment.

Consistent with the MNA Plan developed for downgradient groundwater, SVOCs will be sampled at a lower frequency than the other parameters because SVOCs will likely change more slowly than other parameters in response to source treatment changes. Total Petroleum Hydrocarbons (TPH) will be monitored at the same frequency as SVOCs.

Biological markers and light gases (methane, ethane, and ethene) will not be monitored during this timeframe because source treatment operations will likely create aerobic conditions that will inhibit reductive dechlorination reactions. However, electron donors and acceptors will be analyzed to evaluate potential changes in the source area geochemical environment that might affect natural attenuation processes. TCL VOCs and metals (arsenic, iron, and manganese) will also be monitored.

Stage B monitoring will begin with the start of source treatment, the start of amendment addition during sparging, and with the start of the stabilization period. Stage B monitoring will continue for one year (three monitoring events) after the start of the change in source treatment operations that triggered Stage B monitoring because the groundwater travel time from the source treatment to the downgradient wells is less than one year. Stage B monitoring will change to Stage C monitoring after one year unless increasing concentration trends are detected in which case Stage B monitoring will continue until decreasing or stable trends are detected. A decreasing trend that follows an increasing trend would involve a maximum concentration followed by two lower concentrations. The third value could be higher than the second value but must be lower than the first value. This pattern is anticipated to be likely due to the strong seasonal variations in some wells. The transitions between Stage B and Stage C monitoring will be made individually for each well, and for each analytical parameter class (e.g. VOCs, SVOCs, metals) such that some wells and/or analytical parameter classes might be in the Stage B program while others are in the Stage C program.

6.1.3 Stage C – Between Source Area Transitions

Stage C of the GMP is intended to cover periods of time after a change in the source area treatment (e.g. start-up of system or change in operation condition) has stabilized into a new quasi-steady state groundwater condition. It should be noted that steady state as used herein can indicate steady concentration declines with overprinted seasonal variations and should not be interpreted to mean no change in concentration of the parameters being monitored. It is expected that the GMP will alternate several times between Stage B and Stage C as operation of the source area treatment progresses as depicted in **Figure 9** because the ongoing activities in the source area treatment may cause instability in the downgradient groundwater followed by re-equilibration. It is anticipated that a qualitative evaluation will be used to identify these trends. However, in extreme situations it may be necessary to employ statistical methods to detect trends obscured by strong seasonal variations. During stable periods of source area treatment, when possible changes are trending toward a steady condition, monitoring frequency will slightly decrease, transitioning to semiannually (spring and fall) for most wells (**Table 13**). In cases where it is expected that constituent concentrations may be less affected by source area treatment the sampling frequency will be reduced further to annually. MW-8A and MW-8B are not included in Stages B and C because they are not expected to be affected by the source area treatment. It should be noted that the monitoring program provided in **Table 13** may need to be modified based on actual conditions detected in the future or based on expected changes if amendments other than air sparge, ozone and persulfate ISCO are conducted in the source area treatment.

Stage C monitoring will also occur in the latter part of the stabilization period. As specified in the 2010 ROD, the stabilization period can last for up to five years, but might be less than five years if conditions reach a new steady state faster and significant concentration rebound (as defined in **Table 3**) does not occur.

6.1.4 Stage D – After Source Area Stabilization and Verification Monitoring

Stage D is intended to cover the period after both the active source area treatment and the subsequent stabilization period as specified in the 2010 ROD. During this stage, the GMP will reduce to annual monitoring in the fall only (**Table 14**). Monitoring will focus on the monitoring wells that are more directly downgradient of the source area treatment and are screened in the shallow and intermediate depth zone. It should be noted that the monitoring program provided in **Table 14** may need to be modified based on actual conditions detected in the future or based on expected changes if amendments other than air sparging, ozone and persulfate ISCO are conducted in the source area treatment.

Currently, it is envisioned that Stage D will also be performed during proposed verification monitoring for downgradient groundwater (OU3) outlined in the MNA Plan. The details of the verification monitoring program will be proposed in an annual monitoring report during the latter part of Stage D monitoring.

6.2 Groundwater Monitoring Parameters

Analytical parameters during the various stages include VOCs, SVOCs, TPH (diesel range organics and gasoline range organics), metals (iron, manganese and arsenic), electron donors/acceptors (alkalinity, sulfate, ammonia, nitrate + nitrite, and total organic carbon), and geochemical field parameters (e.g., pH, dissolved oxygen, oxidation-reduction potential) as described in **Tables 12** through **14**. Biological marker(s) and light gases (i.e. methane, ethene, and ethane [MEE]) may also be analyzed during Stage D (**Table 14).** The actual biological marker(s) to be used depends upon the biodegradation pathway that is necessary for the compounds that remain (aerobic, anaerobic, etc.) at that point in the remedy. The biomarker test used, if any, in later stages will be selected at that time based on the groundwater monitoring data. Light gases will only be analyzed if anaerobic conditions prevail in either the source area or the downgradient groundwater and chlorinated ethanes/ethenes persist such that reductive dechlorination processes are being relied upon (possibly Stage D). The monitoring wells will be purged and sampled using dedicated bladder pumps in accordance with the QAPP for OU3 and OU4 (Geosyntec, 2013c).

6.3 Data Analysis

Mass discharge from each transect will be evaluated periodically as outlined in Section 6.1. The baseline mass discharge calculation is presented in **Appendix B** and will be used as the basis for future calculations of mass discharge from the source areas. Mass discharge will be compared between the source area and downgradient transect to evaluate potential changes in the natural attenuation capacity of the aquifer between the two transects. Mass discharge from the source areas transect will also be compared to the baseline mass discharge presented in **Table 2A** to determine if the remedy has achieved the specified treatment performance criteria of a 90% reduction in baseline mass discharge from the source areas.

As shown in **Figure 9**, temporal trends in TCL VOC concentrations will be used to guide the operation and monitoring of the in-situ source treatment. Statistical analyses (e.g., Mann-Kendall Trend Analysis and Linear Regression Trend Analysis) will be used to evaluate temporal trends of TCL compound and metals concentrations detected at GMP wells at the Site. Mann-Kendall Analysis and Linear Regression Trend Analysis evaluate plume stability by examining the concentration trend of each monitoring well. The Mann-Kendall test is a non-parametric statistical procedure that is well suited for analyzing trends in data over time, while Linear Regression is a parametric statistical procedure that is typically used for analyzing temporal trends of a data set. In order to perform a statistical analysis for a given monitoring well location, a total of four sampling events are required for Mann-Kendall Analysis and Linear Regression Trend Analysis. As applicable, data collected as part of RWE I (Golder, 1997a) Operation and Maintenance Plan ([1997 O&M Plan] Golder, 1997b) may be included in the statistical analysis. Other statistical analyses might be more appropriate depending upon the actual monitoring data generated and such methods would be proposed to the regulatory agencies for review and approval.

6.4 Other Groundwater Monitoring Tasks

Monitoring well inspections will be completed on an annual basis during the fall monitoring event. The monitoring well inspections will continue to be performed in accordance with the procedures presented in the 1997 O&M Plan (Golder, 1997b) for RWE I (Golder, 1997a) included as **Appendix H**.

Site-wide synoptic water level measurements will be taken during each sampling event. If possible, water levels will be measured on the same day prior to any purging or sampling. The depth to water will be recorded to the nearest 0.01 foot relative to the top of the inner casing. A potentiometric groundwater surface map will be developed from the water level data and will be used to evaluate potential changes in groundwater flow direction and gradient.

Since 2005, NAPL measurements have been completed at select wells located near the IDDA 1b source area. NAPL measurements will continue to be completed at these wells during each sampling event. However, due to the source area treatment and NAPL recovery during RA construction the presence of NAPL is expected to diminish over-time. If NAPL is not identified in the wells for several consecutive sampling events, it may be appropriate to terminate NAPL measurements. If appropriate, termination of NAPL measurements will be proposed in a future environmental monitoring report.

Table 15 provides a summary list of wells to be included for site-wide synoptic water level measurements and identifies the select wells for NAPL measurements.

7. OTHER SITE OPERATION AND MAINTENANCE ACTIVITIES

7.1 O&M for Remedial Work Element I

It should be noted that this OM&M plan and the O&M QAPP supersede (and terminate) the environmental monitoring program presented in the 1997 O&M Plan (Golder, 1997b) and amendments to the program in 2011 (Geosyntec, 2011b), 2012 (Geosyntec, 2012b), 2013 (Geosyntec, 2013d) and 2014 (Geosyntec, 2014). However, the requirements regarding inspection and maintenance of the major source control components constructed during RWE I that include the landfill cover closure system, surface water drainage system, passive gas venting system, and site security system are still relevant and will be performed in accordance with the 1997 O&M Plan. Reports on the condition of source control components constructed during RWE I will continue to be included in future source area annual environmental monitoring reports as discussed in Section 9 below.

The 1997 O&M Plan has been included in **Appendix H** for reference.

7.2 Gas Monitoring

Based upon USEPA approval on 11 April 2014 of the Group's request to terminate perimeter landfill gas monitoring this section is left intentionally blank.

7.3 LNAPL Monitoring and Recovery

Monitoring and recovery of free light non-aqueous phase liquid (LNAPL) was conducted at monitoring wells MW-13 and S-2 during Source Area RA construction in order to recover LNAPL prior to the start of treatment system operations. LNAPL monitoring will continue bi-weekly following initial SVE startup through the first six (6) months of full-scale AS operation at the eight (8) monitoring well locations listed on **Table 15**. The depth to product and depth to water will be measured to the nearest 0.01 foot relative to the top of the inner casing using an interface probe and recorded. The depth to product will be subtracted from the depth to water in order to determine the LNAPL thickness in the well to the nearest 0.01 feet and recorded.

LNAPL will be recovered to the extent practical without concurrent collection of groundwater using the existing LNAPL skimmers used during Source Area RA construction in accordance with manufacturer recommendations. When a LNAPL thickness of three (3) inches or greater is measured at a monitoring well, the existing LNAPL skimmers used during Source Area RA construction shall be used to recover the LNAPL. When the LNAPL skimmers can no longer recover LNAPL without groundwater, consideration will be given to suspending adsorbent materials (pigs) in select wells to remove additional LNAPL, if feasible. However, complete removal of LNAPL is not a remedy goal. LNAPL and adsorbent materials will be containerized on-site for off-site disposal in accordance with Section 5.5.

8. REPORTING

8.1 Progress Reports

Progress reports for the OU4 Remedy will be submitted on a regular basis in accordance with the Consent Decree and the Amendment to the Consent Decree. At the start of the O&M period, progress reports will be submitted monthly. The frequency of progress report submittal may be adjusted upon USEPA approval or request. Progress reports will include the following information:

- Actions taken toward compliance with the Consent Decree during the reporting period;
- Summaries of sample and test results received during the reporting period;
- Deliverables submitted during the reporting period;
- Work planned during the next reporting period;
- Problems or delays encountered or anticipated during the reporting period;
- Proposed modifications to the schedule, monitoring program, and/or the OM&M Plan for agency review and approval; and
- Community relations actions taken during the reporting period.

Progress reports will also include information related to the progress of RWE I and the MNA remedy for OU3.

8.2 Annual Report

An annual report will be prepared that addresses the performance of the remedial actions for RWE I, OU-3 and OU-4 with the following content:

General

- Summary of actions taken at the Site;

OU-4

- Summary of the maintenance activities completed on each system including copies of treatment system operation and maintenance inspections forms completed throughout the year;

- Results of SVE off-gas monitoring, the annual average VOC concentrations in comparison to AGCs, VGAC change outs, and recommendations as to the need for continued off-gas treatment;

- Potentiometric surface maps to evaluate potential changes in groundwater flow patterns;

- OU-4 groundwater monitoring data in tabular format, along with Equis electronic deliverables in USEPA Region 2 format;

- Statistical analysis including data tables, analysis output results, and time-concentration plots of the data;

- Calculation of mass discharge from both the source area and downgradient transects and comparison with the baseline mass discharge calculated before treatment to determine if the groundwater performance criterion has been achieved;

- Update of the projected time to achieve performance criterion;

- Recommendation for continued source area groundwater monitoring including changes to the monitoring program, if appropriate;

- Recommendation for continued AS/SVE active treatment system operation including changes to the operation (e.g., a recommendation that AS/SVE wells be added to or subtracted from the network), if appropriate, for agency review and approval; and

- Recommendations for transition to subsequent remedy components for agency review and approval and the need to develop operating procedures for their implementation, if appropriate.

OU-3

- OU-3 groundwater and surface water monitoring data in tabular format, along with Equis electronic deliverables in USEPA Region 2 format;

- Statistical analysis if necessary including data tables, analysis output results, comparison of results with the cleanup goals and time-concentration plots of the data;

- Update of the projected time to achieve cleanup goals; and

- Recommendation for continued MNA including changes to the monitoring program, if appropriate.

RWE 1

- Results of annual inspection of engineered remedial components constructed as part of Remedial Work Element I and associated recommendations to correct deficiencies, if appropriate.

The annual report will be submitted to USEPA and NYSDEC within 90 days following the end of the reporting period that will be on a calendar year basis unless requested otherwise and approved by the regulatory agencies.

9. OPERATION AND MAINTENANCE CONTINGENCY PROCEDURES

9.1 AS Well Fouling

Groundwater monitoring data will be used to evaluate changes in the geochemical environment in the treatment zone. Based upon the field-measured dissolved oxygen (DO) and oxidation-reduction potential (ORP) responses during the AS/SVE pilot test (Geosyntec, 2012), it is expected that the AS systems will be able to modify the existing geochemical environment in the source area from anaerobic to aerobic. Such a change should arrest the redox-based dissolution of iron and manganese oxides from the aquifer solids that produces the high dissolved iron and manganese concentrations in groundwater. In this manner, iron and manganese oxides should precipitate out of solution in the source area during system start up. No further iron and manganese oxide precipitation should occur but contingencies for iron fouling of the AS wells are recommended. In addition, the AS wells may also be susceptible over the long-term to fouling via excessive biomass growth, although aerobic biodegradation is not being relied upon as the primary removal mechanism.

Regular monitoring of injection pressure and flow rate at the AS wellhead will provide indications of AS well fouling. Evidence of fouling may include the need for higher injection pressures to achieve the target flow rate or a total loss of air flow into the AS well. Contingent procedures include addition of precipitate inhibitors, mechanical scrubbing and well cleaning with chemical agents. Food-grade precipitation inhibitors (e.g., sodium citrate) may be added to affected AS wells, as needed. Well cleaning can be conducted by injecting a weak organic acid (e.g., the water well cleaner, LBA™ (Liquid Biofouling Agent), CETCO) into a well and vigorously surging the well. The acid would then be pumped from the well, contained, neutralized and transported off-site for disposal.

The O&M Contractor will notify the Supervising Contractor within fourteen (14) days of indications of AS well fouling and propose a response. Once the response is approved by the Group, the agencies will be notified. Agency approval will be required for addition of precipitate inhibitors or well cleaning agents.

9.2 ORP Shock

If AS alone cannot change the geochemical environment to aerobic conditions, then there is a possibility of ongoing iron floc formation around the sparge wells with associated reduction in system performance and increased O&M costs. There is not a definitive concentration of DO, ORP, or dissolved concentration of iron and manganese above or below which these processes would be problematic. However, there should be detectable DO in the treatment zone groundwater, the ORP should increase to greater than +100 millivolts (mV), and filtered iron concentrations should be less than 10 milligrams per liter (mg/L).

Monitoring of redox conditions within the IDDA 1b treatment area during the startup of AS operations will be conducted in accordance with the QAPP. If the target geochemical conditions described above are not achieved, then injection of a strong oxidant such as hydrogen peroxide or persulfate will be considered in order to "shock" the system and temporarily establish an aerobic geochemical environment around the AS well screens with the expectation that AS will be able to maintain an aerobic condition around the well screens from that point forward. A sample calculation using hydrogen peroxide as the oxidant is presented in **Appendix B**.

The O&M Contractor will notify the Supervising Contractor within fourteen (14) days of indications of insufficient aerobic conditions within the treatment area and propose an approach for oxidant addition to the AS wells. Once the approach is approved by the Group, the agencies will be notified and agency approval will be requested for oxidant addition. Once the oxidant is injected, monitoring data will continue to be reviewed to evaluate whether AS is able to maintain the targeted geochemical environment once established by the oxidant addition.

10. OPERATION, MAINTENANCE, AND MONITORING PLAN REVISIONS

The inspection, maintenance, and monitoring activities described in the OM&M Plan will be reviewed on an annual basis to evaluate their effectiveness. In the event modifications are deemed appropriate, a written detailed description of the proposed modification(s) will be submitted to USEPA for review. Modifications to this OM&M Plan will be implemented upon receipt of approval from USEPA.

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TABLES

TABLE 1
PROJECT CONTACT LIST

Cortese Landfill
Narrowsburg, New York

Contact	Title	Organization	Telephone Number	Mailing Address	E-mail Address
Mark Granger	Remedial Project Manager	USEPA Region 2	212-637-3351	290 Broadway, 20th Floor New York, NY 10007-1866	Granger.mark@epa.gov
Jonathan Greco	Case Manager	NYSDEC	518-402-9694	625 Broadway Albany, NY 12233-7016	jxgreco@gw.dec.state.ny.us
Mark Snyder	Project Coordinator	Cortese Landfill PRP Group	585 223-6132	Waste Management 425 Perinton Parkway Fairport, NY 14450	msnyder@wm.com
Robert Glazier	Supervising Contractor	Geosyntec	410-381-4333	10220 Old Columbia Road Suite A Columbia, MD 20146	RGlazier@Geosyntec.com
Aron Krasnopoler	Engineer-of-Record	Geosyntec	410-381-4333	10220 Old Columbia Road Suite A Columbia, MD 20146	AKrasnopoler @Geosyntec.com
Dale Charterrs	RA Construction Project Manager	CRA Services	269-685-5181	200 W. Allegan Street Suite 300 Plainwell, MI 49080	dcharters@craworld.com
Bob Sacco	Process Trailer Fabricator	Bisco Environmental	508-738-5102	135 Robert Treat Paine Drive Taunton, MA 02780	rsacco@biscoenv.com
TBD	O&M Project Manager	TBD	TBD	TBD	TBD
TBD	O&M Technician	TBD	TBD	TBD	TBD
Albert Pleva	Field Sampler	Terra Nova Technical	609-259-0020	P.O. Box 657 Allentown, NJ 08501	terranovanj@msn.com
Peggy Gray-Erdmann	Lab Project Manager	TestAmerica-Buffalo	716-504-9829	10 Hazelwood Drive Amherst, NY 14228	Peggy.Gray-Erdmann@testamericainc.com

TABLE 2A
BASELINE VOC MASS DISCHARGE FROM SOURCE AREA TRANSECT

Cortese Landfill
Narrowsburg, New York

Monitoring Well/Polygon	Total VOC Concentration (C_j) (1)		Geologic Material	Hydraulic Conductivity (K_j)	Area (A_j) (2)		Hydraulic Gradient (i_j)	Mass Discharge (M_{dj})
Units	µg/l	µg/cm^3 *	-	cm/sec *	ft^2	cm^2 *	cm/cm *	µg/sec
MW-10	55	0.055	Sand and Gravel	2.7E-02	1,848	1.7E+06	0.003	7.6E+00
	55	0.055	Silty Sand	5.0E-04	1,104	1.0E+06	0.003	8.5E-02
MW-11	20	0.02	Silty Sand	5.0E-04	11,266	1.0E+07	0.003	3.1E-01
	20	0.02	Clayey Silt	1.0E-06	70	6.5E+04	0.003	3.9E-06
	20	0.02	Sand w/ some Gravel	2.3E-04	357	3.3E+05	0.003	4.6E-03
EX-1	7,060	7.06	Sand and Gravel	2.7E-02	5,974	5.5E+06	0.003	3.2E+03
	7,060	7.06	Silty Sand	5.0E-04	2,371	2.2E+06	0.003	2.3E+01
MW-1A	0	0	Silty Sand	5.0E-04	3,955	3.7E+06	0.003	0.0E+00
	0	0	Clayey Silt	1.0E-06	370	3.4E+05	0.003	0.0E+00
	0	0	Sand w/ some Gravel	2.3E-04	3,647	3.4E+06	0.003	0.0E+00
MW-1B	2,983	2.983	Sand and Gravel	2.7E-02	4,340	4.0E+06	0.003	9.7E+02
	2,983	2.983	Silty Sand	5.0E-04	3,415	3.2E+06	0.003	1.4E+01
	2,983	2.983	Clayey Silt	1.0E-06	360	3.3E+05	0.003	3.0E-03
MW-1C	165	0.165	Sand and Gravel	2.7E-02	3,029	2.8E+06	0.003	3.8E+01
	165	0.165	Silty Sand	5.0E-04	883	8.2E+05	0.003	2.0E-01
MW-20A	73	0.073	Silty Sand	5.0E-04	9,263	8.6E+06	0.003	9.4E-01
	73	0.073	Sand w/ some Gravel	2.3E-04	4,556	4.2E+06	0.003	2.1E-01
MW-20B	291	0.291	Sand and Gravel	2.7E-02	5,766	5.4E+06	0.003	1.3E+02
	291	0.291	Silty Sand	5.0E-04	2,724	2.5E+06	0.003	1.1E+00
	291	0.291	Clayey Silt	1.0E-06	83	7.7E+04	0.003	6.7E-05
MW-8A	0	0	Clayey Silt	1.0E-06	868	8.1E+05	0.003	0.0E+00
	0	0	Sand and Gravel	2.7E-02	2,976	2.8E+06	0.003	0.0E+00
MW-8B	0	0	Sand and Gravel	2.7E-02	2,150	2.0E+06	0.003	0.0E+00
	0	0	Silty Sand	5.0E-04	1,740	1.6E+06	0.003	0.0E+00
	0	0	Sand w/ some Gravel	2.3E-04	1,159	1.1E+06	0.003	0.0E+00

Total Mass Dicharge (M_d)
4.4E+03 µg/sec
3.8E+02 mg/day

Notes:

See Appendix B for details of the mass discharge calculation for the definition of terms.

(1) Micrograms per liter converted to micrograms per cubic centimeter by dividing by 1,000

(2) square feet converted to square centimeters by multiplying by 929

* The product of these columns in each row is M_{dj}

µg/l - micrograms per liter

µg/cm^3 - micrograms per cubic centimeter

cm/sec - centimeters per second

ft^2 - square feet

cm^2 - square centimeters

cm/cm - centimeters per centimeter

µg/sec - micrograms per second

mg/day - milligrams per day

TABLE 2B
BASELINE VOC MASS DISCHARGE FROM DOWNGRADIENT TRANSECT

Cortese Landfill
Narrowsburg, New York

Monitoring Well/Polygon	Total VOC Concentration (C_j) [(1)]		Geologic Material	Hydraulic Conductivity (K_j)	Area (A_j) [(2)]		Hydraulic Gradient (i_j)	Mass Discharge (M_{dj})
Units	µg/l	µg/cm^3 *	-	cm/sec *	ft^2	cm^2 *	cm/cm *	µg/sec
MW-5	0	0	Sand and Gravel	4.8E-02	3,550	3.3E+06	0.003	0.0E+00
	0	0	Silty Sand	5.0E-04	959	8.9E+05	0.003	0.0E+00
	0	0	Clayey Silt	1.0E-06	556	5.2E+05	0.003	0.0E+00
MW-19	140	0.14	Sand and Gravel	4.8E-02	543	5.0E+05	0.003	1.0E+01
	140	0.14	Silty Sand	5.0E-04	9,471	8.8E+06	0.003	1.8E+00
	140	0.14	Clayey Silt	1.0E-06	88	8.2E+04	0.003	3.4E-05
	140	0.14	Sand w/ some Gravel	8.4E-03	3,372	3.1E+06	0.003	1.1E+01
MW-18A	0.3	0.0003	Clayey Silt	1.0E-06	289	2.7E+05	0.003	2.4E-07
	0.3	0.0003	Sand w/ some Gravel	8.4E-03	16,284	1.5E+07	0.003	1.1E-01
MW-18B	2,447	2.447	Silty Sand	5.0E-04	5,690	5.3E+06	0.003	1.9E+01
	2,447	2.447	Sand w/ some Gravel	8.4E-03	718	6.7E+05	0.003	4.1E+01
MW-18C	77	0.077	Sand and Gravel	4.8E-02	5,314	4.9E+06	0.003	5.5E+01
	77	0.077	Silty Sand	5.0E-04	509	4.7E+05	0.003	5.5E-02
MW-6A	538	0.538	Silty Sand	5.0E-04	4,227	3.9E+06	0.003	3.2E+00
	538	0.538	Sand w/ some Gravel	8.4E-03	5,790	5.4E+06	0.003	7.3E+01
	538	0.538	Clayey Silt	1.0E-06	38	3.5E+04	0.003	5.7E-05
MW-6B	73	0.073	Sand and Gravel	4.8E-02	3,185	3.0E+06	0.003	3.1E+01
	73	0.073	Silty Sand	5.0E-04	3,785	3.5E+06	0.003	3.9E-01
	73	0.073	Clayey Silt	1.0E-06	561	5.2E+05	0.003	1.1E-04
MW-21	215	0.215	Silty Sand	5.0E-04	7,630	7.1E+06	0.003	2.3E+00
	215	0.215	Clayey Silt	1.0E-06	719	6.7E+05	0.003	4.3E-04
	215	0.215	Sand w/ some Gravel	8.4E-03	1,523	1.4E+06	0.003	7.7E+00
MW-7A	3.1	0.0031	Clayey Silt	1.0E-06	2,571	2.4E+06	0.003	2.2E-05
	3.1	0.0031	Sand w/ some Gravel	8.4E-03	8,595	8.0E+06	0.003	6.2E-01
MW-7B	40	0.04	Sand and Gravel	4.8E-02	2,170	2.0E+06	0.003	1.2E+01
	40	0.04	Silty Sand	5.0E-04	400	3.7E+05	0.003	2.2E-02
	40	0.04	Clayey Silt	1.0E-06	4,860	4.5E+06	0.003	5.4E-04
MW-7M	52	0.052	Silty Sand	5.0E-04	5,203	4.8E+06	0.003	3.8E-01
	52	0.052	Clayey Silt	1.0E-06	3,815	3.5E+06	0.003	5.5E-04
MW-22	43.5	0.0435	Sand and Gravel	4.8E-02	221	2.1E+05	0.003	1.3E+00
	43.5	0.0435	Silty Sand	5.0E-04	12,680	1.2E+07	0.003	7.7E-01
	43.5	0.0435	Sand w/ some Gravel	8.4E-03	74	6.9E+04	0.003	7.5E-02
	43.5	0.0435	Clayey Silt	1.0E-06	1,364	1.3E+06	0.003	1.7E-04
MW-2A	0	0	Silty Sand	5.0E-04	4,032	3.7E+06	0.003	0.0E+00
	0	0	Sand w/ some Gravel	8.4E-03	7,524	7.0E+06	0.003	0.0E+00
MW-2B	21	0.021	Sand and Gravel	4.8E-02	3,873	3.6E+06	0.003	1.1E+01
	21	0.021	Silty Sand	5.0E-04	3,645	3.4E+06	0.003	1.1E-01
	21	0.021	Clayey Silt	1.0E-06	839	7.8E+05	0.003	4.9E-05

Total Mass Dicharge (M_d)	
2.8E+02	µg/sec
2.4E+01	mg/day

Notes:

See Appendix B for details of the mass discharge calculation for the definition of terms.

(1) Micrograms per liter converted to micrograms per cubic centimeter by dividing by 1,000

(2) square feet converted to square centimeters by multiplying by 929

* The product of these columns in each row is M_{dj}

µg/l - micrograms per liter

µg/cm^3 - micrograms per cubic centimeter

cm/sec - centimeters per second

ft^2 - square feet

cm^2 - square centimeters

cm/cm - centimeters per centimeter

µg/sec - micrograms per second

mg/day - milligrams per day

TABLE 3
SOURCE AREAS (OU4) REMEDY COMPONENTS, FUNCTIONS, DECISIONS AND ACTION LEVELS

Cortese Landfill Site
Narrowsburg, New York

Remedy Component	Component/Decision	Description	Action
1	Air Sparging (AS)	1. Physical removal of VOCs from source areas below the groundwater table through volatilization. Accomplished by mass transfer of VOCs from shallow groundwater in the source area to the overlying vadose zone. 2. In situ aerobic biodegradation of hydrocarbons in groundwater by mass transfer of oxygen from sparge gas into groundwater will likely occur but is not being relied upon. Both processes achieve source treatment by increasing the dissolution rate of the residual source materials.	Operate system, monitor changes to source area geochemical environment and downgradient groundwater mass discharge.
	Decision No. 1 *Redox Adjustment*	Should redox amendments be applied to achieve target groundwater geochemical environment in source area and reduce the potential for iron fouling (see rationale in Remedy Component 1A below)?	Continue AS/SVE operation with or without implementing Remedy Component 1A below.
1A	Initial Redox Amendment (optional)	Consider use of redox amendment in the source area if initial AS operation does not raise the oxidation-reduction potential (ORP) of groundwater in the source area to approximately +100 mV, achieve a detectable dissolved oxygen (DO) concentration in groundwater, or reduce dissolved iron concentrations to less than 10 mg/L. Achieving these geochemical conditions should mitigate the dissolution of iron from aquifer solids in the source area that otherwise has the potential to affect AS/SVE operation by excessive long-term precipitation of iron oxides on or near the sparge wells.	Deliver redox amendment to source area. Continue AS operations and evaluate if they are able to maintain the higher ORP established by the optional amendment delivery and hence mitigate the iron dissolution process. If not, consider other amendments including early start to ozone sparging.
2	Soil Vapor Extraction (SVE)	Collect VOCs transferred to the vadose zone by the AS process using SVE wells. The collected VOCs will be monitored and initially treated prior to discharge to the atmosphere.	Operate system initially with SVE off-gas treatment and monitor changes to gas stream quality.
	Decision No. 2 *Discontinue SVE Off-Gas Treatment*	Should treatment of SVE off-gas be discontinued? Treatment will be necessary during initial system operation but SVE gas stream concentrations might decrease to the point where off-gas treatment is no longer necessary.	Discontinue SVE off-gas treatment if concentrations fall below the NYSDEC DAR-1 guidelines but continue to monitor SVE off gas and resume treatment if concentrations increase above DAR-1 guidelines.
	Decision No. 3 *Amendment Addition*	Should Remedy Component 3, Amendment Addition (such as ozone), begin?	Consider beginning Amendment Addtition if the decreases in the mass discharge of the less volatile or less aerobically biodegradable constituents are not showing adequate progress toward achieving the Performance Criterion and the AS/SVE removal rate becomes mass transfer limited.

TABLE 3
SOURCE AREAS (OU4) REMEDY COMPONENTS, FUNCTIONS, DECISIONS AND ACTION LEVELS

Cortese Landfill Site
Narrowsburg, New York

Remedy Component	Component/Decision	Description	Action
3	Amendment Addition (e.g. Ozone)	Ozone sparging will likely be used as an amendment addition for treatment of recalcitrant compounds in the source areas that are not treated effectively by air sparging in Remedy Component 1. It is also expected to mitigate the redox-based dissolution of manganese from aquifer solids in the source area. Other amendments, or more than one amendment, with or without concurrent air sparging, may be considered by the PRP Group, if appropriate.	If necessary, apply amendment(s) and monitor changes to downgradient groundwater mass discharge.
	Decision No. 4 Discontinue Active Treatment	Should active treatment operations be discontinued?	Discontinue active treatment when downgradient groundwater mass discharge indicates that the Performance Criterion (see Note 2) has been achieved for total VOC COCs.
	Decision No. 5 Resumption of active treatment operations	Should active treatment operations be resumed due to rebound in VOC concentrations?	Monitor groundwater concentrations downgradient from the source area. If the concentration of a constituent rebounds by more than 20% compared to the reduction that has been achieved through treatment, then the data will be evaluated to decide whether active treatment should re-started. The mass discharge will be calculated for the last two monitoring events. If the mass discharge has rebounded by an amount that is more than 20 percent of the decline in mass discharge that has been achieved through treatment for both consecutive monitoring events, and it exceeds the natural attenuation capacity of the downgradient aquifer, the well in question will be resampled to confirm the rebound. If the increase is confirmed, active treatment will be re-started. Otherwise monitoring will continue.
	Decision No. 6 Begin Stablization Period	Should Stabilization Period begin?	If the Performance Criterion has been achieved and rebounding concentrations remain below the thresholds in Decision No. 5 for two consecutive monitoring efvents, the Stabilization Period will begin at the discretion of the PRP Group.
4	Stabilization	Upon discontinuation of AS and amendment addition operations, the source areas and downgradient groundwater will be allowed to re-equilibrate for a period of up to five years.	Groundwater monitoring will be used to track the re-equilibration and evaluate groundwater quality and the groundwater mass discharge with respect to the Performance Criterion.
	Decision No. 7 Post-Stabilization ISCO Application (if necessary)	Should the post-stabilization ISCO application be invoked?	If the Performance Criterion has not been achieved during the five-year Stabilization Period, or if site-specific MNA performance monitoring criteria established consistent with Performance Monitoring for MNA Remedies for VOCs in Groundwater (EPA/600/R-04/027, dated April 2004) are not achieved, the post-stabilization ISCO Application will be conducted.

TABLE 3
SOURCE AREAS (OU4) REMEDY COMPONENTS, FUNCTIONS, DECISIONS AND ACTION LEVELS

Cortese Landfill Site
Narrowsburg, New York

Remedy Component	Component/Decision	Description	Action
5	Post Stabilization ISCO Application	ISCO amendments, potentially including a surfactant enhancement, will be used to facilitate additional active treatment of the remaining source areas, if necessary. The nature, dose, and delivery method for those ISCO amendments will be based upon the types and concentrations of constituents that exceed the Performance Criterion.	Deliver ISCO amendments and monitor downgradient groundwater for possible rebound or concentration decreases. Multiple ISCO amendments and injections may be necessary to achieve the Performance Criterion. The PRP Group might petition the agencies for permission to apply other amendments after the post-stabilization ISCO application, if appropriate.
	Decision No. 8 Consider Contingent Remedy	Should the Contingent Remedy be evaluated?	The PRP Group can consider evaluating the contingent remedy (groundwater extraction and treatment) at any step listed above. If the Performance Criterion cannot be achieved following implementation of the post stabilization ISCO application, then the contingency remedy may be evaluated. The PRP Group might petition the agencies for permission to utilize other innovative approaches that might have been developed since the time the ROD was signed, if appropriate.
	Decision No. 9, Remedy Completion	Has the Performance Criterion been achieved and have groundwater concentrations stabilized?	If the Performance Criterion has been achieved and groundwater concentrations have stabilized (i.e. no rebound above the thresholds in Decision No. 5), then active source treatment at OU 4 will have been completed. Restoration of downgradient groundwater quality will continue as part of the Monitored Natural Attenuation at OU 3 (see Note 1).

Notes:

1. Monitored natural attenuation is the remedy component for groundwater (OU3) in areas downgradient of the source areas throughout the remedial timeframe while active treatment technologies are being implemented in the source areas and thereafter. A separate MNA Plan describes the OU 3 performance standards.
2. The source treatment Performance Criterion is a 90 percent reduction in the pre-treatment mass discharge of total VOC COCs through the near-source vertical plane (C-C').

TABLE 4
LIST OF EQUIPMENT

Cortese Landfill
Narrowsburg, New York

Dwg No.	Tag No.	Equipment Description	Function	Design Temperature (°F)	Design Presssure	Design Capacity	Dimensions	Motor Rating (hp)	Material of Construction	Manufacturer	Model No.
COMPRESSOR AND BLOWERS											
M03A	C-201	Rotary Screw Compressor	Deliver compressed air to the AS wells in the IDDA 1b treatment area	68	125 psig	345 scfm	69.25" x 43.75" x 74.75"	75	Carbon Steel Plate	Kaeser	CSD-75T
M04A	C-203	Regenerative Blower	Extract soil vapors from the compacted backfill in the IDDA 1b treatement area	70	170" H2O Diff.	190 scfm	23.7" x 21.26" x 18.73"	7.5	Cast Aluminum, Iron, Teflon	Rotron	EN808BA72MXL
M04A	C-204	Regenerative Blower	Extract soil vapors from the sand/waste in the IDDA 1b treatement area	79	100" H2O Diff.	480 scfm	29.57" x 25.90" x 8.34"	15	Cast Aluminum, Iron, Teflon	Rotron	EN909BG72WL
HEAT EXCHANGERS AND DRYERS											
M03A	H-501	Closed-cycle Dryer	Cool and dry compressed air prior to injection	78	125 psig	345 scfm	69.25" x 43.75" x 74.75"	75	Carbon Steel Plate	Kaeser	CSD-75T
M04A	H-503	Air-to-air Heat Exchanger	Cool discharge from SVE blowers priot to off-gas treament and discharge to the atmosphere	150	17.3	700 cfm	60.46" x 36" x 2.96"	0.5	Aluminum, Steel	Xchanger	AA-1000
FILTERS											
M03A	F-401	Coalescing Filter	Remove entrained liquid from compressed air stream	--	125 psig	345 scfm	7.63" x 29"	--	Aluminum, Steel, Epoxy Powder	Kaeser	KOR-485.2
M03A	F-402	Carbon Filter	Remove organic vapors from compressed air stream	--	125 psig	345 scfm	7.63" x 29"	--	Aluminum, Steel, Epoxy Powder	Kaeser	KVF-485.2
M04A	F-403	Inline Filter	Remove particulates from extracted soil vapor	--	--	190 scfm	18.62" x 13.5"	--	Cast Alumnium	Solberg	FS-235P-400C
M04A	F-404	Inline Filter	Remove particulates from extracted soil vapor	--	--	480 scfm	18.25" x 19"	--	Carbon Steel	Solberg	CT-275P-600C
M04A	F-405	Inline Filter	Remove particulates from outside air	--	--	190 scfm	10" x 13"	--	Carbon Steel, Polyester, Paper	Solberg	FS-231P-300
M04A	F-406	Inline Filter	Remove particulates from outside air	--	--	480 scfm	10" x 13"	--	Carbon Steel, Polyester, Paper	Solberg	FS-235P-400
PUMPS											
M04A	P-601	Centrifiugual Pump	Transfer condensate from T-703 to T-705	90	14.7	1 gpm	1" x 1.25" - 6	3	Stainless Steel	Goulds	1ST1C7F4
M04A	P-602	Centrifiugual Pump	Transfer condensate from T-704 to T-705	90	14.7	1 gpm	1" x 1.25" - 6	3	Stainless Steel	Goulds	1ST1C7F4
TANKS											
M03A	T-701	Air Receiving Tank	Receive compressed air for injection	68	14.7	400 gallons	93" x 36"	--	Carbon Steel	Manchester	--
M04A	T-703	Moisture Separator	Remove entrained liquid from extracted soil gas	90	14.7	60 gallons	20" x 48"	--	Steel	Steel Fab	A12294
M04A	T-704	Moisture Separator	Remove entrained liquid from extracted soil gas	90	14.7	240 gallons	36" x 69"	--	Steel	Steel Fab	A12286
M04A	T-705	Condensate Holding Tank	Contain soil gas condensate	90	14.7	250 gallons	35 x 68	--	Polyethylene	Chemtainer	TC3568IA
M04A	T-706A/B	Vapor Phase Granular Activated Carbon Vessel	Treat SVE off-gas to remove VOCs prior to discharge to the atmosphere	105	16.8	5000 pounds	72" x 96"	--	Epoxy-Coated Steel	Tetrasolv	VF-5000
MISCELLANEOUS											
M04A	G-801	Discharge Silencer	Sillence discharge from C-203	--	--	190 scfm	10" x 21.5"	--	Steel	Stoddard	C26-4
M04A	G-802	Discharge Silencer	Sillence discharge from C-204	--	--	480 scfm	12" x 26"	--	Steel	Stoddard	C26-6
M04A	G-803	Spill Containment	Contain potential spills from T-705	--	--	270 gallons	52.75" x 36.88"	--	Polyethylene	Chem-Tainer	R364836A

TABLE 5
LIST OF INSTRUMENTATION

Cortese Landfill
Narrowsburg, New York

Dwg No.	Loop Number	Type	Primary Instrument / Equipment	Function	Range	Output	Manufacturer	Model No.	Submittal	Review
FLOW										
M03A	101	Flow	FI-101	Flowmeter for ASW01	2-20 SCFM	DR	Dwyer	RMC-122-BV		
M03A	102	Flow	FI-102	Flowmeter for ASW02	2-20 SCFM	DR	Dwyer	RMC-122-BV		
M03A	103	Flow	FI-103	Flowmeter for ASW03	2-20 SCFM	DR	Dwyer	RMC-122-BV		
M03A	104	Flow	FI-104	Flowmeter for ASW04	2-20 SCFM	DR	Dwyer	RMC-122-BV		
M03A	105	Flow	FI-105	Flowmeter for ASW05	2-20 SCFM	DR	Dwyer	RMC-122-BV		
M03A	106	Flow	FI-106	Flowmeter for ASW06	2-20 SCFM	DR	Dwyer	RMC-122-BV		
M03A	107	Flow	FI-107	Flowmeter for ASW07	2-20 SCFM	DR	Dwyer	RMC-122-BV		
M03A	108	Flow	FI-108	Flowmeter for ASW08	2-20 SCFM	DR	Dwyer	RMC-122-BV		
M03A	109	Flow	FI-109	Flowmeter for ASW09	2-20 SCFM	DR	Dwyer	RMC-122-BV		
M03A	110	Flow	FI-110	Flowmeter for ASW10	2-20 SCFM	DR	Dwyer	RMC-122-BV		
M03A	111	Flow	FI-111	Flowmeter for ASW11	2-20 SCFM	DR	Dwyer	RMC-122-BV		
M03A	112	Flow	FI-112	Flowmeter for ASW12	2-20 SCFM	DR	Dwyer	RMC-122-BV		
M03A	113	Flow	FI-133	Flowmeter for ASW13	2-20 SCFM	DR	Dwyer	RMC-122-BV		
M03A	114	Flow	FI-114	Flowmeter for ASW14	2-20 SCFM	DR	Dwyer	RMC-122-BV		
M03A	115	Flow	FI-115	Flowmeter for ASW15	2-20 SCFM	DR	Dwyer	RMC-122-BV		
M03A	116	Flow	FI-116	Flowmeter for ASW16	2-20 SCFM	DR	Dwyer	RMC-122-BV		
M03A	117	Flow	FI-117	Flowmeter for ASW17	2-20 SCFM	DR	Dwyer	RMC-122-BV		
M03A	118	Flow	FI-118	Flowmeter for ASW18	2-20 SCFM	DR	Dwyer	RMC-122-BV		
M03A	119	Flow	FI-119	Flowmeter for ASW19	2-20 SCFM	DR	Dwyer	RMC-122-BV	PI: Dwyer Ratemaster Ratemaster RMC-122-BV 10", 1/2" NPTF 2 -20 SCFM	Accepted
M03A	120	Flow	FI-120	Flowmeter for ASW20	2-20 SCFM	DR	Dwyer	RMC-122-BV		
M03A	121	Flow	FI-121	Flowmeter for ASW21	2-20 SCFM	DR	Dwyer	RMC-122-BV		
M03A	122	Flow	FI-122	Flowmeter for ASW22	2-20 SCFM	DR	Dwyer	RMC-122-BV		
M03A	123	Flow	FI-123	Flowmeter for ASW23	2-20 SCFM	DR	Dwyer	RMC-122-BV		
M03A	124	Flow	FI-124	Flowmeter for ASW24	2-20 SCFM	DR	Dwyer	RMC-122-BV		
M03A	125	Flow	FI-125	Flowmeter for ASW25	2-20 SCFM	DR	Dwyer	RMC-122-BV		
M03A	126	Flow	FI-126	Flowmeter for ASW26	2-20 SCFM	DR	Dwyer	RMC-122-BV		
M03A	127	Flow	FI-127	Flowmeter for ASW27	2-20 SCFM	DR	Dwyer	RMC-122-BV		
M03A	128	Flow	FI-128	Flowmeter for ASW28	2-20 SCFM	DR	Dwyer	RMC-122-BV		
M03A	129	Flow	FI-129	Flowmeter for ASW29	2-20 SCFM	DR	Dwyer	RMC-122-BV		
M03A	130	Flow	FI-130	Flowmeter for ASW30	2-20 SCFM	DR	Dwyer	RMC-122-BV		
M03A	131	Flow	FI-131	Flowmeter for ASW31	2-20 SCFM	DR	Dwyer	RMC-122-BV		
M03A	132	Flow	FI-132	Flowmeter for ASW32	2-20 SCFM	DR	Dwyer	RMC-122-BV		
M03A	133	Flow	FI-133	Flowmeter for ASW33	2-20 SCFM	DR	Dwyer	RMC-122-BV		
M03A	134	Flow	FI-134	Flowmeter for ASW34	2-20 SCFM	DR	Dwyer	RMC-122-BV		
M03A	135	Flow	FI-135	Flowmeter for ASW35	2-20 SCFM	DR	Dwyer	RMC-122-BV		
M03A	136	Flow	FI-136	Flowmeter for ASW36	2-20 SCFM	DR	Dwyer	RMC-122-BV		
M03A	137	Flow	FI-137	Flowmeter for ASW37	2-20 SCFM	DR	Dwyer	RMC-122-BV		
PRESSURE										
M03A	101	Pressure	PI-101	Pressure for ASW01	0-60 psig	DR	Winters	Q803		
M03A	102	Pressure	PI-102	Pressure for ASW02	0-60 psig	DR	Winters	Q803		
M03A	103	Pressure	PI-103	Pressure for ASW03	0-60 psig	DR	Winters	Q803		
M03A	104	Pressure	PI-104	Pressure for ASW04	0-60 psig	DR	Winters	Q803		
M03A	105	Pressure	PI-105	Pressure for ASW05	0-60 psig	DR	Winters	Q803		
M03A	106	Pressure	PI-106	Pressure for ASW06	0-60 psig	DR	Winters	Q803		
M03A	107	Pressure	PI-107	Pressure for ASW07	0-60 psig	DR	Winters	Q803		
M03A	108	Pressure	PI-108	Pressure for ASW08	0-60 psig	DR	Winters	Q803		
M03A	109	Pressure	PI-109	Pressure for ASW09	0-60 psig	DR	Winters	Q803	Winters Q803 2.5 1/2" Dial 0 -60 psi	
M03A	110	Pressure	PI-110	Pressure for ASW10	0-60 psig	DR	Winters	Q803		Accepted
M03A	111	Pressure	PI-111	Pressure for ASW11	0-60 psig	DR	Winters	Q803		
M03A	112	Pressure	PI-112	Pressure for ASW12	0-60 psig	DR	Winters	Q803		
M03A	114	Pressure	PI-113	Pressure for ASW13	0-60 psig	DR	Winters	Q803		
M03A	115	Pressure	PI-114	Pressure for ASW14	0-60 psig	DR	Winters	Q803		
M03A	116	Pressure	PI-115	Pressure for ASW15	0-60 psig	DR	Winters	Q803		
M03A	117	Pressure	PI-116	Pressure for ASW16	0-60 psig	DR	Winters	Q803		
M03A	118	Pressure	PI-117	Pressure for ASW17	0-60 psig	DR	Winters	Q803		
M03A	119	Pressure	PI-118	Pressure for ASW18	0-60 psig	DR	Winters	Q803		

TABLE 5
LIST OF INSTRUMENTATION

Cortese Landfill
Narrowsburg, New York

Dwg No.	Loop Number	Type	Primary Instrument / Equipment	Function	Range	Output	Manufacturer	Model No.	Submittal	Review
M03A	120	Pressure	PI-119	Pressure for ASW19	0-60 psig	DR	Winters	Q803	Winters Q803 2.5 1/2" Dial 0 -60 psi	Accepted
M03A	121	Pressure	PI-120	Pressure for ASW20	0-60 psig	DR	Winters	Q803		
M03A	122	Pressure	PI-121	Pressure for ASW21	0-60 psig	DR	Winters	Q803		
M03A	123	Pressure	PI-122	Pressure for ASW22	0-60 psig	DR	Winters	Q803		
M03A	124	Pressure	PI-123	Pressure for ASW23	0-60 psig	DR	Winters	Q803		
M03A	125	Pressure	PI-124	Pressure for ASW24	0-60 psig	DR	Winters	Q803		
M03A	126	Pressure	PI-125	Pressure for ASW25	0-60 psig	DR	Winters	Q803		
M03A	127	Pressure	PI-126	Pressure for ASW26	0-60 psig	DR	Winters	Q803		
M03A	128	Pressure	PI-127	Pressure for ASW27	0-60 psig	DR	Winters	Q803		
M03A	129	Pressure	PI-128	Pressure for ASW28	0-60 psig	DR	Winters	Q803		
M03A	130	Pressure	PI-129	Pressure for ASW29	0-60 psig	DR	Winters	Q803		
M03A	131	Pressure	PI-130	Pressure for ASW30	0-60 psig	DR	Winters	Q803		
M03A	132	Pressure	PI-131	Pressure for ASW31	0-60 psig	DR	Winters	Q803		
M03A	113	Pressure	PI-132	Pressure for ASW32	0-60 psig	DR	Winters	Q803		
M03A	133	Pressure	PI-133	Pressure for ASW33	0-60 psig	DR	Winters	Q803		
M03A	134	Pressure	PI-134	Pressure for ASW34	0-60 psig	DR	Winters	Q803		
M03A	135	Pressure	PI-135	Pressure for ASW35	0-60 psig	DR	Winters	Q803		
M03A	136	Pressure	PI-136	Pressure for ASW36	0-60 psig	DR	Winters	Q803		
M03A	137	Pressure	PI-137	Pressure for ASW37	0-60 psig	DR	Winters	Q803		
M03A	101	Pressure	PT-101	Pressure for ASW01	0-60 psig	4-20 mA	Dwyer	628-09-6H-PI-EI-SI	PT: Dwyer 628-10-6H-PI-EI-SI 0 -100 psi, 1% accuracy 1/4" NPT 4 -20 mA	PT: Dwyer 628-09-6H-PI-EI-SI 0 -60 psi 1/4" NPT 4 -20 mA
M03A	102	Pressure	PT-102	Pressure for ASW02	0-60 psig	4-20 mA	Dwyer	628-09-6H-PI-EI-SI		
M03A	103	Pressure	PT-103	Pressure for ASW03	0-60 psig	4-20 mA	Dwyer	628-09-6H-PI-EI-SI		
M03A	104	Pressure	PT-104	Pressure for ASW04	0-60 psig	4-20 mA	Dwyer	628-09-6H-PI-EI-SI		
M03A	105	Pressure	PT-105	Pressure for ASW05	0-60 psig	4-20 mA	Dwyer	628-09-6H-PI-EI-SI		
M03A	106	Pressure	PT-106	Pressure for ASW06	0-60 psig	4-20 mA	Dwyer	628-09-6H-PI-EI-SI		
M03A	107	Pressure	PT-107	Pressure for ASW07	0-60 psig	4-20 mA	Dwyer	628-09-6H-PI-EI-SI		
M03A	108	Pressure	PT-108	Pressure for ASW08	0-60 psig	4-20 mA	Dwyer	628-09-6H-PI-EI-SI		
M03A	109	Pressure	PT-109	Pressure for ASW09	0-60 psig	4-20 mA	Dwyer	628-09-6H-PI-EI-SI		
M03A	110	Pressure	PT-110	Pressure for ASW10	0-60 psig	4-20 mA	Dwyer	628-09-6H-PI-EI-SI		
M03A	111	Pressure	PT-111	Pressure for ASW11	0-60 psig	4-20 mA	Dwyer	628-09-6H-PI-EI-SI		
M03A	112	Pressure	PT-112	Pressure for ASW12	0-60 psig	4-20 mA	Dwyer	628-09-6H-PI-EI-SI		
M03A	113	Pressure	PT-113	Pressure for ASW13	0-60 psig	4-20 mA	Dwyer	628-09-6H-PI-EI-SI		
M03A	114	Pressure	PT-114	Pressure for ASW14	0-60 psig	4-20 mA	Dwyer	628-09-6H-PI-EI-SI		
M03A	115	Pressure	PT-115	Pressure for ASW15	0-60 psig	4-20 mA	Dwyer	628-09-6H-PI-EI-SI		
M03A	116	Pressure	PT-116	Pressure for ASW16	0-60 psig	4-20 mA	Dwyer	628-09-6H-PI-EI-SI		
M03A	117	Pressure	PT-117	Pressure for ASW17	0-60 psig	4-20 mA	Dwyer	628-09-6H-PI-EI-SI		
M03A	118	Pressure	PT-118	Pressure for ASW18	0-60 psig	4-20 mA	Dwyer	628-09-6H-PI-EI-SI		
M03A	119	Pressure	PT-119	Pressure for ASW19	0-60 psig	4-20 mA	Dwyer	628-09-6H-PI-EI-SI		
M03A	120	Pressure	PT-120	Pressure for ASW20	0-60 psig	4-20 mA	Dwyer	628-09-6H-PI-EI-SI		
M03A	121	Pressure	PT-121	Pressure for ASW21	0-60 psig	4-20 mA	Dwyer	628-09-6H-PI-EI-SI		
M03A	122	Pressure	PT-122	Pressure for ASW22	0-60 psig	4-20 mA	Dwyer	628-09-6H-PI-EI-SI		
M03A	123	Pressure	PT-123	Pressure for ASW23	0-60 psig	4-20 mA	Dwyer	628-09-6H-PI-EI-SI		
M03A	124	Pressure	PT-124	Pressure for ASW24	0-60 psig	4-20 mA	Dwyer	628-09-6H-PI-EI-SI		
M03A	125	Pressure	PT-125	Pressure for ASW25	0-60 psig	4-20 mA	Dwyer	628-09-6H-PI-EI-SI		
M03A	126	Pressure	PT-126	Pressure for ASW26	0-60 psig	4-20 mA	Dwyer	628-09-6H-PI-EI-SI		
M03A	127	Pressure	PT-127	Pressure for ASW27	0-60 psig	4-20 mA	Dwyer	628-09-6H-PI-EI-SI		
M03A	128	Pressure	PT-128	Pressure for ASW28	0-60 psig	4-20 mA	Dwyer	628-09-6H-PI-EI-SI		
M03A	129	Pressure	PT-129	Pressure for ASW29	0-60 psig	4-20 mA	Dwyer	628-09-6H-PI-EI-SI		
M03A	130	Pressure	PT-130	Pressure for ASW30	0-60 psig	4-20 mA	Dwyer	628-09-6H-PI-EI-SI		
M03A	131	Pressure	PT-131	Pressure for ASW31	0-60 psig	4-20 mA	Dwyer	628-09-6H-PI-EI-SI		
M03A	132	Pressure	PT-132	Pressure for ASW32	0-60 psig	4-20 mA	Dwyer	628-09-6H-PI-EI-SI		
M03A	133	Pressure	PT-133	Pressure for ASW33	0-60 psig	4-20 mA	Dwyer	628-09-6H-PI-EI-SI		
M03A	134	Pressure	PT-134	Pressure for ASW34	0-60 psig	4-20 mA	Dwyer	628-09-6H-PI-EI-SI		
M03A	135	Pressure	PT-135	Pressure for ASW35	0-60 psig	4-20 mA	Dwyer	628-09-6H-PI-EI-SI		
M03A	136	Pressure	PT-136	Pressure for ASW36	0-60 psig	4-20 mA	Dwyer	628-09-6H-PI-EI-SI		
M03A	137	Pressure	PT-137	Pressure for ASW37	0-60 psig	4-20 mA	Dwyer	628-09-6H-P1-E1-S1		

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Cortese Landfill
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Dwg No.	Loop Number	Type	Primary Instrument / Equipment	Function	Range	Output	Manufacturer	Model No.	Submittal	Review
M03A	201	Pressure	PI-201	IDDA1b Compressor discharge pressure indicator	0-200 psig	DR	Winters	Q806	PI: Winter Q806 0 - 200 psi PT: Dwyer 628-13 0 -300 psi	Accepted
	201	Pressure	PT-201	IDDA1b Compressor discharge pressure indicator	0-300 psig	4-20 mA	Dwyer	628-13-GH-P1-E1-S1	PI: Winter Q806 0 - 200 psi PT: Dwyer 628-13 0 -300 psi	Accepted
M04A	203	Pressure	PIT-203	Pressure indicator for IDDA1b Blower discharge (C-203)	0-50 inches H2O	--	Dwyer	605-50	Dwyer 605-50 0 - 50" H2O Max. Pressure 11 psi	Accepted
M04A	204	Pressure	PIT-204	Pressure indicator for IDDA1b Blower discharge (C-204)	0-50 inches H2O	--	Dwyer	605-50		
M04A	601	Pressure	PI-601	Pressure indicator for IDDA1b Transfer Pump (P-601) discharge	0-30 psig	DR	Winters	Q802	PI: Winter Q802 0 - 30 psi PT: Dwyer 628-08 0 -30 psi	Accepted
	601	Pressure	PT-601	Pressure transmitter for IDDA1b Transfer Pump (P-601) discharge	0-30 psig	4-20 mA	Dwyer	628-08-GH-P1-E1-S1		
M04A	602	Pressure	PI-602	Pressure indicator for IDDA1b Transfer Pump (P-602) discharge	0-30 psig	DR	Winters	Q802		
	602	Pressure	PT-602	Pressure transmitter for IDDA1b Transfer Pump (P-602) discharge	0-30 psig	4-20 mA	Dwyer	628-08-GH-P1-E1-S1		
M03A	201	Pressure Relief Valve	PSV-201	Pressure safety valve for discharge from IDDA1b filters	--	--	--	--	No submittal	Moved to Tank T-701
M04A	22	Pressure	PI-022	Pressure gauge for 1DDA1b Moisture separator discharge (T-703)	0-100 inches H2O	DR	Winters	P304V	Winters P304V 0 - 100" H2O vac.	Accepted
M04A	23	Pressure	PI-023	Pressure gauge for 1DDA1b Moisture separator discharge (T-703)	0-100 inches H2O	DR	Winters	P304V		
M04A	26	Pressure	PI-026	Pressure gauge for 1DDA1b Moisture separator discharge (T-704)	0-100 inches H2O	DR	Winters	P304V		
M04A	27	Pressure	PI-027	Pressure gauge for 1DDA1b Moisture separator discharge (T-704)	0-100 inches H2O	DR	Winters	P304V		
M04A	32	Pressure	PI-032	Pressure sensor for IDDA1b Vapor Phase Carbon Inlet	0-100 inches H2O	--	Winters	P304V	Winters P304 0 - 100" H2O	Accepted
M04A	33	Pressure	PI-033	Pressure sensor for IDDA1b 2nd vessel Vapor Phase Carbon Inlet	0-100 inches H2O	--	Winters	P304V		
M04A	21	Pressure Relief Valve	PSV-021	Pressure safety valve for discharge from 1DDA1b Moisture separator (T-703)	--	--	Kunkle	215V-H01ANEQE0006	Kunkle 215V	Specify Set Pressre (5 in Hg)
M04A	24	Pressure Relief Valve	PSV-024	Pressure safety valve for discharge from 1DDA1b Moisture separator (T-704)	--	--	Kunkle	215V-H01ANEQE0006		
M03A	201	Pressure/Flow	PDIT-201	Differential pressure flowmeter for discharge from IDDA1b Compressor	--	DR	Lambda Squared	CV-200	PDIT: Dwyer 631B FE: Lambda Squared CV-200	Need size of FE and PD range of PDIT

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Cortese Landfill
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Dwg No.	Loop Number	Type	Primary Instrument / Equipment	Function	Range	Output	Manufacturer	Model No.	Submittal	Review
M04A	203	Pressure	PDIT-203	Differential Pressure sensor for 1DDA1b Moisture separator discharge (T-703)	--	--	Dwyer	Magnesense	PDIT: Dwyer Magnesense FE: Dwyer DS-300 4" Pitot Tube	Need Gauge range of PDIT
M04A	204	Pressure	PDIT-204	Differential Pressure sensor for 1DDA1b Moisture separator discharge (T-704)	--	--	Dwyer	Magnesense		
TEMPERATURE										
M03A	001	Temp	TE-001	IDDA1b equipment room temperature sensor	0-200 F	--	Pyromation	RI-T185L	TE-001/002 Pyromation RI-T185L 0 - 200F	TT-001: SVE Room Temp Transmitter
M03A	001	Temp	TE-002	IDDA1b equipment room temperature sensor	0-200 F	--	Pyromation	401-85U-1800	TT-001/002 Pyromation 401-85U-1800 0 - 200F	TT-002: AS Room Temp Transmitter
M03A	501	Temp	TI-501	IDDA1b Compressor discharge temperature indicator	--	4-20 mA	Dwyer	TTE-104-W-LCD	Dwyer TTE-104-W-LCD	Accepted
M04A	203	Temp	TIT-203	Temperature indicator for IDDA1b Blower discharge (C-203)	--	4-20 mA	Dwyer	TTE-104-W-LCD	Dwyer TTE-104-W-LCD	Accepted
M04A	204	Temp	TIT-204	Temperature indicator for IDDA1b Blower discharge (C-204)	--	4-20 mA	Dwyer	TTE-104-W-LCD		
M04A	503	Temp	TIT-503	Temperature indicator for IDAA1b Heat Exchanger discharge	--	4-20 mA	Dwyer	TTE-104-W-LCD		
GAS SENSORS										
M04A	203	Chemical analysis	AIT-203	Gas (methane) sensor for 1DDA1b Moisture separator discharge (T-703)	--	4-20 mA	--	--	Ammonia Gas Sensor?	Incomplete Need Manufacturer and Model Number of LEL Monitor
M04A	204	Chemical analysis	AIT-204	Gas (methane) sensor for 1DDA1b Moisture separator discharge (T-704)	--	4-20 mA	--	--		
LEVEL										
M04A	703	Level	LI-703	Level indicator for 1DDA1b Moisture separator (T-703)	--	--	--	--	Not shown	
M04A	704	Level	LI-704	Level indicator for 1DDA1b Moisture separator (T-704)	--	--	--	--	Not shown	
M04A	705	Level	LT-705	Level transmitter for IDAA1b Holding Tank	--	4-20 mA	Gems	XT-800	GEMS XT-800 2" S.S. Float 4 -20 mA	Accepted
M04A	703	Level	LSL-703	Level switch low level 1DDA1b Moisture separator (T-703)	11 in	Direct Contact	Innovative Solutions	L500-09-08-03-00	Innovative Solutions L500-09-08-08-03-00 2" NPT Float Material: S.S. SPST	Accepted
M04A	703	Level	LSH-703	Level switch high level 1DDA1b Moisture separator (T-703)	21 in	Direct Contact	Innovative Solutions	L500-09-08-03-00		
M04A	703	Level	LSHH-703	Level switch high high level 1DDA1b Moisture separator (T-703)	26 in	Direct Contact	Innovative Solutions	L500-09-08-03-00		
M04A	704	Level	LSL-704	Level switch low level 1DDA1b Moisture separator (T-704)	18 in	Direct Contact	Innovative Solutions	L500-09-08-03-00		
M04A	704	Level	LSH-704	Level switch high level 1DDA1b Moisture separator (T-704)	28 in	Direct Contact	Innovative Solutions	L500-09-08-03-00		
M04A	704	Level	LSHH-704	Level switch high high level 1DDA1b Moisture separator (T-704)	33 in	Direct Contact	Innovative Solutions	L500-09-08-03-00		

TABLE 6
LIST OF VALVES

Cortese Landfill
Narrowsburg, New York

Dwg. No.	Valve No.	Range	Port Size	Type	Location	Manufacturer	Model No.
NEEDLE VALVES							
M03A	V-3101	--	1"	Needle	Needle valve for ASW01	Dwyer	RMC-122-BV
M03A	V-3102	--	1"	Needle	Needle valve for ASW02	Dwyer	RMC-122-BV
M03A	V-3103	--	1"	Needle	Needle valve for ASW03	Dwyer	RMC-122-BV
M03A	V-3104	--	1"	Needle	Needle valve for ASW04	Dwyer	RMC-122-BV
M03A	V-3105	--	1"	Needle	Needle valve for ASW05	Dwyer	RMC-122-BV
M03A	V-3106	--	1"	Needle	Needle valve for ASW06	Dwyer	RMC-122-BV
M03A	V-3107	--	1"	Needle	Needle valve for ASW07	Dwyer	RMC-122-BV
M03A	V-3108	--	1"	Needle	Needle valve for ASW08	Dwyer	RMC-122-BV
M03A	V-3109	--	1"	Needle	Needle valve for ASW09	Dwyer	RMC-122-BV
M03A	V-3110	--	1"	Needle	Needle valve for ASW10	Dwyer	RMC-122-BV
M03A	V-3111	--	1"	Needle	Needle valve for ASW11	Dwyer	RMC-122-BV
M03A	V-3112	--	1"	Needle	Needle valve for ASW12	Dwyer	RMC-122-BV
M03A	V-3113	--	1"	Needle	Needle valve for ASW13	Dwyer	RMC-122-BV
M03A	V-3114	--	1"	Needle	Needle valve for ASW14	Dwyer	RMC-122-BV
M03A	V-3115	--	1"	Needle	Needle valve for ASW15	Dwyer	RMC-122-BV
M03A	V-3116	--	1"	Needle	Needle valve for ASW16	Dwyer	RMC-122-BV
M03A	V-3117	--	1"	Needle	Needle valve for ASW17	Dwyer	RMC-122-BV
M03A	V-3118	--	1"	Needle	Needle valve for ASW18	Dwyer	RMC-122-BV
M03A	V-3119	--	1"	Needle	Needle valve for ASW19	Dwyer	RMC-122-BV
M03A	V-3120	--	1"	Needle	Needle valve for ASW20	Dwyer	RMC-122-BV
M03A	V-3121	--	1"	Needle	Needle valve for ASW21	Dwyer	RMC-122-BV
M03A	V-3122	--	1"	Needle	Needle valve for ASW22	Dwyer	RMC-122-BV
M03A	V-3123	--	1"	Needle	Needle valve for ASW23	Dwyer	RMC-122-BV
M03A	V-3124	--	1"	Needle	Needle valve for ASW24	Dwyer	RMC-122-BV
M03A	V-3125	--	1"	Needle	Needle valve for ASW25	Dwyer	RMC-122-BV
M03A	V-3126	--	1"	Needle	Needle valve for ASW26	Dwyer	RMC-122-BV
M03A	V-3127	--	1"	Needle	Needle valve for ASW27	Dwyer	RMC-122-BV
M03A	V-3128	--	1"	Needle	Needle valve for ASW28	Dwyer	RMC-122-BV
M03A	V-3129	--	1"	Needle	Needle valve for ASW29	Dwyer	RMC-122-BV
M03A	V-3130	--	1"	Needle	Needle valve for ASW30	Dwyer	RMC-122-BV
M03A	V-3131	--	1"	Needle	Needle valve for ASW31	Dwyer	RMC-122-BV
M03A	V-3132	--	1"	Needle	Needle valve for ASW32	Dwyer	RMC-122-BV
M03A	V-3133	--	1"	Needle	Needle valve for ASW33	Dwyer	RMC-122-BV
M03A	V-3134	--	1"	Needle	Needle valve for ASW34	Dwyer	RMC-122-BV

TABLE 6
LIST OF VALVES

Cortese Landfill
Narrowsburg, New York

Dwg. No.	Valve No.	Range	Port Size	Type	Location	Manufacturer	Model No.
M03A	V-3135	--	1"	Needle	Needle valve for ASW35	Dwyer	RMC-122-BV
M03A	V-3136	--	1"	Needle	Needle valve for ASW36	Dwyer	RMC-122-BV
M03A	V-3137	--	1"	Needle	Needle valve for ASW37	Dwyer	RMC-122-BV
AIR REGULATOR VALVES							
M03A	V-4101	0-30 psig	1/2"	Air Regulator	Air Regulator for ASW01	Ingersoll Rand	R37341-400
M03A	V-4102	0-30 psig	1/2"	Air Regulator	Air Regulator for ASW02	Ingersoll Rand	R37341-400
M03A	V-4103	0-30 psig	1/2"	Air Regulator	Air Regulator for ASW03	Ingersoll Rand	R37341-400
M03A	V-4104	0-30 psig	1/2"	Air Regulator	Air Regulator for ASW04	Ingersoll Rand	R37341-400
M03A	V-4105	0-30 psig	1/2"	Air Regulator	Air Regulator for ASW05	Ingersoll Rand	R37341-400
M03A	V-4106	0-30 psig	1/2"	Air Regulator	Air Regulator for ASW06	Ingersoll Rand	R37341-400
M03A	V-4107	0-30 psig	1/2"	Air Regulator	Air Regulator for ASW07	Ingersoll Rand	R37341-400
M03A	V-4108	0-30 psig	1/2"	Air Regulator	Air Regulator for ASW08	Ingersoll Rand	R37341-400
M03A	V-4109	0-30 psig	1/2"	Air Regulator	Air Regulator for ASW09	Ingersoll Rand	R37341-400
M03A	V-4110	0-30 psig	1/2"	Air Regulator	Air Regulator for ASW10	Ingersoll Rand	R37341-400
M03A	V-4111	0-30 psig	1/2"	Air Regulator	Air Regulator for ASW11	Ingersoll Rand	R37341-400
M03A	V-4112	0-30 psig	1/2"	Air Regulator	Air Regulator for ASW12	Ingersoll Rand	R37341-400
M03A	V-4113	0-30 psig	1/2"	Air Regulator	Air Regulator for ASW13	Ingersoll Rand	R37341-400
M03A	V-4114	0-30 psig	1/2"	Air Regulator	Air Regulator for ASW14	Ingersoll Rand	R37341-400
M03A	V-4115	0-30 psig	1/2"	Air Regulator	Air Regulator for ASW15	Ingersoll Rand	R37341-400
M03A	V-4116	0-30 psig	1/2"	Air Regulator	Air Regulator for ASW16	Ingersoll Rand	R37341-400
M03A	V-4117	0-30 psig	1/2"	Air Regulator	Air Regulator for ASW17	Ingersoll Rand	R37341-400
M03A	V-4118	0-30 psig	1/2"	Air Regulator	Air Regulator for ASW18	Ingersoll Rand	R37341-400
M03A	V-4119	0-30 psig	1/2"	Air Regulator	Air Regulator for ASW19	Ingersoll Rand	R37341-400
M03A	V-4120	0-30 psig	1/2"	Air Regulator	Air Regulator for ASW20	Ingersoll Rand	R37341-400
M03A	V-4121	0-30 psig	1/2"	Air Regulator	Air Regulator for ASW21	Ingersoll Rand	R37341-400
M03A	V-4122	0-30 psig	1/2"	Air Regulator	Air Regulator for ASW22	Ingersoll Rand	R37341-400
M03A	V-4123	0-30 psig	1/2"	Air Regulator	Air Regulator for ASW23	Ingersoll Rand	R37341-400
M03A	V-4124	0-30 psig	1/2"	Air Regulator	Air Regulator for ASW24	Ingersoll Rand	R37341-400
M03A	V-4125	0-30 psig	1/2"	Air Regulator	Air Regulator for ASW25	Ingersoll Rand	R37341-400
M03A	V-4126	0-30 psig	1/2"	Air Regulator	Air Regulator for ASW26	Ingersoll Rand	R37341-400
M03A	V-4127	0-30 psig	1/2"	Air Regulator	Air Regulator for ASW27	Ingersoll Rand	R37341-400
M03A	V-4128	0-30 psig	1/2"	Air Regulator	Air Regulator for ASW28	Ingersoll Rand	R37341-400
M03A	V-4129	0-30 psig	1/2"	Air Regulator	Air Regulator for ASW29	Ingersoll Rand	R37341-400
M03A	V-4130	0-30 psig	1/2"	Air Regulator	Air Regulator for ASW30	Ingersoll Rand	R37341-400
M03A	V-4131	0-30 psig	1/2"	Air Regulator	Air Regulator for ASW31	Ingersoll Rand	R37341-400

TABLE 6
LIST OF VALVES

Cortese Landfill
Narrowsburg, New York

Dwg. No.	Valve No.	Range	Port Size	Type	Location	Manufacturer	Model No.
M03A	V-4132	0-30 psig	1/2"	Air Regulator	Air Regulator for ASW32	Ingersoll Rand	R37341-400
M03A	V-4133	0-30 psig	1/2"	Air Regulator	Air Regulator for ASW33	Ingersoll Rand	R37341-400
M03A	V-4134	0-30 psig	1/2"	Air Regulator	Air Regulator for ASW34	Ingersoll Rand	R37341-400
M03A	V-4135	0-30 psig	1/2"	Air Regulator	Air Regulator for ASW35	Ingersoll Rand	R37341-400
M03A	V-4136	0-30 psig	1/2"	Air Regulator	Air Regulator for ASW36	Ingersoll Rand	R37341-400
M03A	V-4137	0-30 psig	1/2"	Air Regulator	Air Regulator for ASW37	Ingersoll Rand	R37341-400
CONTROL VALVES							
M03A	V-801	--	1"	Control	Solenoid control valve for ASW01	SMC Pneumatics	VXP22
M03A	V-802	--	1"	Control	Solenoid control valve for ASW02	SMC Pneumatics	VXP22
M03A	V-803	--	1"	Control	Solenoid control valve for ASW03	SMC Pneumatics	VXP22
M03A	V-804	--	1"	Control	Solenoid control valve for ASW04	SMC Pneumatics	VXP22
M03A	V-805	--	1"	Control	Solenoid control valve for ASW05	SMC Pneumatics	VXP22
M03A	V-806	--	1"	Control	Solenoid control valve for ASW06	SMC Pneumatics	VXP22
M03A	V-807	--	1"	Control	Solenoid control valve for ASW07	SMC Pneumatics	VXP22
M03A	V-808	--	1"	Control	Solenoid control valve for ASW08	SMC Pneumatics	VXP22
M03A	V-809	--	1"	Control	Solenoid control valve for ASW09	SMC Pneumatics	VXP22
M03A	V-810	--	1"	Control	Solenoid control valve for ASW10	SMC Pneumatics	VXP22
M03A	V-811	--	1"	Control	Solenoid control valve for ASW11	SMC Pneumatics	VXP22
M03A	V-812	--	1"	Control	Solenoid control valve for ASW12	SMC Pneumatics	VXP22
M03A	V-813	--	1"	Control	Solenoid control valve for ASW13	SMC Pneumatics	VXP22
M03A	V-814	--	1"	Control	Solenoid control valve for ASW14	SMC Pneumatics	VXP22
M03A	V-815	--	1"	Control	Solenoid control valve for ASW15	SMC Pneumatics	VXP22
M03A	V-816	--	1"	Control	Solenoid control valve for ASW16	SMC Pneumatics	VXP22
M03A	V-817	--	1"	Control	Solenoid control valve for ASW17	SMC Pneumatics	VXP22
M03A	V-818	--	1"	Control	Solenoid control valve for ASW18	SMC Pneumatics	VXP22
M03A	V-819	--	1"	Control	Solenoid control valve for ASW19	SMC Pneumatics	VXP22
M03A	V-820	--	1"	Control	Solenoid control valve for ASW20	SMC Pneumatics	VXP22
M03A	V-821	--	1"	Control	Solenoid control valve for ASW21	SMC Pneumatics	VXP22
M03A	V-822	--	1"	Control	Solenoid control valve for ASW22	SMC Pneumatics	VXP22
M03A	V-823	--	1"	Control	Solenoid control valve for ASW23	SMC Pneumatics	VXP22
M03A	V-824	--	1"	Control	Solenoid control valve for ASW24	SMC Pneumatics	VXP22
M03A	V-825	--	1"	Control	Solenoid control valve for ASW25	SMC Pneumatics	VXP22
M03A	V-826	--	1"	Control	Solenoid control valve for ASW26	SMC Pneumatics	VXP22
M03A	V-827	--	1"	Control	Solenoid control valve for ASW27	SMC Pneumatics	VXP22
M03A	V-828	--	1"	Control	Solenoid control valve for ASW28	SMC Pneumatics	VXP22

TABLE 6
LIST OF VALVES

Cortese Landfill
Narrowsburg, New York

Dwg. No.	Valve No.	Range	Port Size	Type	Location	Manufacturer	Model No.
M03A	V-829	--	1"	Control	Solenoid control valve for ASW29	SMC Pneumatics	VXP22
M03A	V-830	--	1"	Control	Solenoid control valve for ASW30	SMC Pneumatics	VXP22
M03A	V-831	--	1"	Control	Solenoid control valve for ASW31	SMC Pneumatics	VXP22
M03A	V-832	--	1"	Control	Solenoid control valve for ASW32	SMC Pneumatics	VXP22
M03A	V-833	--	1"	Control	Solenoid control valve for ASW33	SMC Pneumatics	VXP22
M03A	V-834	--	1"	Control	Solenoid control valve for ASW34	SMC Pneumatics	VXP22
M03A	V-835	--	1"	Control	Solenoid control valve for ASW35	SMC Pneumatics	VXP22
M03A	V-836	--	1"	Control	Solenoid control valve for ASW36	SMC Pneumatics	VXP22
M03A	V-837	--	1"	Control	Solenoid control valve for ASW37	SMC Pneumatics	VXP22
BALL VALVES							
M03A	V-901	--	1"	Ball	Shut-off valve for ASW01	Legend	T-1002
M03A	V-902	--	1"	Ball	Shut-off valve for ASW02	Legend	T-1002
M03A	V-903	--	1"	Ball	Shut-off valve for ASW03	Legend	T-1002
M03A	V-904	--	1"	Ball	Shut-off valve for ASW04	Legend	T-1002
M03A	V-905	--	1"	Ball	Shut-off valve for ASW05	Legend	T-1002
M03A	V-906	--	1"	Ball	Shut-off valve for ASW06	Legend	T-1002
M03A	V-907	--	1"	Ball	Shut-off valve for ASW07	Legend	T-1002
M03A	V-908	--	1"	Ball	Shut-off valve for ASW08	Legend	T-1002
M03A	V-909	--	1"	Ball	Shut-off valve for ASW09	Legend	T-1002
M03A	V-910	--	1"	Ball	Shut-off valve for ASW10	Legend	T-1002
M03A	V-911	--	1"	Ball	Shut-off valve for ASW11	Legend	T-1002
M03A	V-912	--	1"	Ball	Shut-off valve for ASW12	Legend	T-1002
M03A	V-913	--	1"	Ball	Shut-off valve for ASW13	Legend	T-1002
M03A	V-914	--	1"	Ball	Shut-off valve for ASW14	Legend	T-1002
M03A	V-915	--	1"	Ball	Shut-off valve for ASW15	Legend	T-1002
M03A	V-916	--	1"	Ball	Shut-off valve for ASW16	Legend	T-1002
M03A	V-917	--	1"	Ball	Shut-off valve for ASW17	Legend	T-1002
M03A	V-918	--	1"	Ball	Shut-off valve for ASW18	Legend	T-1002
M03A	V-919	--	1"	Ball	Shut-off valve for ASW19	Legend	T-1002
M03A	V-920	--	1"	Ball	Shut-off valve for ASW20	Legend	T-1002
M03A	V-921	--	1"	Ball	Shut-off valve for ASW21	Legend	T-1002
M03A	V-922	--	1"	Ball	Shut-off valve for ASW22	Legend	T-1002
M03A	V-923	--	1"	Ball	Shut-off valve for ASW23	Legend	T-1002
M03A	V-924	--	1"	Ball	Shut-off valve for ASW24	Legend	T-1002
M03A	V-925	--	1"	Ball	Shut-off valve for ASW25	Legend	T-1002

TABLE 6
LIST OF VALVES

Cortese Landfill
Narrowsburg, New York

Dwg. No.	Valve No.	Range	Port Size	Type	Location	Manufacturer	Model No.
M03A	V-926	--	1"	Ball	Shut-off valve for ASW26	Legend	T-1002
M03A	V-927	--	1"	Ball	Shut-off valve for ASW27	Legend	T-1002
M03A	V-928	--	1"	Ball	Shut-off valve for ASW28	Legend	T-1002
M03A	V-929	--	1"	Ball	Shut-off valve for ASW29	Legend	T-1002
M03A	V-930	--	1"	Ball	Shut-off valve for ASW30	Legend	T-1002
M03A	V-931	--	1"	Ball	Shut-off valve for ASW31	Legend	T-1002
M03A	V-932	--	1"	Ball	Shut-off valve for ASW32	Legend	T-1002
M03A	V-933	--	1"	Ball	Shut-off valve for ASW33	Legend	T-1002
M03A	V-934	--	1"	Ball	Shut-off valve for ASW34	Legend	T-1002
M03A	V-935	--	1"	Ball	Shut-off valve for ASW35	Legend	T-1002
M03A	V-936	--	1"	Ball	Shut-off valve for ASW36	Legend	T-1002
M03A	V-937	--	1"	Ball	Shut-off valve for ASW37	Legend	T-1002
M04A	V-01	--	1.5"	Ball	Moisture Separator T-703 discharge to Pump P-601	Legend	T-1002
M04A	V-04	--	1.5"	Ball	Moisture Separator T-704 discharge to Pump P-602	Legend	T-1002
M04A	V-03	--	--	Ball	Pump P-601 discharge	Legend	T-400
M04A	V-06	--	--	Ball	Pump P-602 discharge	Legend	T-400
PRESSURE SAFETY VALVES							
M04A	PSV 021	2-29" HG	2"	Pressure Safety	Moisture Separator T-703	Kunkle	215V
M04A	PSV 024	2-29" HG	2"	Pressure Safety	Moisture Separator T-704	Kunkle	215V
SAMPLE PORT VALVES							
M04A	SP-021	--	0.25"	Sample Port	Moisture Separator T-703	Legend	T-1002
M04A	SP-022	--	0.25"	Sample Port	SVE Blower SVE C-203 Discharge	Legend	T-400
M04A	SP-024	--	0.25"	Sample Port	Moisture Separator T-704	Legend	T-1002
M04A	SP-025	--	0.25"	Sample Port	SVE Blower SVE C-204 Discharge	Legend	T-400
M04A	SP-501	--	0.25"	Sample Port	Pump discharge - IDDA1b-backfill	Legend	T-1002
M04A	SP-502	--	0.25"	Sample Port	Pump discharge - IDDA1b-sand/waste	Legend	T-400
M04A	SP-503	--	0.25"	Sample Port	Heat exchanger discharge - IDDA1b	Legend	T-1002
M04A	SP-504	--	0.25"	Sample Port	VP Carbon Vessel A discharge - IDDA1b	Legend	T-400
M04A	SP-505	--	0.25"	Sample Port	Discharge to atmosphere - IDDA1b	Legend	T-1002
BUTTERFLY VALVE							
M04A	V-09	--	4"	Butterfly	SVE blower discharge - IDDA1b-sand/waste	DelVal	Series 50
M04A	V-10	--	4"	Butterfly	SVE blower discharge - IDDA1b-backfill	DelVal	Series 50

TABLE 6
LIST OF VALVES

Cortese Landfill
Narrowsburg, New York

Dwg. No.	Valve No.	Range	Port Size	Type	Location	Manufacturer	Model No.
M04A	V-11	--	4"	Butterfly	SVE blower discharge - IDDA1b	DelVal	Series 50
M04A	V-12	--	4"	Butterfly	Heat exchanger bypass - IDDA1b	DelVal	Series 50
M04A	V-13	--	4"	Butterfly	Heat exchanger discharge - IDDA1b	DelVal	Series 50
CHECK VALVES							
M04A	V-02	--	1"	Check	Pump P-601 discharge	Legend	T-453
M04A	V-05	--	1"	Check	Pump P-602 discharge	Legend	T-453
M04A	V-17	--	4"	Check	SVE Blower C-203 discharge	Legend	T-453
M04A	V-18	--	4"	Check	SVE Blower C-204 discharge	Legend	T-453
MISCELLANEOUS VALVES							
M04A	V-07	--	1"	Drain	Moisture Separator T-703 drain	Legend	T-1002
M04A	V-08	--	1"	Drain	Moisture Separator T-704 drain	Legend	T-1002
M04A	V-14	--	--	Drain	Holding Tank drain - IDDA1b	Legend	T-1002
M04A	V-15	--	--	Gate	Holding Tank vent - IDDA1b	Legend	T-1002
M04A	V-1001	--	--	Gate	Dilution air from atmosphere - IDDA1b-backfill	Legend	T-400
M04A	V-2001	--	--	Ball	Dilution air from atmosphere - IDDA1b-sand/waste	Legend	T-400
M04A	V-3000	--	4"	Gate	SVE11-14 discharge - IDDA1b-backfill	Legend	T-400
M04A	V-3001	--	8"	Ball	SVE02-10 discharge - IDDA1b-sand/waste	Legend	T-400

TABLE 7
LIST OF ALARMS

Cortese Landfill
Narrowsburg, New York

Alarm	Tag No.	Description	Set Point	Response	Notification
1	LAHH-703C	Tank T-703 High High Level	Contact Switch	Shutdown C-203	✓
2	PAH-601	Transfer Pump TP-601 High Pressure	30 PSIG	Shutdown TP-601	✓
3	VAL-203	Blower C-203 Low Vacuum	10 in WC	Shutdown C-203	✓
4	PAH-203	Blower C-203 High Pressure	2 PSIG	Shutdown C-203	✓
5	TAL-203	Blower C-203 High Temperature	230*F	Shutdown C-203	✓
6	LAHH-704C	Tank T-704 High High Level	Contact Switch	Shutdown C-204	✓
7	PAH-602	Transfer Pump TP-602 High Pressure	25 PSIG	Shutdown TP-602	✓
8	VAL-204	Blower C-204 Low Vacuum	10 in WC	Shutdown C-204	✓
9	PAH-204	Blower C-204 High Pressure	2 PSIG	Shutdown C-204	✓
10	TAL-204	Blower C-204 High Temperature	230*F	Shutdown C-204	✓
11	TAHH-503	Heat Exchanger H-503 High High Temperature	104 F	Shutdown C-204	✓
12	LAHH-705	Holding Tank T-705 High High Level	90%	Shutdown TP-601 and TP-602	✓
13	TAH-501	Compressor C-201 High Temperature	120 F	Close all AS solenoid valves	✓
14	PAL-201	Compressor C-201 Low Pressure	80 PSIG	Close all AS solenoid valves	✓
15	PAH-201	Compressor C-201 High Pressure	130 PSIG	Close all AS solenoid valves	✓
16	FAL-20	Compressor C-201 Low Flow	1 scfm	Close all AS solenoid valves	✓
17	TAL-001	AS Room Temperature Low	40 F	Notification only	✓
18	TAH-001	AS Room Temperature High	140 F	Notification only	✓
19	TAL-002	SVE Room Temperature Low	40 F	Notification only	✓
20	TAH-002	SVE Room Temperature High	140 F	Notification only	✓
21		E-stop	Contact Switch	All systems shutdown	✓
	YC-203	Blower C-203 Status	Off	Close all AS solenoid valves	✓
	YC-204	Blower C-204 Status	Off	Close all AS solenoid valves	✓
	LSH-703	Tank T-703 High Level	Contact Switch	Start TP-601	
	LSL-703	Tank T-703 Low Level	Contact Switch	Stop TP-601	
	LSH-704	Tank T-704 High Level	Contact Switch	Start TP-602	
	LSL-704	Tank T-704 Low Level	Contact Switch	Stop TP-602	
	TSH-203	SVE Blower C-203 High Temperature	100 F	Start H-503	
	TSH-204	SVE Blower C-204 High Temperature	100 F	Start H-503	
	TSH-503	Heat Exchanger H-503 High Temperature	100 F	Start H-503	
	TSL-203	SVE Blower C-203 High Temperature	90 F	Stop H-503	
	TSL-204	SVE Blower C-204 High Temperature	90 F	Stop H-503	
	TSL-503	Heat Exchanger H-503 High Temperature	90 F	Stop H-503	

Notes:

PSIG - pounds per square inch gauge
in WC - inches water colum
F - degrees Fahrenheit
AS - air sparging
SVE - soil vapor extraction

TABLE 8
MAXIMUM PRE-REMEDIAL VOC AND SVOC CONCENTRATIONS DETECTED AT OU3 AND OU4 PERFORMANCE MONITORING WELLS

Cortese Landfill Site
Narrowsburg, New York

Monitoring Well ID		Total VOCs [1]			Total SVOCs [1]		
		Date	Maximum Concentration Detected [2] (µg/L)	2X Maximum Concentration (µg/L)	Date	Maximum Concentration Detected [2] (µg/L)	2X Maximum Concentration (µg/L)
Source Area Transect	MW-10	Apr-93	2,049	4,098	Apr-08	561	1,122
	MW-11	May-10	171	342	Oct-07	5	10
	EX-1	Apr-08	24,277	48,554	Apr-08	1,467	2,934
	MW-1A	Apr-93	20	40	Apr-93	0	0
	MW-1B	Jul-97	28,481	56,962	Jul-89	1,985	3,970
	MW-1C	Nov-87	3,262	6,524	Oct-96	106	212
	MW-20A	Nov-12	80	160	Nov-12	47	94
	MW-20B	Apr-14	980	1,960	Apr-12	45	90
	MW-8A	Dec-87	61	121	Jul-89	9	17
	MW-8B	Dec-87	54	109	Apr-93	0	0
Downgradient Transect	MW-5	Dec-87	47	95	Jul-89	10	20
	MW-19 [3]	Apr-13	220	440	Apr-13	50	100
	MW-18A	Oct-11	2	3	Dec-11	26	52
	MW-18B	Apr-13	5,500	11,000	Apr-13	280	560
	MW-18C	Apr-12	190	380	Apr-12	87	174
	MW-6A	Jul-05	797	1,594	Apr-13	85	53
	MW-6B	Apr-97	805	1,610	Apr-13	43	86
	MW-21 [3]	Apr-13	230	460	Oct-13	84	168
	MW-7A	Dec-87	107	214	Jul-89	27	55
	MW-7B	Nov-03	166	332	Apr-13	29	58
	MW-7M	Nov-12	64	128	Dec-11	28	56
	MW-22 [3]	Oct-13	54	108	Oct-13	24	48
	MW-2B	Oct-97	598	1,196	Jan-87	5	10
	MW-2A	Nov-87	54	108	Apr-93	2	4

Notes:

1. Total VOCs and SVOCs are a sum of only the detected compounds.
2. The maximum concentration is the highest sum total VOC or SVOC concentration ever detected in the well during a single monitoring event through calendar year 2013.
3. Wells MW-19, MW-21, and MW-22 were recently installed in January 2013. Only a limited data set exists for those wells.

VOC - Volatile Organic Compound
SVOC - Semi-Volatile Organic Compound
2X - Twice
µg/L - micrograms per liter

TABLE 9
SVE OFF-GAS GUIDELINE CONCENTRATIONS

Cortese Landfill
Narrowsburg, New York

Parameter[1]	*Guideline Concentrations[2] (µg/m³)*	*Guideline Concentrations[2] (µg/m³)*	*AS/SVE Pilot Test Measurements (µg/m3)*		
			AS-SP1	AS-SP2	AS-SP3
			Influent	Midpoint	Effluent
1,1,1-Trichloroethane	*5000*	*916*	**440000**	**220000**	4.3 U
1,1,2,2-Tetrachloroethane	*16*	*2.3*	19000 U	9500 U	5.5 U
1,1,2-Trichloroethane	*1.4*	*0.26*	15000 U	7500 U	4.3 U
1,1-Dichloroethane	*0.63*	*0.16*	**77000**	**38000**	3.2 U
1,1-Dichloroethene	*70*	*17.6*	11000 U	5500 U	3.1 U
1,2,4-Trichlorobenzene[3]	*3700*	*498.7*	52000 U	26000 U	15 U
1,2-Dichloroethane	*0.04*	*0.01*	11000 U	5600 U	3.2 U
1,2-Dichloropropane	*4*	*0.87*	13000 U	6400 U	3.7 U
1,4-Dichlorobenzene	*0.09*	*0.015*	17000 U	8300 U	4.8 U
1,4-Dioxane	*0.13*	*0.036*	250000 U	120000 U	72 U
Benzene	*0.13*	*0.041*	**15000**	**7500**	2.5 U
Bromoform	*0.91*	*0.09*	29000 U	14000 U	8.2 U
Bromomethane	*5*	*1.3*	11000 U	5400 U	3.1 U
Carbon Disulfide	*700*	*225*	22000 U	11000 U	6.2 U
Carbon Tetrachloride	*0.17*	*0.027*	18000 U	8700 U	5 U
Chlorobenzene	*110*	*24*	13000 U	6300 U	3.6 U
Chloroethane	*10000*	*3788*	**26000**	**13000**	5.2 U
Chloroform	*0.04*	*0.009*	14000 U	6700 U	3.9 U
Chloromethane	*90*	*43*	14000 U	7100 U	**7.8**
Ethylbenzene	*1000*	*230*	**21000**	**9600**	3.4 U
Hexachlorobutadiene	*0.05*	*0.004*	30000 U	15000 U	8.5 U
Methylene Chloride	*2.10*	*0.61*	**46000**	**22000**	6.9 U
Naphthalene	*3*	*0.35*	37000 U	18000 U	10 U
Styrene	*1000*	*235*	12000 U	5900 U	3.4 U
Tetrachloroethene	*1*	*0.15*	**67000**	**33000**	5.4 U
Toluene	*5000*	*1326*	**750000**	**370000**	**3.3**
Trichloroethene	*0.5*	*0.093*	**1400000**	**690000**	**11**
Vinyl chloride	*0.11*	*0.043*	**100000**	**52000**	**300**
Xylene (total)	*100*	*23*	**75000**	**33000**	3.4 U

Notes:

1. Parameters are VOC analytes that have been detected in groundwater and/or during the AS/SVE pilot test.
2. Guideline concetrations are the AGCs published by NYSDEC. If no AGC has been published the SGC is used.
3. No AGC has been published for this compound. The guideline concentration is the SGC.

SGC - Short-Term Guideline Concentrations (NYSDEC, 1997)

AGC- Annual Guideline Concentrations (NYSDEC, 1997)

VOC - volatile organic compound

µg/m³ - micrograms per cubic meter

ppbv - parts per billion vapor

Bolding indicates detection of parameter.

Light gray shading indicates exceedance of guideline concentrations.

TABLE 10
EQUIPMENT MAINTENANCE SCHEDULE

Cortese Landfill
Narrowsburg, New York

Site Name:	Cortese Landfill	**Project No.:** MR0562	
Address:	Narrowsburg, New York		
Date:	**Weather:**	**Technician:**	

Component	Model	Monthly Maintenance[1]	Annual Maintenance[1]
SVE Blowers (C-203 and C-204)	Rotron Model EN808BA72MXL	None	Replace Bearing Bi-Annually
Vacuum Relief Valve (PSV-021)	Knuckle 215V-H01ANEQE0006	Test	None
Inlet Vacuum Filter (F-403)	Solberg CT-235P-400C	Clean	Clean/Replace
Dilution Filter Silencer (F-405)	Solberg FS-231P-300	Clean and inspect filter	None
Moisture Separators (T-703, T-704, T-705)	240/60 gallons	Drain as needed	None
		Inspect sight tube/clean as needed	
Float switches (LSL, LSH, LSHH: 703 and 704)	L500	Make sure switches are unobstructed	Test floats
Transfer Pumps (TP-601 and TP-602)	Goulds NPE Centrifugal Pump	Grease pump bearings	None
Sparge Compressor (C-201)	Kaeser CSD 75 T	Check Cooling Level	Change Oil separator cartridge
		Clean/Replace Filter	Test Pressure relief valve
		Clean Cooler	Check Overheat shutdown
		Grease Motor Bearings	Change filter mat 2X year
		Check for leaks	Change Oil Filter/Oil[2]
		Inspect filter	check fan motor every 3 years
Compressor Filters (F-401 and F-402)	Kaeser KVF-485.2 and KOR 485.2	Check for leaks	None
Compressor Filters Drains	ECO-Drain 30	Check bucket level/ check for blockage	None
Butterfly Valves (V-3001, V-09,V-10, V-11, V-12, and V-13)	DelVal 52-040-111-E-1-L-0	Check for smooth movement	Check seal
			Inspect valves for wear on disc, seats, seals, and body; replace if needed
Check Valves (V-02, V-05, V-16, and V-17)	07-1-0-V	None	None
Pressure/Vacuum Switches	1952-20-2F	Clean switch/check vent for obstructions	Check Calibration/Test
	605-50		
	628-08-GH-P1-E1-S1		
Heat Exchanger (H-503)	Xchanger AA-1000	Clean service air vent	None
Control Panel Vent Fan	C-More EA7	Clean Fan Filter	None
		Check for leaks	None

Notes:

1 - Maintenece procedures are detailed in manufacturer O&M Manual

2- Oil and oil filter replacement frequency is dependent on oil used in the compressor.

TABLE 11
OVERVIEW OF SOURCE AREA GROUNDWATER MONITORING PROGRAM STAGES

Cortese Landfill Site
Narrowsburg, New York

Stage	Description[(1)]	Reference Table for MNA Monitoring Program
A – Pre-Treatment Baseline	Intended to cover the period prior to implementation of the OU4 source area active treatment	Monitoring previously completed in accordance with OU2 O&M Manual and subsequent addenda
B – Following OU4 Source Area Treatment Changes[(2)]	Intended to cover the period of time immediately after changes in operation of the OU4 source area active treatment that might disrupt quasi-steady state conditions including: • start of the source area treatment (years 1-2) • start of amendment addition during source area treatment (years 5-6) • start of post treatment stabilization (years 8-9) and • post-stabilization ISCO treatment, if necessary (years 13-14)	Table 12
C – Between OU4 Source Area Treatment Changes [(3)]	Intended to cover the period of time when conditions are fairly stable well after changes to the OU4 source area treatment (years 3-4, 7, and 10-12, 15, and 13-14 if post-stabilization ISCO is not necessary)	Table 13
D – After OU4 Source Area Active Treatment and Stabilization	Intended to cover the period of time following OU4 source area stabilization (years 13+) until the start of verification monitoring to be completed for downgradient groundwater to verify attainment of RAOs.	Table 14

Notes:

1. Years given correspond to anticipated timeframe of operation of various components of the source area treatment and reflect year after start of source area treatment. Full detail of the source area treatment was provided in the *Final Remedial Design Report, Operable Unit 4, Source Areas* (Geosyntec, 2012).
2. “Changes” indicates timeframes when rapid changes are expected to occur due to changes in treatment operations in the OU4 source area that might result in rapid concentration changes of target constituents and/or biogeochemical parameters.
3. “Between Changes” indicates timeframes after “transition” when changes due to source treatment operations are much lower and trending toward a new steady state condition. Hence monitoring frequency/locations can be temporarily reduced.

TABLE 12
SOURCE AREA GMP
STAGE B - DURING SOURCE AREA TRANSITIONS [1]

Cortese Landfill Site
Narrowsburg, New York

Location ID	Well Construction		Lithologic Unit	Sampling Event	TCL VOCs	TCL SVOCs[2]	TPH [3]	Metals	Electron Donors/Acceptors [4]
	Top of Screen (ft bgs)	Bottom of Screen (ft bgs)							
MW-1A [5]	63.7	73.7	Lower Sand and Gravel	Spring	X	X	X	X	X
				Summer					
				Fall					
MW-1B	28.1	43.1	Upper Sand and Gravel	Spring	X	X	X	X	X
				Summer	X			X	X
				Fall	X		X	X	X
MW-1C	10.5	25.5	Upper Sand and Gravel	Spring	X	X	X	X	X
				Summer	X			X	X
				Fall	X		X	X	X
EX-1 [7]	28	33	Upper Sand and Gravel	Spring	X	X	X	X	X
				Summer	X			X	X
				Fall	X		X	X	X
MW-10 [6]	13.8	29.3	Upper Sand and Gravel	Spring	X	X	X	X	X
				Summer	X			X	X
				Fall	X		X	X	X
MW-11 [4]	60.5	70.5	Intermediate Silty Sand	Spring	X	X	X	X	X
				Summer					
				Fall					

Notes:

1. Stage B is intended to cover the period of time following start of the source area treatment and following subsequent changes in operation of the source area treatment that might disrupt quasi-steady state conditions.
2. SVOCs will be monitored at a lower frequency because they are less mobile and concentration changes are expected to be slower than other parameters.
3. Total Petroleum Hydrocarbons (TPH) include TPH-Gasoline Range Organics and TPH-Diesel Range Organics.
4. Electron donors/acceptors include alkalinity, sulfate, ammonia, nitrate+nitrite, and total organic carbon. All sampling events will also include collection of field parameters (i.e., pH, dissolved oxygen, oxidation-reduction potential).
5. MW-1A and MW-11 are screened below the treatment areas, have historically had low COC concentrations, and may be less affected by the source area treatment.
6. MW-10 is slightly sidegradient to the former IDDA 1b source area, has historically had low COC cocentrations, and may be less affected by the source area treatment.
7. EX-1 will be monitored for VOCs on a monthly basis for the first six months following intial startup of air sparging operations.

GMP - Groundwater Monitoring Program
TCL - target compound list
VOCs - volatile organic compounds
SVOCs - semi-volatile organic compounds
TPH- Total Petroleum Hydrocarbons
TBD - to be determined
TSS - total suspended solids

TABLE 13
SOURCE AREA GMP
STAGE C- BETWEEN SOURCE AREA TRANSITIONS [1]

Cortese Landfill Site
Narrowsburg, New York

Location ID	Well Construction		Lithologic Unit	Sampling Event	TCL VOCs	TCL SVOCs[2]	TPH [3]	Metals	Electron Donors/Acceptors [4]
	Top of Screen (ft bgs)	Bottom of Screen (ft bgs)							
MW-1A [5, 7]	63.7	73.7	Lower Sand and Gravel	Spring	X	X	X	X	X
				Summer					
				Fall					
MW-1B	28.1	43.1	Upper Sand and Gravel	Spring	X	X	X	X	X
				Summer					
				Fall	X		X	X	X
MW-1C	10.5	25.5	Upper Sand and Gravel	Spring	X	X	X	X	X
				Summer					
				Fall	X		X	X	X
EX-1	28	33	Upper Sand and Gravel	Spring	X	X	X	X	X
				Summer					
				Fall	X		X	X	X
MW-10 [6]	13.8	29.3	Upper Sand and Gravel	Spring	X	X	X	X	X
				Summer					
				Fall	X		X	X	X
MW-11 [5, 7]	60.5	70.5	Intermediate Silty Sand	Spring	X	X	X	X	X
				Summer					
				Fall					

Notes:
1. Stage C is intended to cover the period of time when conditions are fairly stable (i.e. well after changes to the source treatment).
2. SVOCs will be monitored at a lower frequency because they are less mobile and concentration changes are expected to be slower than other parameters.
3. Total Petroleum Hydrocarbons (TPH) include TPH-Gasoline Range Organics and TPH-Diesel Range Organics.
4. Electron donors/acceptors include alkalinity, sulfate, ammonia, nitrate+nitrite, and total organic carbon. All sampling events will also include collection of field parameters (i.e., pH, dissolved oxygen, oxidation-reduction potential).
5. MW-1A and MW-11 are screened below the treatment areas, have historically had low COC concentrations, and may be less affected by the source area treatment.
6. MW-10 is more sidegradient to the former IDDA 1b source area, has historically had low COC cocentrations, and may be less affected by the source area treatment.
7. MW-1A and MW-11 are deep wells that have low VOC concentrations and therefore will not be monitored during Stage C unless increased concentrations are detected during Stage B.

GMP - Groundwater Monitoring Program
TCL - target compound list
VOCs - volatile organic compounds
SVOCs - semi-volatile organic compounds
TBD - to be determined
TSS - total suspended solids

TABLE 14
SOURCE AREA GMP
STAGE D - AFTER SOURCE AREA STABILIZATION[1]

Cortese Landfill Site
Narrowsburg, New York

Location ID	Well Construction		Lithologic Unit	Sampling Event	TCL VOCs	TCL SVOCs	Metals	Electron Donors/Acceptors [2]	Biological Marker [3]	Methane, Ethane, Ethene [4]
	Top of Screen (ft bgs)	Bottom of Screen (ft bgs)								
MW-1B	28.1	43.1	Upper Sand and Gravel	Spring	X	X	X	X		
				Summer						
				Fall						
EX-1	88.2	98.2	Upper Sand and Gravel	Spring	X	X	X	X		
				Summer						
				Fall						

Notes:
1. Stage D is intended to cover the period of time following source area active treatment and stabilization that is expected to have steady declining concentrations.
2. Electron donors/acceptors include alkalinity, sulfate, ammonia, nitrate+nitrite, and total organic carbon. All sampling events will also include collection of field parameters (i.e., pH, dissolved oxygen, oxidation-reduction potential).
3. Bilogical marker used, if needed, depends upon the biodegradation pathway that is necessary for the compounds that remain (aerobic, anaerobic, etc.) The biomarker test to be used (if needed) will be selected at that time based on the groundwater monitoring data.
4. Methane, ethene, and ethane will only be analyzed if chlorinated ethene/ethanes persist to this stage in the remedy and reductive dechlorination processes are being relied upon.

GMP - Groundwater Monitoring Program
TCL - target compound list
VOCs - volatile organic compounds
SVOCs - semi-volatile organic compounds
TBD - to be determined
TSS - total suspended solids

TABLE 15
MONITORING WELLS REQUIRING WATER LEVEL AND DEPTH TO NAPL MEASUREMENTS

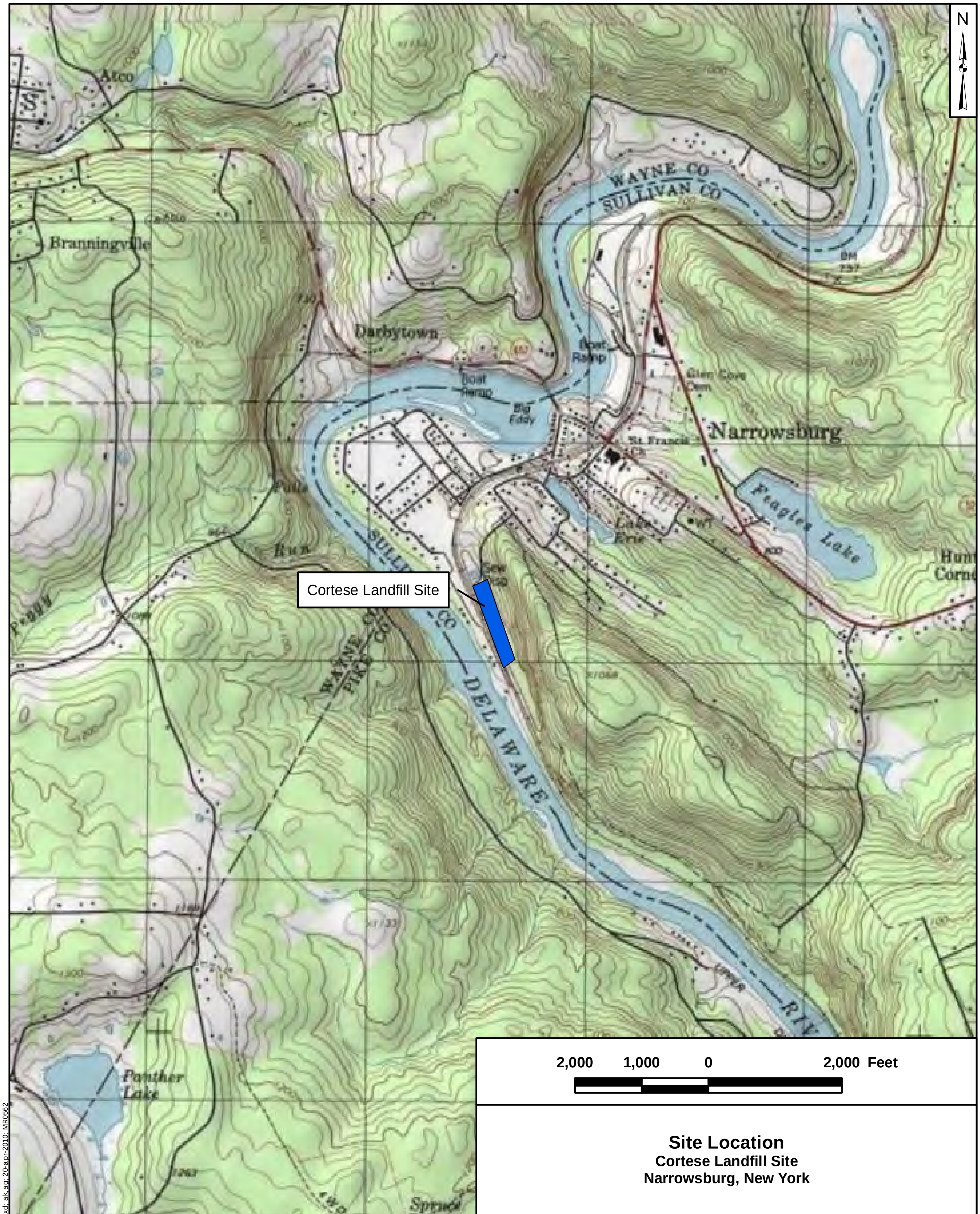
Cortese Landfill Site
Narrowsburg, New York

Monitoring Well ID	Measuring Point Elevation[1] (ft MSL)	Measurement	
		Depth to Water	Depth to NAPL
EX-1	697.19	X	
MW-1A	692.58	X	
MW-1B	692.25	X	
MW-1C	691.80	X	
MW-2A	684.49	X	
MW-2B	684.55	X	
MW-3A	698.36	X	
MW-3B	698.42	X	
MW-4B	700.04	X	
MW-5	697.04	X	
MW-6A	693.50	X	
MW-6B	695.00	X	
MW-7A	694.12	X	
MW-7B	693.52	X	
MW-7M	691.90	X	
MW-8A	691.15	X	
MW-8B	690.59	X	
MW-9	695.14	X	
MW-10	693.91	X	X
MW-11	699.35	X	
MW-12	701.25	X	X
MW-13	700.84	X	X
MW-14	700.70	X	X
MW-15	700.03	X	X
MW-16	701.16	X	X
MW-17	700.44	X	
MW-18A	695.00	X	
MW-18B	694.70	X	
MW-18C	694.20	X	
MW-19	695.90	X	
MW-20A	693.70	X	
MW-20B	693.70	X	
MW-21	693.90	X	
MW-22	685.70	X	
S-1	700.44	X	X
S-2	700.39	X	X

Notes:
[1] Data provided by Thew Associates PE-LS, PLLC. on December 23, 2010 and Fisher Associates on February 19,

ft - feet
ft MSL - feet above mean sea level
NAPL - Non-Aqueous Phase Liquid

FIGURES



2,000 1,000 0 2,000 Feet

Site Location
Cortese Landfill Site
Narrowsburg, New York

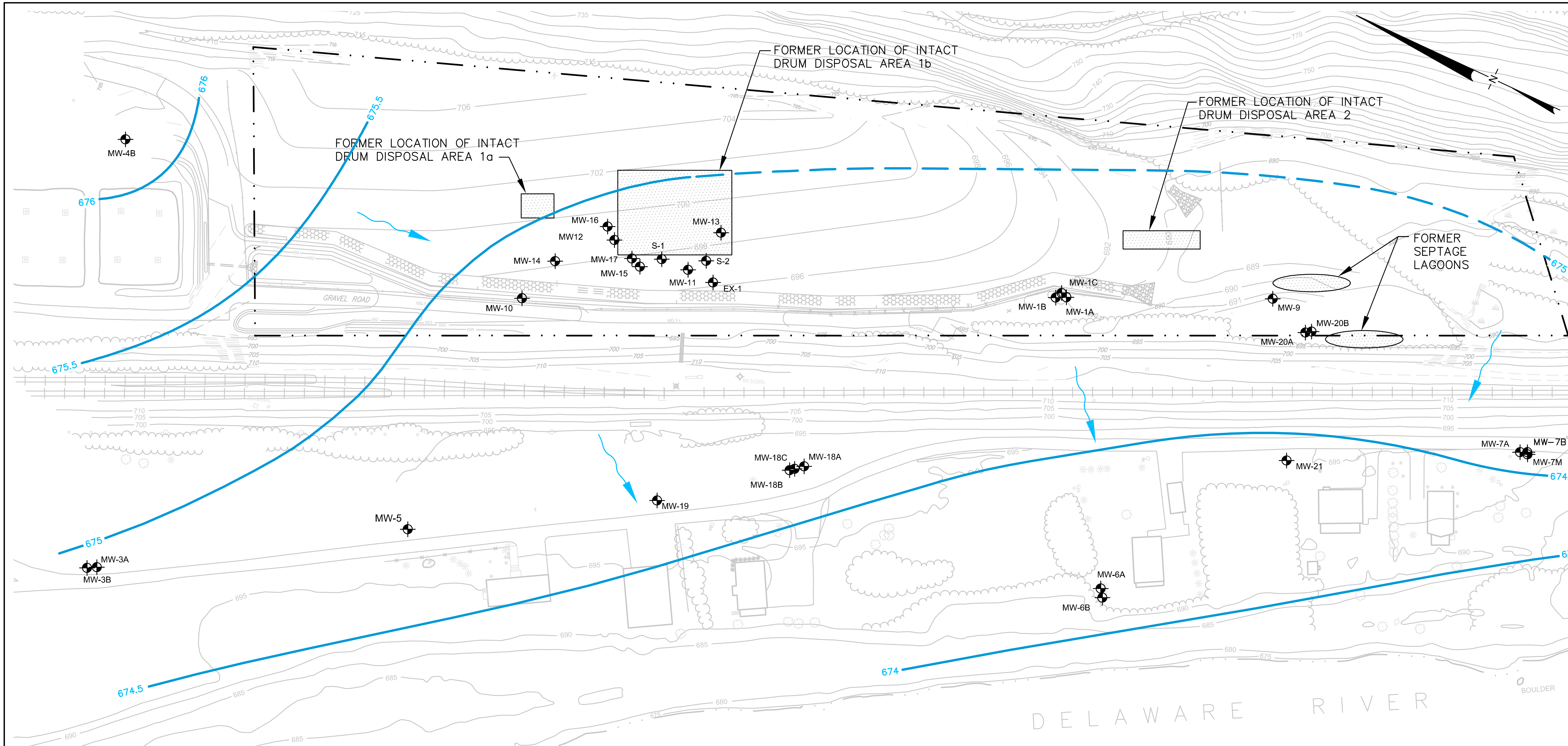
Notes
USGS 7.5' Topographic Quadrangle Narrowsburg, New York

Geosyntec consultants

Columbia, Maryland | **July 2014**

Figure 1

P:\GIS\MR0562\SiteLocationMap.mxd; ak ag 20-apr-2010; MR0562



NOTES:

1. ALL COORDINATES SHOWN ON THIS MAP REFLECT THE NORTH AMERICAN DATUM 1983 (NAD 83) AS DERIVED USING THE NATIONAL GEODETIC SURVEY SHIFT OF N 05°05'25" AND E A DISTANCE OF 426,246.03' AS APPLIED TO THE NATIONAL GEODETIC SURVEY DATUM OF 1927 (NAD 27). ALL ELEVATIONS SHOWN ON THIS MAP REFLECT THE NORTH AMERICAN VERTICAL DATUM OF 1988, AS DERIVED USING THE NATIONAL GEODETIC SURVEY SHIFT OF −0.5479' AS APPLIED TO THE NATIONAL GEODETIC VERTICAL DATUM OF 1929.
2. TOPOGRAPHY AND SURFACE FEATURES EAST OF DELAWARE DRIVE WERE ORIGINALLY PREPARED BY FIELD METHODS BY OM P. POPLI P.E., L.S. PC CONSULTING ENGINEERS & SURVEYORS, ROCHESTER, NEW YORK, MARCH 1995. TOPOGRAPHY CHANGES SINCE MARCH 1995 PREPARED BY ENVIRONMENTAL RESEARCH, INC. ON DECEMBER 12, 1996. TOPOGRAPHY AND SURFACE FEATURES WEST OF DELAWARE DRIVE WERE DIGITIZED FROM AN ELECTRONICALLY SCANNED FILE OF THE TOPOGRAPHIC BASE MAP PREPARED BY ROBINSON AERIAL SURVEYS, INC., BY PHOTOGRAMMETRIC METHODS FROM PHOTOGRAPH TAKEN APRIL 18, 1985.
3. LANDFILL PROPERTY BOUNDARY TAKEN FROM BASELINE–PROPERTY BOUNDARY–CONTROL, CORTESE LANDFILL SITE, TOWN OF TUSTEN, SULLIVAN COUNTY, NY, MAY 7, 1985, BY GARY PARKER, P.L.S.
4. REFERENCE: DRAWING DEVELOPED FROM FIGURE 2, "SITE PLAN" OF THE SOURCE CHARACTERIZATION REPORT BY GOLDER ASSOCIATES, INC., DATED 24 JANUARY 2008.
5. MONITORING WELL LOCATIONS AND REFERENCE ELEVATIONS FOR WELLS INSTALLED PRIOR TO DECEMBER 2010 WERE PROVIDED BY THEW ASSOCIATES, P.E., L.S., PLLC IN DECEMBER 2010. MONITORING WELLS INSTALLED AFTER DECEMBER 2010 WERE SURVEYED BY FISHER ASSOCIATES IN FEBRUARY 2013.
6. GROUNDWATER ELEVATION CONTOURS ARE BASED ON "FIGURE 11, GROUNDWATER TABLE ELEVATION – NOVEMBER 2012, CORTESE LANDFILL SITE, NARROWSBURG, NEW YORK" IN THE INTERIM GROUNDWATER REMEDIAL ACTION REPORT (GEOSYNTEC CONSULTANTS, 2013).

LEGEND

- SITE BOUNDARY
- APPROXIMATE EDGE OF DELAWARE RIVER
- FENCE
- TOPOGRAPHY CONTOUR (750)
- MONITORING WELL
- GROUNDWATER ELEVATION CONTOUR (FEET–MSL) (675)
- GROUNDWATER FLOW DIRECTION

100 50 0 100

SCALE: 1" = 100'

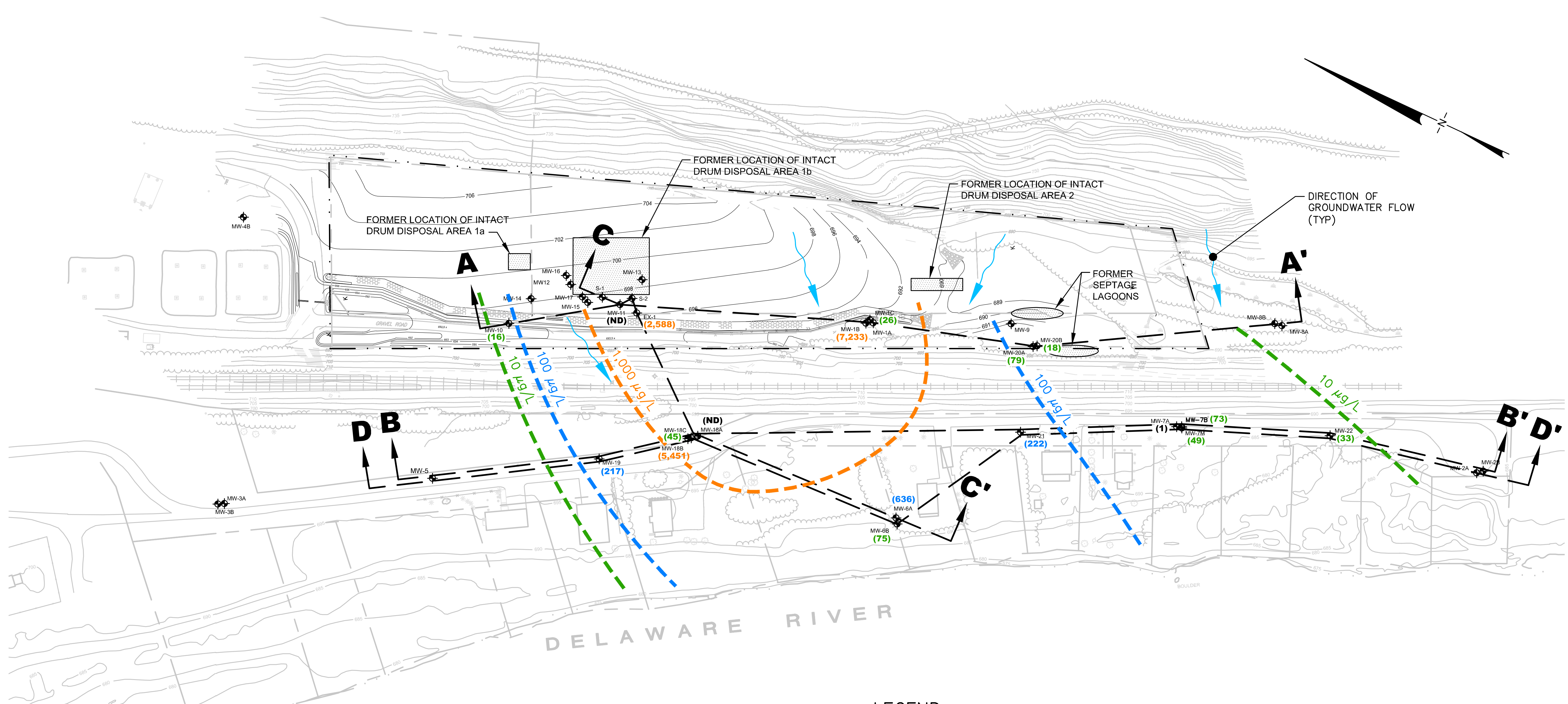
FORMER SOURCE AREAS

CORTESE LANDFILL SITE
NARROWSBURG, NEW YORK

Geosyntec consultants
COLUMBIA, MARYLAND

DATE:	JULY 2014
PROJECT NO.	MR0562F
DOCUMENT NO.	MD14196
FILE NO.	05621302
FIGURE NO.	2

P:\cadd\0562-cortese\05621300\05621302.dwg, 2, 7/1/2014 10:55:08 AM, JOConnor



LEGEND

	PROPERTY BOUNDARIES
	SITE BOUNDARY
	APPROXIMATE EDGE OF DELAWARE RIVER
	FENCE
750	PRE-EXISTING TOPOGRAPHY ELEVATION CONTOUR
	MONITORING WELL
(217)	TOTAL VOC CONCENTRATION (NOTE 2)
	INFERRED TOTAL VOCs ISOCONCENTRATION CONTOUR
	CROSS SECTION (NOTE 3)

NOTES:

1. SEE FIGURE 2 FOR FEATURE REFERENCES.
2. TOTAL TCL VOC DATA SHOWN FOR APRIL 2013. ND STANDS FOR NON-DETECT.
3. SEE FIGURE 4 FOR SECTION A-A', FIGURE 5 FOR SECTION B-B', FIGURE 6 FOR SECTION C-C', AND FIGURE 7 FOR SECTION D-D'.

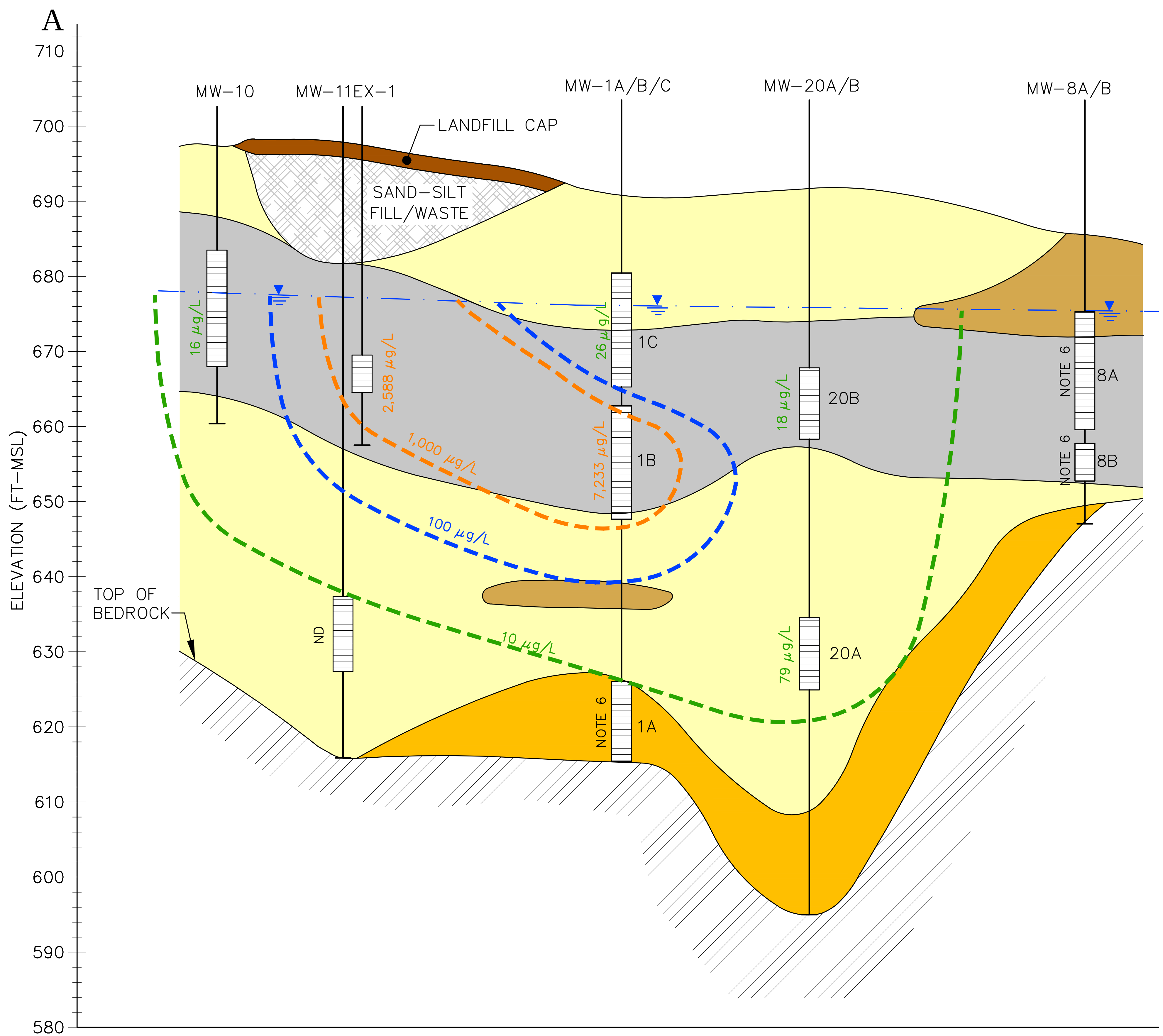
150 75 0 150
SCALE: 1" = 150'

COMBINED OU3 AND OU4 GROUNDWATER MONITORING NETWORK

CORTESE LANDFILL SITE
NARROWSBURG, NEW YORK

Geosyntec consultants
COLUMBIA, MARYLAND

DATE:	JULY 2014
PROJECT NO.	MR0562F
DOCUMENT NO.	MD14196
FILE NO.	05621303
FIGURE NO.	3



LEGEND

- WELL/SCREEN LOCATION
- WATER TABLE
- GRAVEL AND SAND
- SILTY SAND/SANDY SILT
- CLAYEY SILT
- SAND WITH SOME GRAVEL
- INFERRED TOTAL VOCs ISOCONCENTRATION CONTOUR
- ND — VOC NON-DETECT

NOTE:

1. LOCATION OF CROSS SECTION SHOWN ON FIGURE 3.
2. WELL CLUSTERS ARE SEPARATE COMPLETIONS IN SEPARATE BOREHOLES BUT SHOWN ON ONE WELL SYMBOL FOR CLARITY.
3. GEOLOGIC AND EXISTING WELL CONSTRUCTION DATA FROM GOLDER AND GEOSYNTEC (VARIOUS).
4. CONDITIONS MAY VARY FROM THAT SHOWN BETWEEN EXISTING BORINGS.
5. TOTAL TCL VOC DATA SHOWN FOR APRIL 2013.
6. TOTAL VOC CONCENTRATIONS AT MW-1A, MW-8A, AND MW-8B HAVE HISTORICALLY BEEN VERY LOW OR NON-DETECT.

150 75 0 150
HORIZONTAL SCALE: 1" = 150'

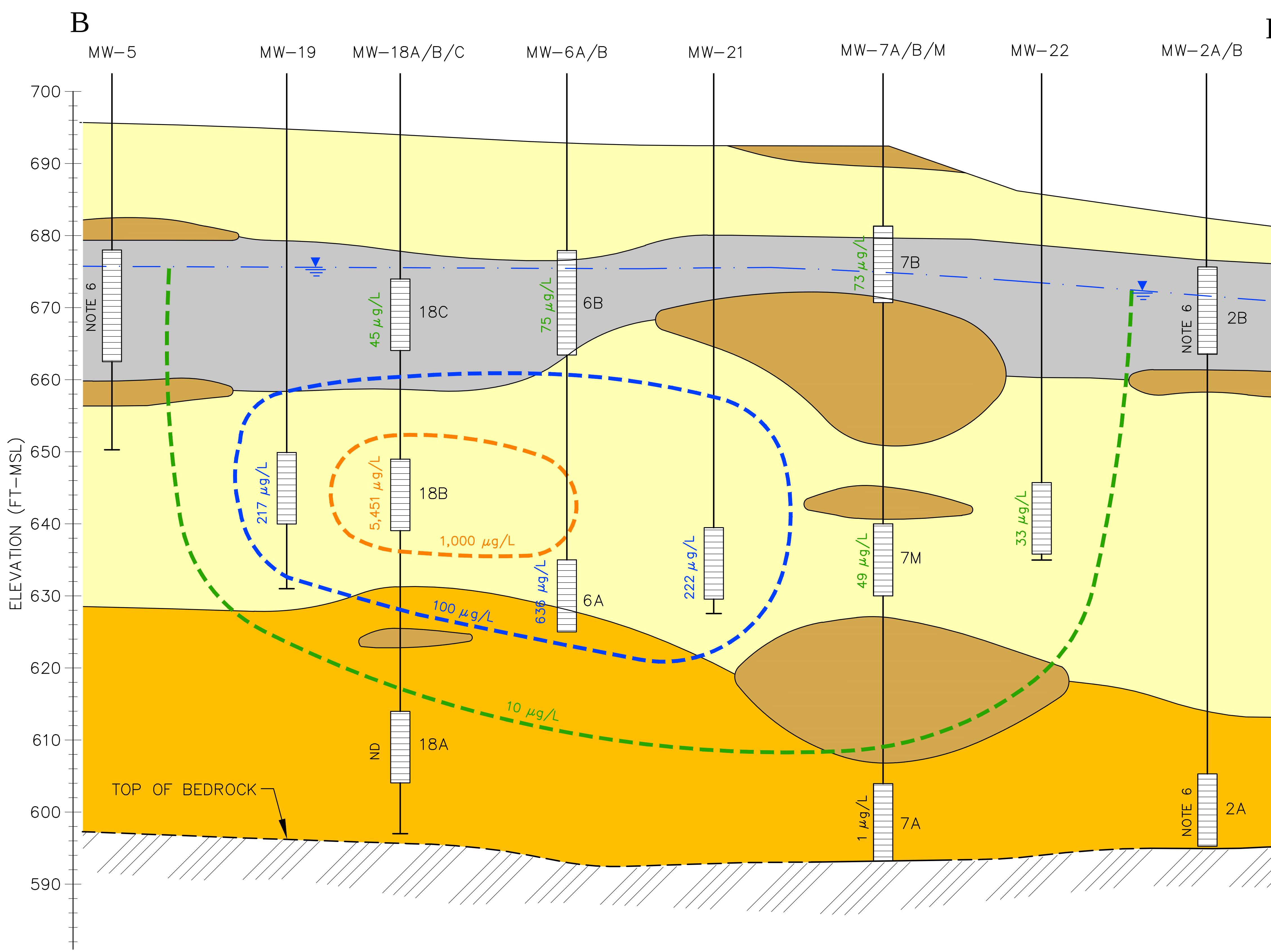
15 7.5 0 15
VERTICAL SCALE: 1" = 15'

CROSS SECTION A-A' OF SOURCE AREAS TRANSECT

CORTESE LANDFILL SITE
NARROWSBURG, NEW YORK

Geosyntec consultants
COLUMBIA, MARYLAND

DATE:	JULY 2014
PROJECT NO.	MR0562F
DOCUMENT NO.	MD14196
FILE NO.	05621304-7
FIGURE NO.	4



LEGEND

WELL/SCREEN LOCATION

WATER TABLE

GRAVEL AND SAND

SILTY SAND/SANDY SILT

CLAYEY SILT

SAND WITH SOME GRAVEL

INFERRED TOTAL VOCs ISOCONCENTRATION CONTOUR

ND — VOC NON-DETECT

NOTES:

1. LOCATION OF CROSS SECTION SHOWN ON FIGURE 3.
2. WELL CLUSTERS ARE SEPARATE COMPLETIONS IN SEPARATE BOREHOLES BUT SHOWN ON ONE WELL SYMBOL FOR CLARITY.
3. GEOLOGIC AND EXISTING WELL CONSTRUCTION DATA FROM GOLDER AND GEOSYNTEC (VARIOUS).
4. CONDITIONS MAY VARY FROM THAT SHOWN BETWEEN EXISTING BORINGS.
5. TOTAL TCL VOC DATA SHOWN FOR APRIL 2013.
6. TOTAL VOC CONCENTRATIONS AT MW-5, MW-2A, AND MW-2B HAVE HISTORICALLY BEEN VERY LOW OR NON-DETECT.
7. MONITORING WELL PAIR MW-6A/6B ARE PROJECTED HORIZONTALLY TO CROSS SECTION B-B'. THE SCREEN FOR MW-6A IS ALSO PROJECTED TO A SHALLOWER DEPTH IN ORDER TO MATCH THE DIVING PLUME CONCEPTUAL SITE MODEL SHOWN ON FIGURE 6. SEE FIGURE 7 FOR GEOLOGIC CROSS SECTION D-D' THROUGH THE MW-6A/6B WELL PAIR.

150 75 0 150
HORIZONTAL SCALE: 1" = 150'

15 7.5 0 15
VERTICAL SCALE: 1" = 15'

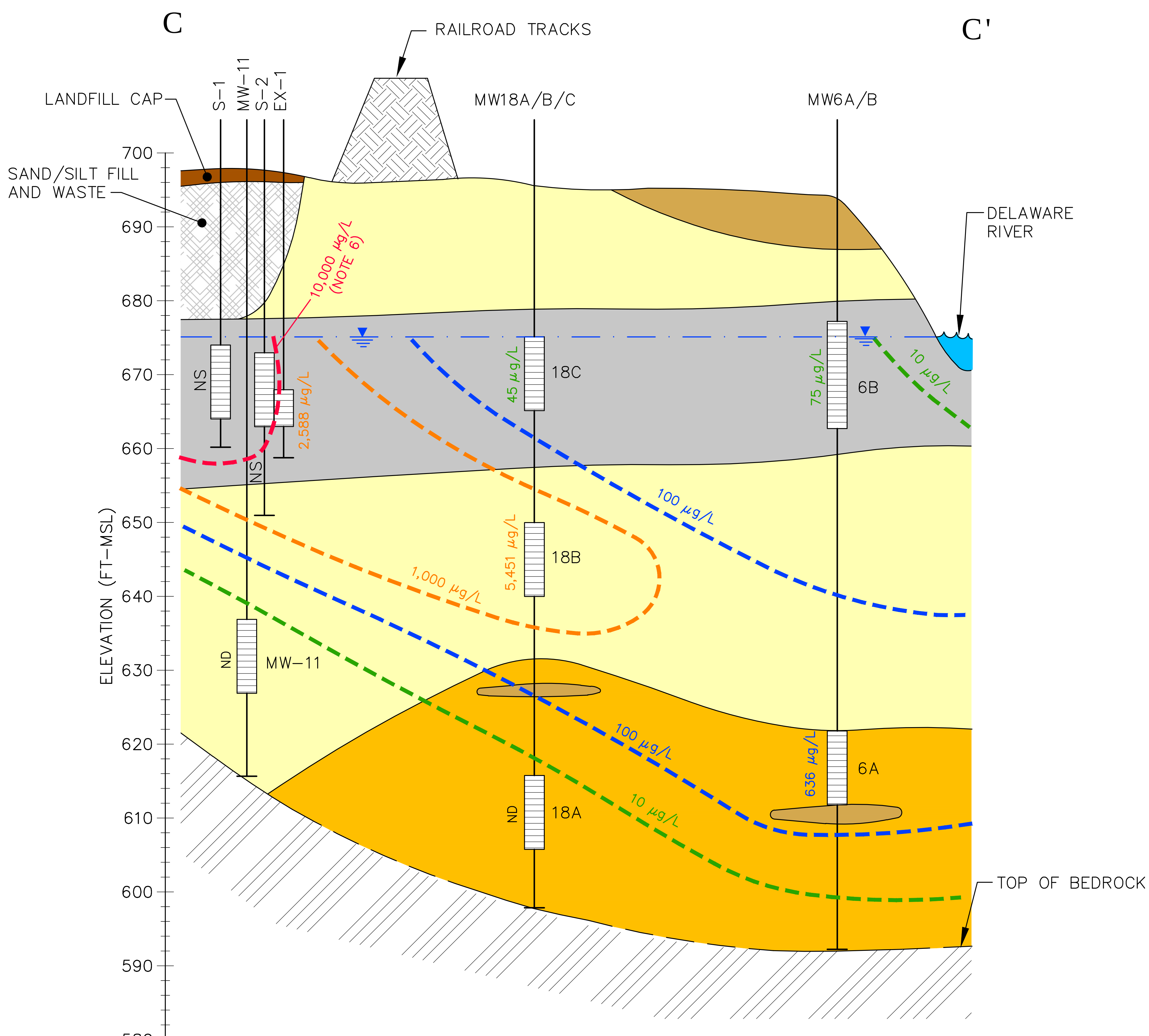
CROSS SECTION B-B' OF DOWNGRADIENT TRANSECT

CORTESE LANDFILL SITE
NARROWSBURG, NEW YORK

Geosyntec consultants
COLUMBIA, MARYLAND

DATE:	JULY 2014
PROJECT NO.	MR0562F
DOCUMENT NO.	MD14196
FILE NO.	05621304-7
FIGURE NO.	5

P:\cadd\0562-cortese\05621300\05621304-7.dwg, 5, 6/13/2014 4:53:17 PM, JOConnor



LEGEND

- WELL/SCREEN LOCATION
- WATER TABLE
- GRAVEL AND SAND
- SILTY SAND/SANDY SILT
- CLAYEY SILT
- SAND WITH SOME GRAVEL
- INFERRED TOTAL VOCs ISOCONCENTRATION CONTOUR
- ND VOC NON-DETECT
- NS NOT SAMPLED

NOTES:

1. LOCATION OF CROSS SECTION SHOWN ON FIGURE 3.
2. WELL CLUSTERS ARE SEPARATE COMPLETIONS IN SEPARATE BOREHOLES BUT SHOWN ON ONE WELL SYMBOL FOR CLARITY.
3. GEOLOGIC AND EXISTING WELL CONSTRUCTION DATA FROM GOLDER AND GEOSYNTEC (VARIOUS).
4. CONDITIONS MAY VARY FROM THAT SHOWN BETWEEN EXISTING BORINGS.
5. TOTAL TCL VOC DATA SHOWN FOR APRIL 2013.
6. 10,000 µg/L CONTOUR BASED ON HISTORICAL RESULTS.

100 50 0 100
HORIZONTAL SCALE: 1" = 100'

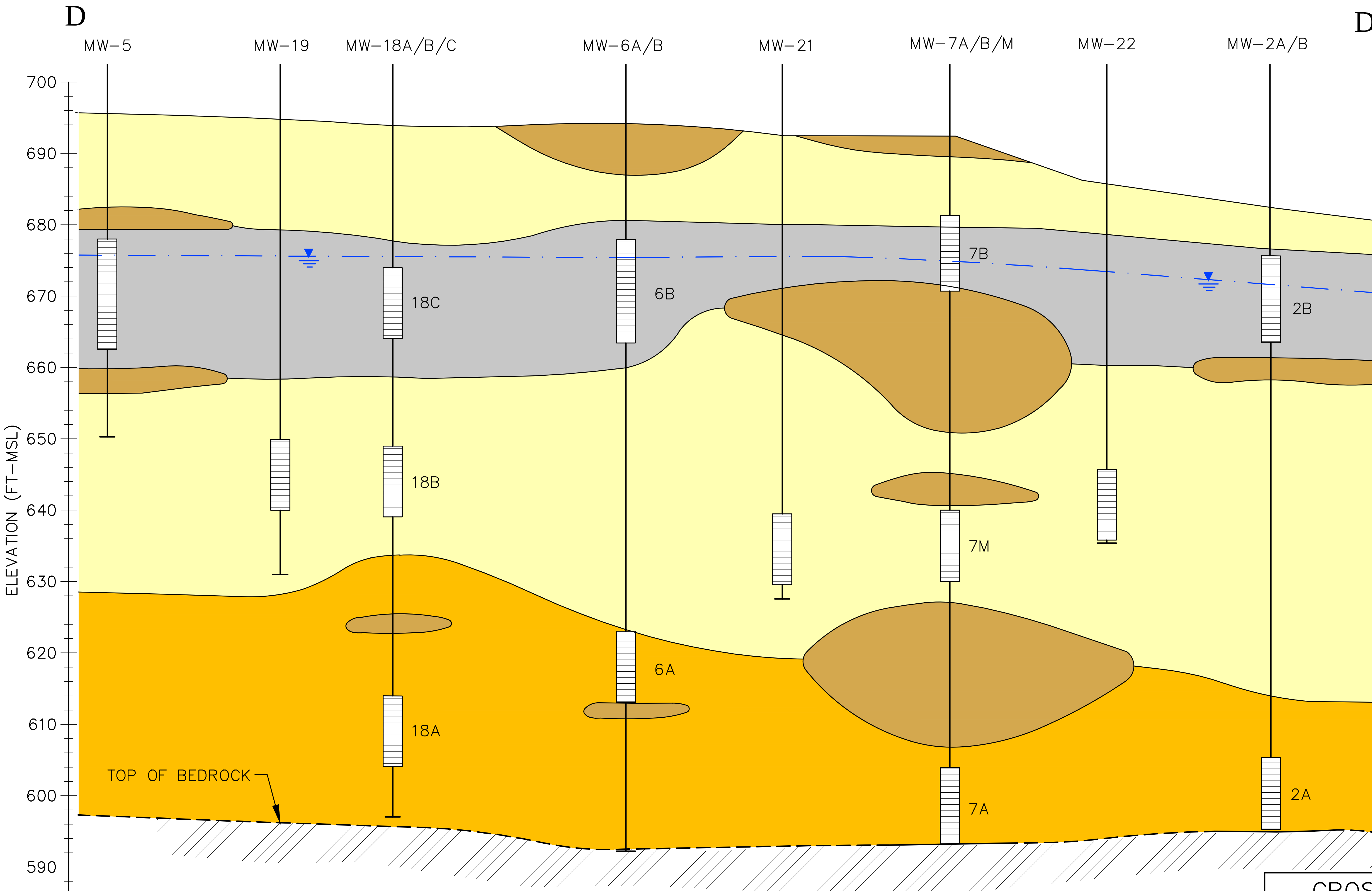
15 7.5 0 15
VERTICAL SCALE: 1" = 15'

CROSS SECTION C–C' ALONG GROUNDWATER FLOW DIRECTION

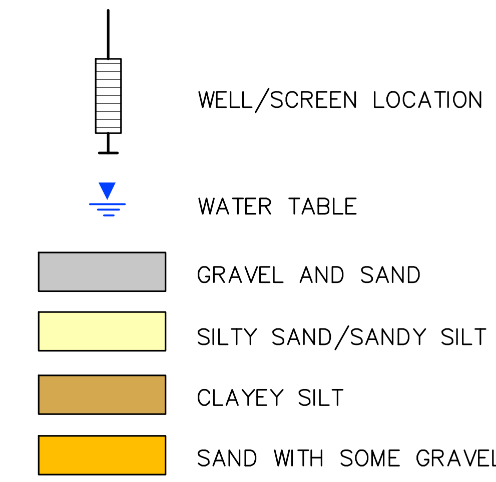
CORTESE LANDFILL SITE
NARROWSBURG, NEW YORK

Geosyntec consultants
COLUMBIA, MARYLAND

DATE:	JULY 2014
PROJECT NO.	MR0562F
DOCUMENT NO.	MD14196
FILE NO.	05621304–7
FIGURE NO.	6

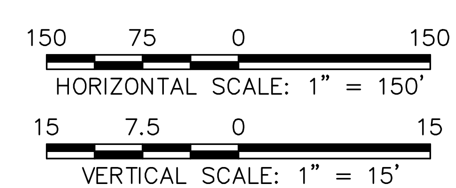


LEGEND



NOTES:

1. LOCATION OF CROSS SECTION SHOWN ON FIGURE 3.
2. WELL CLUSTERS ARE SEPARATE COMPLETIONS IN SEPARATE BOREHOLES BUT SHOWN ON ONE WELL SYMBOL FOR CLARITY.
3. GEOLOGIC AND EXISTING WELL CONSTRUCTION DATA FROM GOLDER AND GEOSYNTEC (VARIOUS).
4. CONDITIONS MAY VARY FROM THAT SHOWN BETWEEN EXISTING BORINGS.

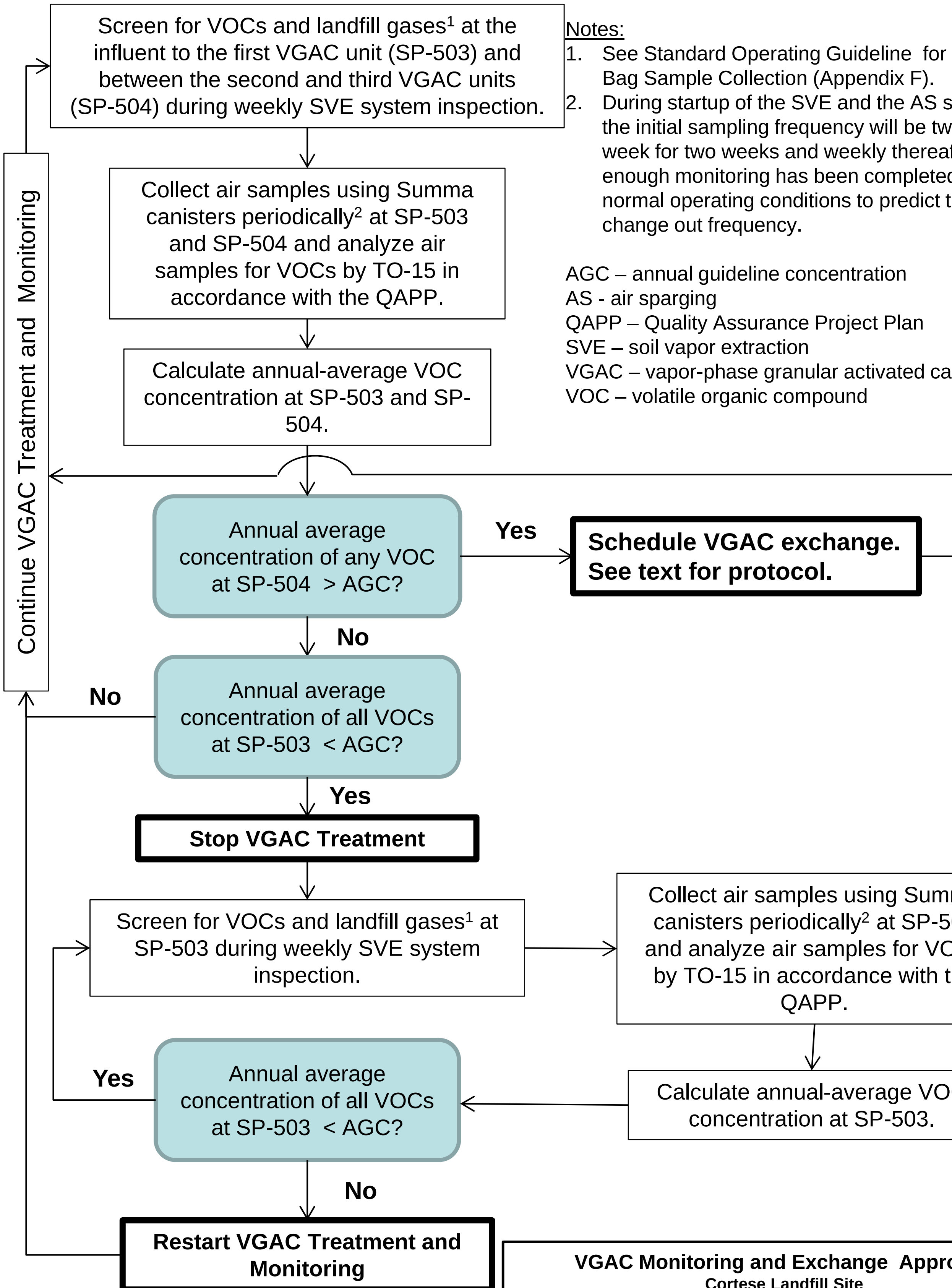


CROSS SECTION D–D' OF DOWNGRADIENT TRANSECT

CORTESE LANDFILL SITE
NARROWSBURG, NEW YORK

Geosyntec consultants
COLUMBIA, MARYLAND

DATE:	JULY 2014
PROJECT NO.	MR0562F
DOCUMENT NO.	MD14196
FILE NO.	05621304–7
FIGURE NO.	7



Notes:

1. See Standard Operating Guideline for Tedlar® Bag Sample Collection (Appendix F).
2. During startup of the SVE and the AS systems, the initial sampling frequency will be twice per week for two weeks and weekly thereafter until enough monitoring has been completed under normal operating conditions to predict the VGAC change out frequency.

AGC – annual guideline concentration
AS - air sparging
QAPP – Quality Assurance Project Plan
SVE – soil vapor extraction
VGAC – vapor-phase granular activated carbon
VOC – volatile organic compound

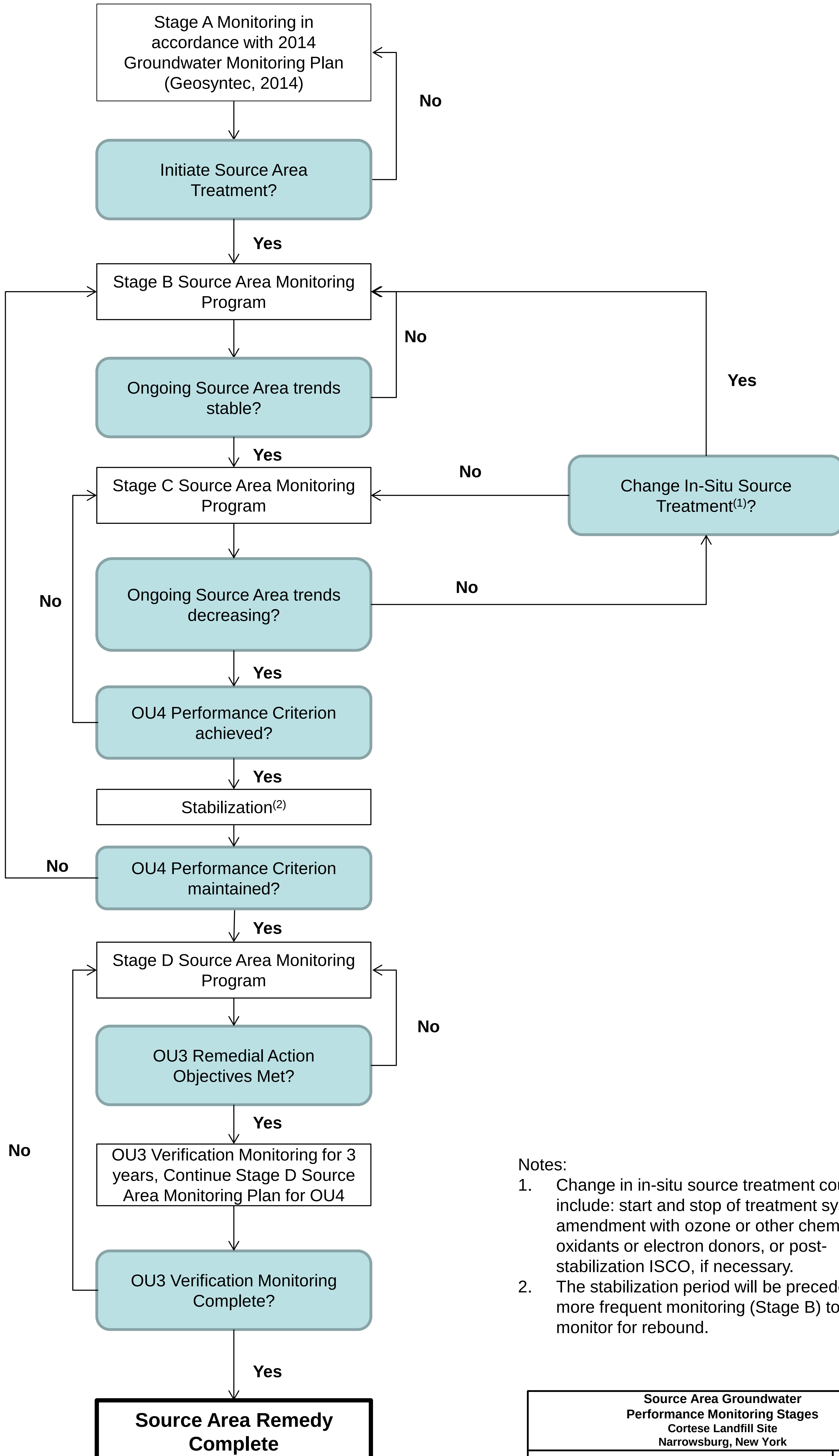
VGAC Monitoring and Exchange Approach
Cortese Landfill Site
Narrowsburg, New York

Geosyntec consultants

Columbia, Maryland | **July 2014**

Figure 8

P:\PRJ1\Mdrem\PROJECTS\MR0562 Cortese NPL Site\Remedial Design\OM&M Plan\Figures\Figure6.MonitoringStages.pptx



Notes:

1. Change in in-situ source treatment could include: start and stop of treatment system, amendment with ozone or other chemical oxidants or electron donors, or post-stabilization ISCO, if necessary.
2. The stabilization period will be preceded by more frequent monitoring (Stage B) to monitor for rebound.

Source Area Groundwater Performance Monitoring Stages
Cortese Landfill Site
Narrowsburg, New York

Geosyntec consultants

Figure 9

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APPENDIX A

Health and Safety Contingency Plan Specification

SECTION 01 35 00 Special Procedures

01 35 29 Health, Safety, and Emergency Response Procedures

01 35 29.13 Health, Safety, and Emergency Response Procedures for Contaminated Sites

Part 1 General

1.01 Section Includes

A. This section describes Health and Safety Specifications (HSS) to establish minimum health and safety requirements for the O&M CONTRACTOR. The O&M CONTRACTOR shall employ monitoring and procedures as necessary to protect the health and safety of workers and the surrounding community during work.

1.02 Applicability

A. These requirements shall be used by the O&M CONTRACTOR'S Health and Safety Officer to assist in preparation of the O&M CONTRACTOR'S Health and Safety Contingency Plan (HSCP). There requirements shall not relieve any party from compliance with any applicable State, Federal, or other health and/or safety requirements and safe construction practices which are not identified in these requirements.

B. During O&M activities, it is anticipated that Site workers may come in contact with a number of potential hazards, including, but not limited to, (i) exposure to impacted groundwater and associated breathing hazards; (ii) lifting heavy equipment while conducting O&M; (iii) hand tools used to conduct O&M; (iv) fall and trip hazards; (v) electrocution hazards; and (vi) burn hazards around running equipment.

1.03 Cited Standards

A. United States Federal Government - Code of Federal Regulations:

1. 29 CFR 1910.120 – Subpart H Hazardous Materials - Hazardous Waste Operations and Emergency Response.

2. 29 CFR 1910.134 – Subpart I – Personal Protective Equipment-Respiratory Protection.

3. 29 CFR 1910.146 – Subpart J – General Environmental Controls - Permit-required Confined Spaces.

4. 29 CFR 1910.1200 - Subpart Z- Toxic and Hazardous Substances – Hazard Communication.

5. 29 CFR 1926.65 - Subpart D – Occupational Health and Environmental Controls - Hazardous Waste Operations and Emergency Response.

6. 29 CFR 1910 Subpart I - Personal Protective Equipment.

7. 29 CFR 1910 Subpart Z - Toxic and Hazardous Substances.

1.04 Quality Control

A. The O&M CONTRACTOR will ensure that all Site activities are performed in such a manner as to ensure the safety and health of all personnel and the surrounding community. All Site activities shall be conducted in accordance with all pertinent general industry (29 CFR 1910) and construction (29 CFR 1926) Occupational Health and Safety Administration (OSHA) standards, and the United States Environmental Protection Agency's (USEPA) *Standard Operating Safety Guides* (OSWER, 1988), as well as any other applicable New York State and municipal codes or ordinances. The O&M CONTRACTOR is also responsible for ensuring that all Site activities comply with those requirements set forth in OSHA's final rule entitled *Hazardous Waste Operation and Emergency Response* (HAZWOPER), 29 CFR 1910.120, Subpart H.

B. To ensure that all Site activities are in compliance, the O&M CONTRACTOR shall prepare a Project HSCP in accordance with the aforementioned regulations. The HSCP shall conform to the requirements of 29 CFR 1910.120 and all applicable state, federal, local, and other health and safety requirements and safe operational practices not specifically identified in these requirements. The O&M CONTRACTOR's HSCP will be submitted to the SUPERVISING CONTRACTOR for subsequent submittal to the regulating agencies. SUPERVISING CONTRACTOR's review of O&M CONTRACTOR's HSCP shall be limited to verification that the various components of the Project are adequately addressed. O&M CONTRACTOR shall also submit to SUPERVISING CONTRACTOR for their records, HSCPs for all subcontractors or submit written documentation that said subcontractors shall follow O&M CONTRACTOR's HSCP. In any case, all HSCPs or the written documentation shall be submitted at least 14 days prior to the O&M CONTRACTOR's or subcontractor's mobilization to the Site. All HSCPs, at a minimum, will include the following:

1. Plans showing the location and layout of any temporary and permanent facilities to be constructed on or near the Site;

2. Description of the known hazards and evaluation of the risks associated with the Site and the potential health impacts related to Site activities;

3. List of key personnel and alternates responsible for Site safety, response operations, and protection of the public;

4. Description of levels of protection (based on specific standards) to be utilized by all personnel;

5. Delineation of Work, decontamination, and safe zones, and definitions of the movement of zones;

6. Description of decontamination procedures for personnel and equipment, and handling and removal of disposable clothing or equipment;

7. Incidental emergency procedures that address emergency care for personnel injuries and exposure problems, and containment measures. These procedures shall include evacuation routes, internal and external communication procedures for response to fire, explosion, or other emergencies, the name of the nearest hospital and the route to that hospital. Local agencies with the capability to respond to emergencies shall be identified and their capabilities shall be described. A description of the procedures for informing the community of these measures shall be outlined.

8. A description of the personnel medical surveillance program in effect;

9. A description of monitoring for personnel safety;

10. A description of routine and special personnel training programs; and

11. A description of an air monitoring program to determine concentrations of airborne contaminants to which worker on-Site and persons near the Site boundary may be exposed. The results of work-zone air monitoring may be used as a trigger for implementing Site-boundary air monitoring, additional control measures, and/or cessation of work.

1.05 Submittals

A. HSCP

1. The O&M CONTRACTOR shall prepare and submit a HSCP to the SUPERVISING CONTRACTOR for subsequent submittal to the regulating agencies. the regulating agencies. As part of the Health and Safety Program to be implemented by the O&M CONTRACTOR and as specified herein, submittals are also required for the documentation of normal Health and Safety procedures during the duration of the project.

2. Proof of training (40 hr., 8-hr. refresher, respirator test fit 8-hr. mgr, 10-hr OSHA construction safety)

1.06 Site Background

A. The Cortese Landfill Site (Site) is located in Narrowsburg, Sullivan County, New York on the floodplain of the Delaware River. The Site is bounded to the northeast by a steep bedrock escarpment and to the southwest by a railroad embankment. The northern edge of the landfill lies approximately 70 feet south of the Narrowsburg Waste Water Treatment Plant. The Delaware River is approximately 400 feet southwest of the landfill, separated from the Site by the railroad embankment. Seven residences are located along the river across the railroad embankment from the Site. Other features of interest in the immediate area include a small borrow pit (White’s Pond) and a small backwater area (the embayment) along the eastern shoreline of the Delaware River located approximately 800 feet southwest of the landfill. The Site property boundary encompasses approximately 3.75 acres of land owned by Mr. John Cortese and another 1.53 acre parcel along the northern margin of the Cortese property owned by the Town of Tusten, which purchased the property from Mr. Cortese in 1973.

B. The Site received municipal solid waste (MSW) from approximately July 1970 to July 1981 at an estimated rate of approximately 3,000 cubic yards per year. Disposal practices were poorly documented, such that records about the types and volume of wastes received are essentially non-existent. The extent of MSW has been assessed based upon geophysical surveys and test pits. For a six-month period in 1973, the Site received industrial wastes including paint thinners, sludge, solvents, dyes, waste oil, and other petroleum products. Disposal of these wastes included the burial of drums in trenches. According to depositional testimony of the former landfill owner/operator and landfill employees, drums were disposed in three areas in the landfill. Initially, drums were emptied and/or crushed or mixed with MSW in a trench located in the northwest corner of the landfill. Subsequently, drums were segregated from MSW and were disposed intact in the main drum disposal area located in the center of the landfill, referred to as Intact Drum Disposal Area 1 (IDDA 1). Drums were also disposed intact in another area just beyond the southern end of the landfill referred to as IDDA 2. Two septage lagoons, which also received industrial wastes, were located outside of the southern end of the landfill adjacent to IDDA 2.

C. Various remedial investigations, removal actions, and other remedial activities have been implemented at the Site. These remedial activities have shown that soil and groundwater impacts associated with Volatile Organic Compounds (VOCs), Semi-Volatile Organic Compounds (SVOCs), and Metals still exist in the vicinity of the former IDDA1b, IDDA2 and the septage lagoons. The major Site Constituents of Concern are:

Constituent[1]	*Medium*	*Maximum Concentration*[2]	*Medium*	*Maximum Concentration*[2]
1,1,1-trichloroethane	soil	15	water	7,300
1,1-dichloroethane	soil	5	water	98,000
1,2,4-trichlorobenzene	soil	1,200	water	8,000
1,2-dichloroethane	soil	-	water	3,600
1,4-dichlorobenzene	soil	120	water	31,000
2-butanone (MEK)	soil	24	water	69,000
benzene	soil	12	water	11,000
carbon disulfide	soil	-	water	21
carbon tetrachloride	soil	57	water	120
chlorobenzene	soil	12	water	27,000
chloroethane	soil	-	water	43,000
chloroform	soil	7.6	water	3,900
ethylbenzene	soil	140	water	50,000
methyl isobutylene ketone (MIBK)	soil	16	water	3,000
methylene chloride	soil	0.5	water	12,000
naphthalene	soil	150	water	17,0000
tetrachloroethene	soil	36	water	10,000
toluene	soil	490	water	550,000
total xylenes	soil	610	water	130,000
trichloroethene	soil	360	water	67,000
vinyl chloride	soil	1	water	22,000

Footnotes:

1 Constituents that are included on this list have been detected at the Site at concentrations that may cause potential dermal, ingestion, or inhalation hazards, or the constituent is suspected to potentially be present at elevated concentrations but no analytical data are available.

2 Maximum concentration previously detected for the constituent based on historic data (if available). Liquid concentrations are presented in micrograms of constituent per liter of solution (μg/L). Solids concentrations are presented in milligrams of constituent per kilogram of soil (mg/kg).

Part 2 PRODUCTS – Not used

Part 3 EXECUTION

3.01 GENERAL

A. The O&M CONTRACTOR will be responsible for ensuring that all Site activities are completed in a safe manner that is protective of human health and the environment. To help facilitate the Site health and safety procedures and comply with the quality control requirements above, additional O&M CONTRACTOR requirements and responsibilities are summarized below.

3.02 HAZARD ANALYSIS AND MITIGATION

A. Several potential health and safety hazards will be encountered during construction of the Remedial Design. These hazards can be grouped into three categories that include chemical, physical, and biological hazards.

Each Site activity completed by the O&M CONTRACTOR and/or sub-contractors will be evaluated for potential chemical, physical, and biological hazards and appropriate safety procedures will be developed to protect workers.

B. Chemical hazards will be evaluated for each Site activity. Potential exposure pathways will be considered and include inhalation, dermal exposure, and/or ingestion. To effectively manage risk to exposure, a list of constituents of concern (COCs) and maximum detected concentrations that have been documented and/or are suspected to be present based on previous operation/activities are tabulated in Section 1.06. Based on this list, the O&M CONTRACTOR will develop a plan to monitor workers chemical exposure and methods to mitigate any potential exposures.

C. Physical hazards will be considered for all Site activities. Potential physical hazards include, but are not limited to: cold and heat stress; hand/foot injuries; eye injuries; falling objects; slips, trips, and falls; loud noise; electrocution; etc. The O&M CONTRACTOR will implement appropriate safety measures to limit exposure to physical hazards.

D. Potential biological hazards (e.g. allergic reactions to poisonous plant or insects indigenous to area, etc) associated with tasks to be performed will be considered by the O&M CONTRACTOR. Bear and rattlesnakes have been observed at the Site in the past. Safety procedures will be developed for each biological hazard identified.

3.03 HEALTH AND SAFETY PERSONNEL

A. The O&M CONTRACTOR will provide a list of key project personnel responsible for Site Health and Safety. At a minimum, the O&M CONTRACTOR will provide and designate a competent and authorized individual to serve as the Site Health and Safety Officer (SHSO) during the execution of all work. The SHSO should have work experience related to construction activities at hazardous waste Sites and be familiar with the potential hazards associated with each work activity. The SHSO will be responsible, at a minimum, for the following:

1. Hold daily health and safety meetings prior to the start of each work shift. Each health and safety meeting will be documented on log which will include, at a minimum, all personnel present and safety topics reviewed during the meeting.

2. Implementing and daily enforcing of monitoring activities associated with the Site-specific HSCP;

3. Verify that all on-Site personnel are made aware of provisions in the HSCP and have been informed of the nature of any physical and/or chemical hazards associated with Site activities;

4. Maintain a daily log of all significant health and safety activities and incidents;

5. Suspend work if health and/or safety-related concerns arise;

6. Conduct Site safety orientation training;

7. Coordinate emergency procedures and notify appropriate authorities in the event of an emergency;

8. Establish actual levels of protection for each work area based on planned activity and location of each activity;

9. Evaluate Site health and safety as environmental or work conditions change; and

10. Maintain required health and safety documents and records on-Site;

3.04 LEVELS OF PERSONAL PROTECTION

A. All work completed at the Site will at a minimum, be completed in modified Level-D Personal Protective Equipment (PPE) that will include safety glasses/goggles, steel toe boots, long pants, outer gloves and protective clothing when handling potentially impacted media, and a hard-hat when overhead hazards are present. Some of the Work at the Site may need to be conducted in Level B or C PPE depending on COC concentrations in the breathing zone measured during air monitoring activities described in Section 3.08. The O&M CONTRACTOR will be responsible for providing all necessary PPE to its workers, including air purifying respirators or pressurized breathable air supply as necessary to support Level C and B work, respectively. The O&M CONTRACTOR is responsible for providing employees with all necessary training requirements to complete work in Level C or B PPE.

3.05 DECONTAMINATION

A. The O&M CONTRACTOR will be responsible for delineation of work, safe, and decontamination zones as well as determining the type and level of decontamination procedures for both personnel and equipment based on the evaluation of specific work activities in the controlled work zones. In an emergency, the primary concern is to prevent the loss of life or serious injury to personnel. Medical treatment will take precedence over decontamination in the event of a life threatening and/or serious injury/illness. Personnel will perform decontamination in designated and identified areas within or outside the Work Zone.

B. Wash solutions and PPE may require disposal at a licensed waste facility. Equipment that is contacted by potentially impacted media will be decontaminated as needed by washing in decontamination basins with appropriate solutions, or, if possible, by dry decontamination.

3.06 EMERGENCY PREPAREDNESS AND RESPONSE

A. The O&M CONTRACTOR's HSCP will need to include an emergency response and action plan. This plan is intended to provide guidance for immediate response to a serious Site occurrence such as a life threatening or serious personnel injury, explosion, fire, or migration of significant quantities of a toxic or hazardous material from the Site, which could endanger the public or adjacent public or private properties. This plan should at a minimum include internal and external communication procedures to inform others of the emergency, list of contacts and telephone numbers for applicable off-Site emergency responders (i.e., fire department, hospital, police department, etc.), evacuation routes, procedures for handling personnel injuries and/or exposures, and the name and directions to the nearest hospital or emergency care center.

3.07 PERSONNEL MEDICAL SURVEILLANCE, MONITORING, AND TRAINING

A. The O&M CONTRACTOR will be required to provide personnel that meet all local, state, and federal eligibility requirements to work on Hazardous Material and Waste Sites. These monitoring and training requirements include, but are not limited to those set forth in 29 CFR 1910.120 and 29 CFR 1926.65.

3.08 AIR MONITORING

A. During O&M ACTIVITIES, at a minimum, the Work environment and workers' breathing zones, at a minimum, shall be monitored on a regular basis using a Photoionization Detector (PID) and a combustible gas indicator. Air monitoring equipment will be operated and calibrated according to manufacturer's operating procedures. Instruments shall be serviced to ensure their readiness for use and shall be removed from service and replaced by another similar unit when not operating properly.

B. O&M CONTRACTOR shall observe the following Action Levels in workers' breathing zones:

Instrument	Action Level	Specific Action
PID	Peak reading greater than 5 ppm or any reading above background for 5 continuous minutes in breathing zone.	O&M CONTRACTOR shall wear a VOC air purifying respirator or supplied air respirators, or perform constituent specific personal air monitoring to evaluate the need for respiratory protection.
Combustible Gas Indicator	Reading greater than 10% and less than 25% LEL	Secure ignition sources, continue monitoring, and continue Work.
	Reading greater than 25% LEL	Temporarily cease Work and contact O&M CONTRACTOR SHSO.

C. The upwind and downwind perimeters of the Work area shall be monitored for VOCs with a PID during O&M activities. The following action levels/actions will be taken:

1. If total VOC levels exceed 5 ppm above background at the downwind perimeter, the O&M CONTRACTOR shall install and monitor a wind sock at the Site to determine wind direction. Work activities must be halted and monitoring continued.

2. If, after halting Work, the VOC levels decrease below 5 ppm above background, Work activities with monitoring can resume.

3. If, after halting Work the VOC levels are greater than 5 ppm but less than 25 ppm over background at the perimeter of the Work area, VOC levels at 200 feet downwind of the work area perimeter (or half the distance to the nearest residential or commercial structure, whichever is less) will be measured. If the VOC levels are below 5 ppm over background at this location, Work activities can resume with monitoring.

4. If the VOC levels are above 25 ppm at the perimeter of the Work area, Work activities must be shut down. When Work activities are shut down, downwind air monitoring, as directed by the SHSO, will be conducted to ensure that the nearest residential or commercial structure is not impacted at levels exceeding background.

3.09 DOCUMENTATION

A. Generally, the O&M CONTRACTOR via the SHSO will document all pertinent health and safety operations. Specific activities that will be documented, at a minimum, shall include the following:

1. Daily health and safety meeting sheets documenting workers in attendance and covered safety topics;

2. Daily PID and combustible gas meter calibration records;

3. PID and combustible gas meter readings;

4. Maintain a daily log of all health and safety activities and incidences and report deficiencies to the SUPERVISING CONTRACTOR; and

5. Report and document “near-miss” situations where personnel injury or damage to property was narrowly avoided, so that corrective actions can be implemented to help prevent future incidences.

END OF SECTION

APPENDIX B

Calculation Packages

APPENDIX B-1

MR0562F – CORTESE LANDFILL
BASELINE MASS DISCHARGE CALCULATION PACKAGE

GEOSYNTEC CONSULTANTS

COMPUTATION COVER SHEET

Client: Cortese PRP **Project:** Cortese Landfill **Project/Proposal #:** MR0562F **Task #:** 04

TITLE OF COMPUTATIONS Baseline Groundwater Mass Discharge

COMPUTATIONS BY:
Signature
Printed Name and Title: Adam Gray, Scientist
DATE: 2 July 2013

ASSUMPTIONS AND PROCEDURES CHECKED BY: (Peer Reviewer)
Signature
Printed Name and Title: Aron Krasnopoler, Project Engineer
DATE: 3 July 2013

COMPUTATIONS CHECKED BY:
Signature
Printed Name and Title: Aron Krasnopoler, Project Engineer
DATE: 3 July 2013

COMPUTATIONS BACKCHECKED BY: (Originator)
Signature
Printed Name and Title: Adam Gray, Scientist
DATE: 3 July 2013

APPROVED BY: (PM or Designate)
Signature
Printed Name and Title: Robert Glazier, Associate
DATE: 26 July 2013

APPROVAL NOTES:

REVISIONS (Number and initial all revisions)

NO.	SHEET	DATE	BY	CHECKED BY	APPROVAL
1	Tables 1,3, and 4 Figures 3-5	1 July 2014			

REVISION NOTES: Revision 1 added monitoring wells MW-6A and MW-6B to the calculation by projecting the well pair onto the B-B' cross-section and added analytical data from the October 2013 groundwater monitoring event to the total VOC concentration data set.

Prepared by: Adam Gray **Date: 7/3/13** **Reviewed by:** Aron Krasnopoler **Date: 7/3/2013**

Client: Cortese PRP **Project: Cortese Landfill** **Project/Proposal No.: MR0562F** **Task No.: 04**

PURPOSE

The purpose of this calculation package is to determine the baseline mass discharge of volatile organic compounds (VOCs) in groundwater from both the source areas and downgradient mass discharge transects at the Cortese Landfill Site in Narrowsburg, New York (the Site) prior to implementation of in-situ source treatment at Operable Unit 4 (Source Areas). The source areas and downgradient mass discharge transect locations are shown on **Figure 1**. Vertical cross-sections of the source areas (A-A') and downgradient (B-B') transects are provided as **Figures 2 and 3**, respectively.

BACKGROUND

As presented in the Final Remedial Design Report for Operable Unit 4, Source Areas (RD) (Geosyntec, 2012), a Performance Criterion has been established to evaluate the effectiveness of the in-situ source treatment. This Performance Criterion will guide the operation of the AS/SVE treatment system, inform the need to supplement the basic AS/SVE technology with ozone or other potential amendments, and inform the need for a potential post-stabilization in-situ chemical oxidation application. The Performance Criterion is to achieve a 90% reduction in the baseline mass discharge of total VOCs at the source areas transect closer to the treatment area (cross-section A-A' on **Figure 1**). Mass discharge is defined as the total contaminant mass moving through a plane perpendicular to the direction of groundwater flow per unit time. It is the product of groundwater discharge (groundwater flux) multiplied by the contaminant concentration in that plane.

BASELINE MASS DISCHARGE TRANSECT METHOD

Baseline mass discharge from each transect was calculated using the transect method as described in the Mass Flux/Mass Discharge Guidance [ITRC Guidance (ITRC, 2010)]. The transect method relies on monitoring points along a transect perpendicular to groundwater flow. A vertical cross-section across the transect is divided into any number of sub-areas, each representing a discrete area of uniform concentration and groundwater flow discharge. The Delaunay triangulation method was used to create a Theissen polygon around the center of each well screen in order to divide each cross-section into subareas. The Delaunay triangulation is shown on **Figures 4** and **5**, respectively, for the source areas and downgradient transects. Computer-aided design (CAD) software was used to generate the triangulation and polygons using a 10:1 vertical exaggeration as shown. The vertical exaggeration is reasonable given the greater length of the transects compared to the height of the mass discharge planes as shown on **Figures 2** and **3**. Polygons were then subdivided based on the lithological stratigraphy. The area of each subarea was then calculated using CAD software with no vertical exaggeration.

The mass discharge is the sum of the fluxes from each of these subareas. Mass discharge via the transect method was mathematically calculated from each cross-section as follows:

$$M_d = \sum_{j=1}^{n} M_{dj} = \sum_{j=1}^{n} C_j \cdot q_j \cdot A_j \qquad (1)$$

Where:

M_d = mass discharge, (micrograms/second)

M_{dj} = portion of total transect mass discharge through polygon j, (micrograms/second)

C_j = concentration of constituent at polygon j in transect, (micrograms/cubic centimeter)

A_j = flow area through polygon j, (square centimeters)

q_j = specific discharge (also called Darcy velocity) through polygon j, (centimeters per second)

$$q_j = -K_j \cdot i_j \qquad (2)$$

Where:

Kj = hydraulic conductivity at polygon j, (centimeters/second)

i_j = hydraulic gradient at polygon j, (cm/cm)

INPUT PARAMETERS AND RESULTS

Plume Transects – As shown on **Figure 1,** both transects are nearly perpendicular to horizontal groundwater flow. Historical water table elevation measurements have indicated that groundwater flow occurs from the sources areas generally to the southwest toward the Delaware River.

(C_j) **Total VOC Concentrations**

Per the RD, total VOC data generated at each transect well since 2004 through 2013 were used to calculate the baseline total VOC concentration in each polygon. Monitoring wells MW-1A, MW-8A, and MW-8B in the source area transect and MW-5 and MW-2A in the downgradient transect have not been sampled since July 1997. Total VOC concentrations in these wells were historically very low or non-detect. As a result, for the purposes of this calculation baseline total VOC concentrations in these 5 wells were assumed to be zero. Summary statistics of total VOCs sample data in each well since 2004 are provided in **Table 1**. The average total VOC concentration for each well was used as C_j for their respective polygons.

(K_j) **Hydraulic Conductivity**

Hydraulic conductivity measurements generated via slug testing were presented in the Phase III Remedial Investigation Report (Golder, 1994) and serve as the basis for K_j in the Sand and Gravel Unit and the Sand with some Gravel Unit shown on the cross-sections (**Figures 2 and 3**). The hydraulic conductivity measurements within each geologic unit within the cross-section were averaged and used as K_j for that unit in the mass discharge calculations. These data are summarized on **Table 2**.

Site-specific hydraulic conductivity data were not available for the Silty Sand Unit or the Clayey Silt Unit shown on the cross-sections (**Figures 2 and 3)**. For the purposes of the calculation, hydraulic conductivity values of $5x10^{-4}$ centimeters per second (cm/s) and $1x10^{-6}$ cm/s were used for K_j in the Silty Sand and Clayey Silt Units, respectively. These values fall within the range of published values for the geologic material type (Freeze and Cherry, 1979; Domenico and Swartz, 1998).

(i_j) **Hydraulic Gradient**

Although the horizontal hydraulic gradient is somewhat variable throughout the year, gradients between the landfill and the Delaware River are typically approximately 0.003 centimeters per centimeter. As a result, a constant value of 0.003 was used as i_j throughout the calculation.

(q_j) **Specific Discharge**

The specific discharge is calculated using Equation 2 using the hydraulic conductivity K_j and hydraulic gradient i_j.

(A_j) **Subareas**

Subareas were generated as Theissen polygons around the center of each well screen on a transect and subdivided based on lithology. The results are shown on **Figures 2** and **3**, respectively, for the source areas and downgradient transects. The inputs are presented on **Tables 3** and **4**.

(M_d) **Mass Discharge**

Mass discharge M_d from each transect was calculated using Equation 1 by calculating the mass discharge for each subarea and summing the results as summarized on **Tables 3** and **4**. The total VOC mass discharge for the source areas and downgradient transects are approximately 380 mg/day and 24 mg/day, respectively.

REFERENCES

Domenico, P.A. and Schwartz, F.W 1998. Physical and Chemical Hydrogeology, second edition. John Wiley and Sons, Inc.

Freeze, R.A. and Cherry, J.A. 1979. Groundwater. Prentice-Hall Inc.

Geosyntec Consultants, Inc., 2012. Final Remedial Design Report Operable Unit 4, Source Areas, Cortese Landfill Site, Narrowsburg, New York, March.

Golder Associates, Inc., 1994. Revised Phase III Remedial Investigation Report, Cortese Landfill Site, Narrowsburg, New York, January.

Interstate Technology & Regulatory Council, 2010. Use and Measurement of Mass Flux and Mass Discharge. August.

TABLES

TABLE 1
SUMMARY OF TOTAL VOLATILE ORGANIC COMPOUND CONCENTRATION INPUTS

Cortese Landfill
Narrowsburg, New York

Operable Unit	Monitoring Well	Date Range	Number of Sampling Events Since 2004	Total Volatile Organic Compounds [1]		
				Minimum Concentration	Maximum Concentration	Mean Concentration [3]
OU4 (Source Areas)	MW-10	4/28/2004-10/21/2013	23	2.7	208	55
	MW-11	10/18/2007-10/21/2013	12	ND	171	20
	EX-1	4/28/2004-10/21/2013	22	988	24,277	7,060
	MW-1A [2]	NA	0	NA	NA	NA
	MW-1B	4/8/2004-10/21/2013	23	99	7,911	2,983
	MW-1C	4/28/2004-10/21/2013	23	1.7	1,801	165
	MW-20A	12/27/2011-10/21/2013	5	62	82	73
	MW-20B	12/27/2011-10/21/2013	5	18	985	291
	MW-8A [2]	NA	0	NA	NA	NA
	MW-8B [2]	NA	0	NA	NA	NA
OU3 (Downgradient Groundwater)	MW-5 [2]	NA	0	NA	NA	NA
	MW-19	4/17/2013-10/22/2013	2	60	220	140
	MW-18A	12/27/11-10/22/2013	5	ND	1.4	0.3
	MW-18B	12/27/11-10/22/2013	5	226	5,500	2,447
	MW-18C	12/27/11-10/22/2013	5	27	196	77
	MW-6A	4/28/2004-10/22/2013	27	205	770	538
	MW-6B	4/28/2004-10/22/2013	27	12	362	73
	MW-21	4/17/2013-10/22/2013	2	200	230	215
	MW-7B	4/28/2004-4/17/2013	11	4.2	84	40
	MW-7M	12/27/11-10/22/2013	5	41	64	52
	MW-7A	4/28/2004-4/17/2013	14	0.6	7.7	3.1
	MW-22	4/17/2013-10/22/2013	2	33	54	43.5
	MW-2A [2]	NA	0	NA	NA	NA
	MW-2B	4/28/2004-10/19/2011	23	0.6	152	21

Notes:

(1) All concentrations are in micrograms per liter

(2) Well has not been sampled since July 1997. Total VOC concentrations have historically been very low or non-detect.

(3) Value used as Cj in mass discharge calculation. For wells MW-5, MW-2A, MW-1A, MW-8A, and MW-8B the total VOC concentration was assumed to be zero. See Tables 3 and 4.

NA - Data not available. See Note 2.

ND - Not detected

OU - operable unit

TABLE 2
SUMMARY OF HYDRAULIC CONDUCTIVITY INPUTS

Cortese Landfill
Narrowsburg, New York

Operable Unit	Geologic Unit	Monitoring Well	K (cm/s) [1]	Mean K in Well (cm/s)	Mean K in OU [2]
OU4 - Source Areas Transect	Sand and Gravel	MW-10	4.3E-05	3.9E-05	2.7E-02
			3.4E-05		
		MW-1B	3.4E-02	3.4E-02	
			3.4E-02		
		MW-1C	9.2E-02	8.6E-02	
			7.9E-02		
		MW-8A	3.4E-03	5.7E-03	
			7.9E-03		
		MW-8B	1.1E-02	7.6E-03	
			7.9E-03		
			4.6E-03		
			6.7E-03		
	Silty Sand	NA	NA	NA	5.0E-04 [3]
	Clayey Silt	NA	NA	NA	1.0E-06 [3]
	Sand w/some Gravel	MW-1A	2.1E-04	2.3E-04	2.3E-04
			2.4E-04		
OU3 - Downgradient Transect	Sand and Gravel	MW-2B	7.4E-02	8.7E-02	4.8E-02
			9.9E-02		
		MW-5	9.1E-02	7.4E-02	
			5.7E-02		
		MW-6B	1.2E-03	1.3E-03	
			1.3E-03		
		MW-7B	3.2E-02	3.0E-02	
			2.8E-02		
	Silty Sand	NA	NA	NA	5.0E-04 [3]
	Clayey Silt	NA	NA	NA	1.0E-06 [3]
	Sand w/some Gravel	MW-2A	3.1E-03	3.4E-03	8.4E-03
			3.6E-03		
		MW-7A	1.3E-02	1.4E-02	
			1.1E-02		
			1.5E-02		
			1.5E-02		

Notes:
(1) Hydraulic conductivity value from slug test analysis presented in the Revised Phase III Remedial Investigation Report (Golder, 1994)
(2) Value used as K_j in mass discharge calculation. See Tables 3 and 4
(3) Assumed hydraulic conductivity. These values fall within the range of published values for the geologic material type (Domenico and Swartz, 1998; Freeze and Cherry, 1979).
K - hydraulic conductivity
OU - operable unit
cm/s - centimeters per second

TABLE 3
OPERABLE UNIT 4 TRANSECT TOTAL VOLATILE ORGANIC COMPOUND MASS DISCHARGE

Cortese Landfill
Narrowsburg, New York

Monitoring Well/Polygon	Total VOC Concentration (C_j) (1)		Geologic Material	Hydraulic Conductivity (K_j)	Area (A_j) (2)		Hydraulic Gradient (i_j)	Mass Discharge (M_{dj})
Units	µg/l	µg/cm^3 *	-	cm/sec *	ft^2	cm^2 *	cm/cm *	µg/sec
MW-10	55	0.055	Sand and Gravel	2.7E-02	1,848	1.7E+06	0.003	7.6E+00
	55	0.055	Silty Sand	5.0E-04	1,104	1.0E+06	0.003	8.5E-02
MW-11	20	0.02	Silty Sand	5.0E-04	11,266	1.0E+07	0.003	3.1E-01
	20	0.02	Clayey Silt	1.0E-06	70	6.5E+04	0.003	3.9E-06
	20	0.02	Sand w/ some Gravel	2.3E-04	357	3.3E+05	0.003	4.6E-03
EX-1	7,060	7.06	Sand and Gravel	2.7E-02	5,974	5.5E+06	0.003	3.2E+03
	7,060	7.06	Silty Sand	5.0E-04	2,371	2.2E+06	0.003	2.3E+01
MW-1A	0	0	Silty Sand	5.0E-04	3,955	3.7E+06	0.003	0.0E+00
	0	0	Clayey Silt	1.0E-06	370	3.4E+05	0.003	0.0E+00
	0	0	Sand w/ some Gravel	2.3E-04	3,647	3.4E+06	0.003	0.0E+00
MW-1B	2,983	2.983	Sand and Gravel	2.7E-02	4,340	4.0E+06	0.003	9.7E+02
	2,983	2.983	Silty Sand	5.0E-04	3,415	3.2E+06	0.003	1.4E+01
	2,983	2.983	Clayey Silt	1.0E-06	360	3.3E+05	0.003	3.0E-03
MW-1C	165	0.165	Sand and Gravel	2.7E-02	3,029	2.8E+06	0.003	3.8E+01
	165	0.165	Silty Sand	5.0E-04	883	8.2E+05	0.003	2.0E-01
MW-20A	73	0.073	Silty Sand	5.0E-04	9,263	8.6E+06	0.003	9.4E-01
	73	0.073	Sand w/ some Gravel	2.3E-04	4,556	4.2E+06	0.003	2.1E-01
MW-20B	291	0.291	Sand and Gravel	2.7E-02	5,766	5.4E+06	0.003	1.3E+02
	291	0.291	Silty Sand	5.0E-04	2,724	2.5E+06	0.003	1.1E+00
	291	0.291	Clayey Silt	1.0E-06	83	7.7E+04	0.003	6.7E-05
MW-8A	0	0	Clayey Silt	1.0E-06	868	8.1E+05	0.003	0.0E+00
	0	0	Sand and Gravel	2.7E-02	2,976	2.8E+06	0.003	0.0E+00
MW-8B	0	0	Sand and Gravel	2.7E-02	2,150	2.0E+06	0.003	0.0E+00
	0	0	Silty Sand	5.0E-04	1,740	1.6E+06	0.003	0.0E+00
	0	0	Sand w/ some Gravel	2.3E-04	1,159	1.1E+06	0.003	0.0E+00

Total Mass Dicharge (M_d)
4.4E+03 µg/sec
3.8E+02 mg/day

Notes:

(1) Micrograms per liter converted to micrograms per cubic centimeter by dividing by 1,000
(2) square feet converted to square centimeters by multiplying by 929
* The product of these columns in each row is M_{dj}
µg/l - micrograms per liter
µg/cm^3 - micrograms per cubic centimeter
cm/sec - centimeters per second
ft^2 - square feet
cm^2 - square centimeters
cm/cm - centimeters per centimeter
µg/sec - micrograms per second
mg/day - milligrams per day

TABLE 4
OPERABLE UNIT 3 TRANSECT TOTAL VOLATILE ORGANIC COMPOUND MASS DISCHARGE

Cortese Landfill
Narrowsburg, New York

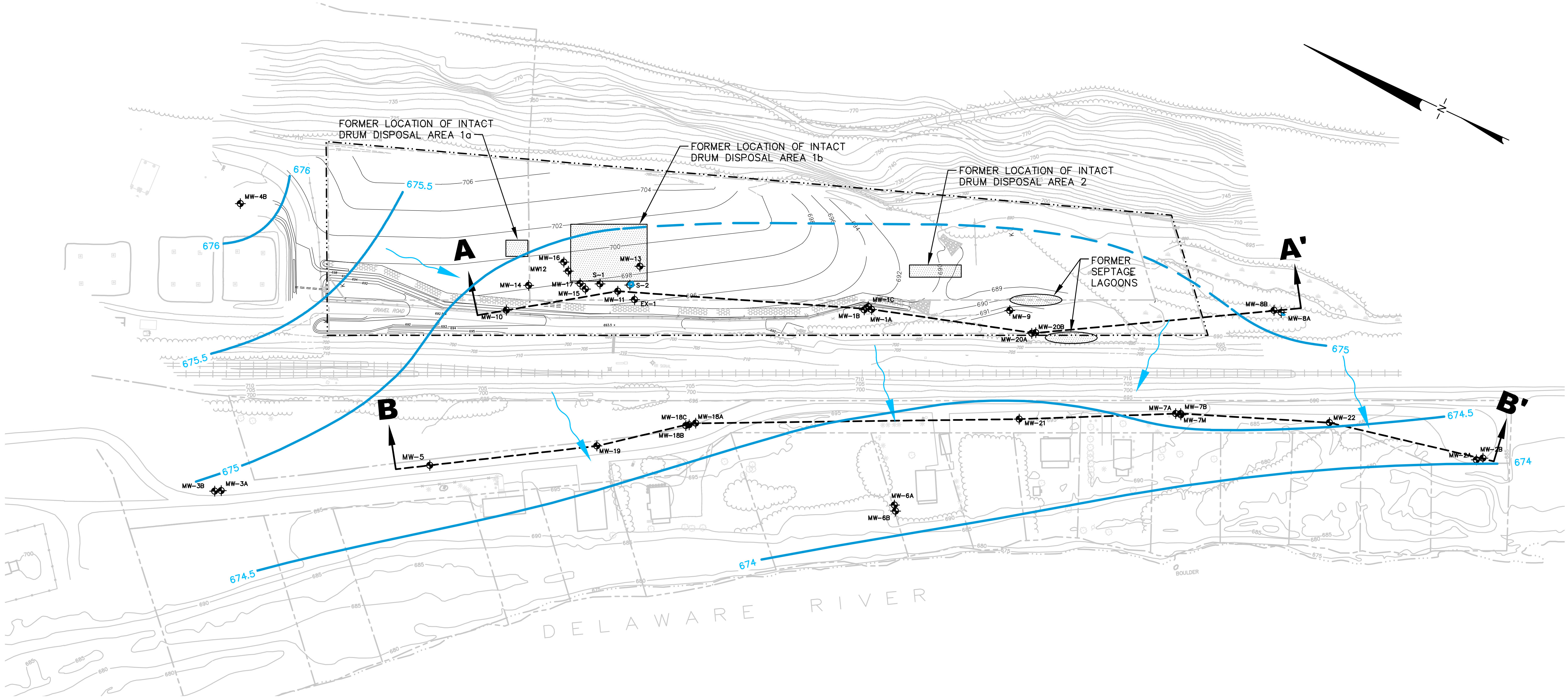
Monitoring Well/Polygon	Total VOC Concentration (C_j) (1)		Geologic Material	Hydraulic Conductivity (K_j)	Area (A_j) (2)		Hydraulic Gradient (i_j)	Mass Discharge (M_{dj})
Units	µg/l	µg/cm^3 *	-	cm/sec *	ft^2	cm^2 *	cm/cm *	µg/sec
MW-5	0	0	Sand and Gravel	4.8E-02	3,550	3.3E+06	0.003	0.0E+00
	0	0	Silty Sand	5.0E-04	959	8.9E+05	0.003	0.0E+00
	0	0	Clayey Silt	1.0E-06	556	5.2E+05	0.003	0.0E+00
MW-19	140	0.14	Sand and Gravel	4.8E-02	543	5.0E+05	0.003	1.0E+01
	140	0.14	Silty Sand	5.0E-04	9,471	8.8E+06	0.003	1.8E+00
	140	0.14	Clayey Silt	1.0E-06	88	8.2E+04	0.003	3.4E-05
	140	0.14	Sand w/ some Gravel	8.4E-03	3,372	3.1E+06	0.003	1.1E+01
MW-18A	0.3	0.0003	Clayey Silt	1.0E-06	289	2.7E+05	0.003	2.4E-07
	0.3	0.0003	Sand w/ some Gravel	8.4E-03	16,284	1.5E+07	0.003	1.1E-01
MW-18B	2,447	2.447	Silty Sand	5.0E-04	5,690	5.3E+06	0.003	1.9E+01
	2,447	2.447	Sand w/ some Gravel	8.4E-03	718	6.7E+05	0.003	4.1E+01
MW-18C	77	0.077	Sand and Gravel	4.8E-02	5,314	4.9E+06	0.003	5.5E+01
	77	0.077	Silty Sand	5.0E-04	509	4.7E+05	0.003	5.5E-02
MW-6A	538	0.538	Silty Sand	5.0E-04	4,227	3.9E+06	0.003	3.2E+00
	538	0.538	Sand w/ some Gravel	8.4E-03	5,790	5.4E+06	0.003	7.3E+01
	538	0.538	Clayey Silt	1.0E-06	38	3.5E+04	0.003	5.7E-05
MW-6B	73	0.073	Sand and Gravel	4.8E-02	3,185	3.0E+06	0.003	3.1E+01
	73	0.073	Silty Sand	5.0E-04	3,785	3.5E+06	0.003	3.9E-01
	73	0.073	Clayey Silt	1.0E-06	561	5.2E+05	0.003	1.1E-04
MW-21	215	0.215	Silty Sand	5.0E-04	7,630	7.1E+06	0.003	2.3E+00
	215	0.215	Clayey Silt	1.0E-06	719	6.7E+05	0.003	4.3E-04
	215	0.215	Sand w/ some Gravel	8.4E-03	1,523	1.4E+06	0.003	7.7E+00
MW-7A	3.1	0.0031	Clayey Silt	1.0E-06	2,571	2.4E+06	0.003	2.2E-05
	3.1	0.0031	Sand w/ some Gravel	8.4E-03	8,595	8.0E+06	0.003	6.2E-01
MW-7B	40	0.04	Sand and Gravel	4.8E-02	2,170	2.0E+06	0.003	1.2E+01
	40	0.04	Silty Sand	5.0E-04	400	3.7E+05	0.003	2.2E-02
	40	0.04	Clayey Silt	1.0E-06	4,860	4.5E+06	0.003	5.4E-04
MW-7M	52	0.052	Silty Sand	5.0E-04	5,203	4.8E+06	0.003	3.8E-01
	52	0.052	Clayey Silt	1.0E-06	3,815	3.5E+06	0.003	5.5E-04
MW-22	43.5	0.0435	Sand and Gravel	4.8E-02	221	2.1E+05	0.003	1.3E+00
	43.5	0.0435	Silty Sand	5.0E-04	12,680	1.2E+07	0.003	7.7E-01
	43.5	0.0435	Sand w/ some Gravel	8.4E-03	74	6.9E+04	0.003	7.5E-02
	43.5	0.0435	Clayey Silt	1.0E-06	1,364	1.3E+06	0.003	1.7E-04
MW-2A	0	0	Silty Sand	5.0E-04	4,032	3.7E+06	0.003	0.0E+00
	0	0	Sand w/ some Gravel	8.4E-03	7,524	7.0E+06	0.003	0.0E+00
MW-2B	21	0.021	Sand and Gravel	4.8E-02	3,873	3.6E+06	0.003	1.1E+01
	21	0.021	Silty Sand	5.0E-04	3,645	3.4E+06	0.003	1.1E-01
	21	0.021	Clayey Silt	1.0E-06	839	7.8E+05	0.003	4.9E-05

Total Mass Dicharge (M_d)
2.8E+02 µg/sec
2.4E+01 mg/day

Notes:

(1) Micrograms per liter converted to micrograms per cubic centimeter by dividing by 1,000
(2) square feet converted to square centimeters by multiplying by 929
* The product of these columns in each row is M_{dj}
µg/l - micrograms per liter
µg/cm^3 - micrograms per cubic centimeter
cm/sec - centimeters per second
ft^2 - square feet
cm^2 - square centimeters
cm/cm - centimeters per centimeter
µg/sec - micrograms per second
mg/day - milligrams per day

FIGURES



NOTES:

1. SEE FIGURE 2 FOR SECTION A–A' AND FIGURE 3 FOR SECTION B–B'.
2. GROUNDWATER ELEVATION CONTOURS ARE BASED ON "FIGURE 11, GROUNDWATER TABLE ELEVATION – NOVEMBER 2012, CORTESE LANDFILL SITE, NARROWSBURG, NEW YORK" IN THE INTERIM GROUNDWATER REMEDIAL ACTION REPORT (GEOSYNTEC CONSULTANTS, 2013).

LEGEND

- PROPERTY BOUNDARIES
- SITE BOUNDARY
- APPROXIMATE EDGE OF DELAWARE RIVER
- FENCE
- 750 PRE-EXISTING TOPOGRAPHY ELEVATION CONTOUR
- MONITORING WELL
- 675 GROUNDWATER ELEVATION CONTOUR (FEET-MSL)
- GROUNDWATER FLOW DIRECTION
- CROSS SECTION (NOTE 1)

150 75 0 150

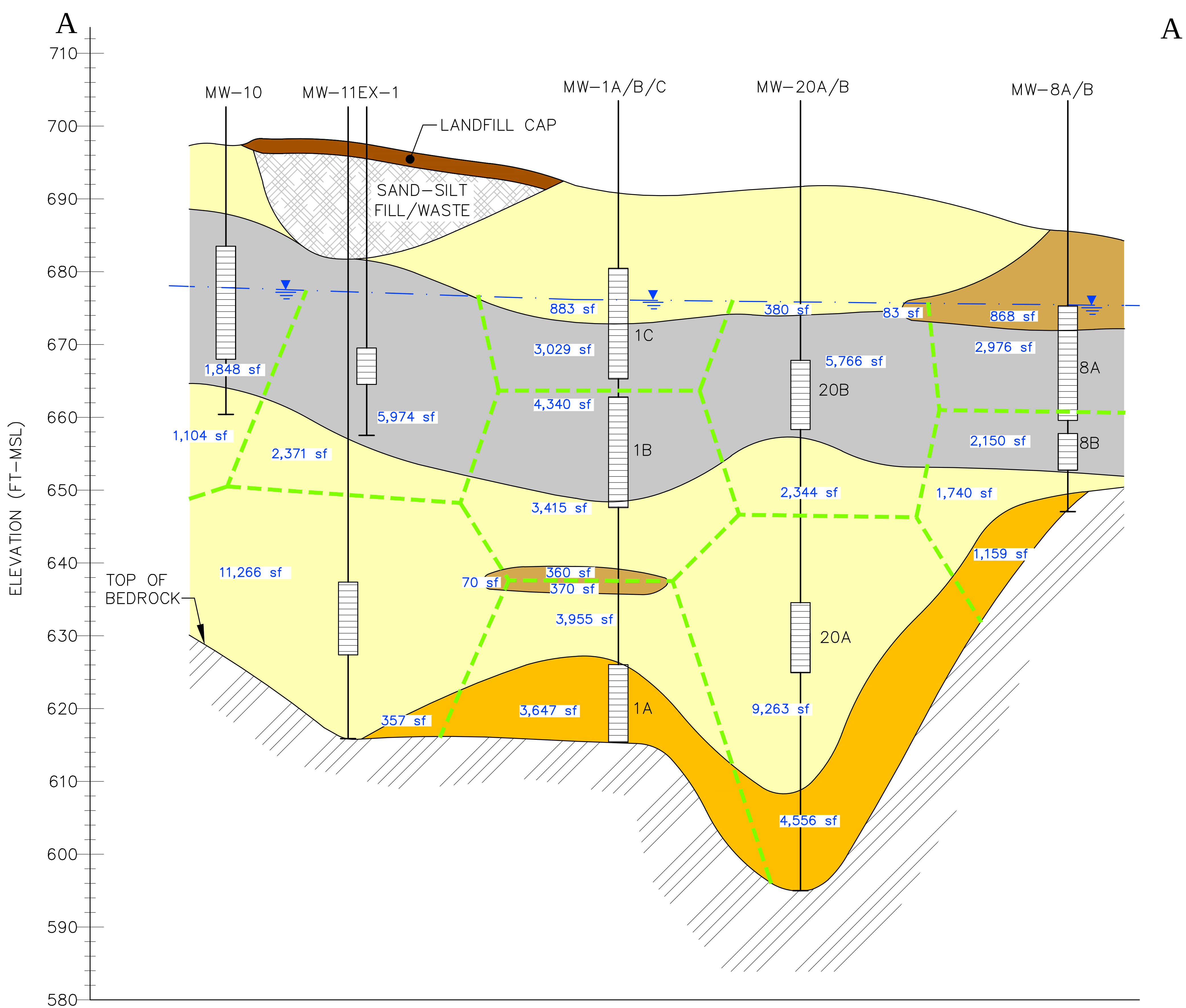
SCALE: 1" = 150'

COMBINED OU3 AND OU4 GROUNDWATER MONITORING NETWORK

CORTESE LANDFILL SITE
NARROWSBURG, NEW YORK

Geosyntec consultants
COLUMBIA, MARYLAND

DATE:	JULY 2013
PROJECT NO.	MR0562
DOCUMENT NO.	
FILE NO.	05621103
FIGURE NO.	1



LEGEND

WELL/SCREEN LOCATION

WATER TABLE

GRAVEL AND SAND

SILTY SAND/SANDY SILT

CLAYEY SILT

SAND WITH SOME GRAVEL

SF — SQUARE FT

NOTE:

1. LOCATION OF CROSS SECTION SHOWN ON FIGURE 1.
2. WELL CLUSTERS ARE SEPARATE COMPLETIONS IN SEPARATE BOREHOLES BUT SHOWN ON ONE WELL SYMBOL FOR CLARITY.
3. GEOLOGIC AND EXISTING WELL CONSTRUCTION DATA FROM GOLDER AND GEOSYNTEC (VARIOUS).
4. CONDITIONS MAY VARY FROM THAT SHOWN BETWEEN EXISTING BORINGS.

150 75 0 150

HORIZONTAL SCALE: 1" = 150'

15 7.5 0 15

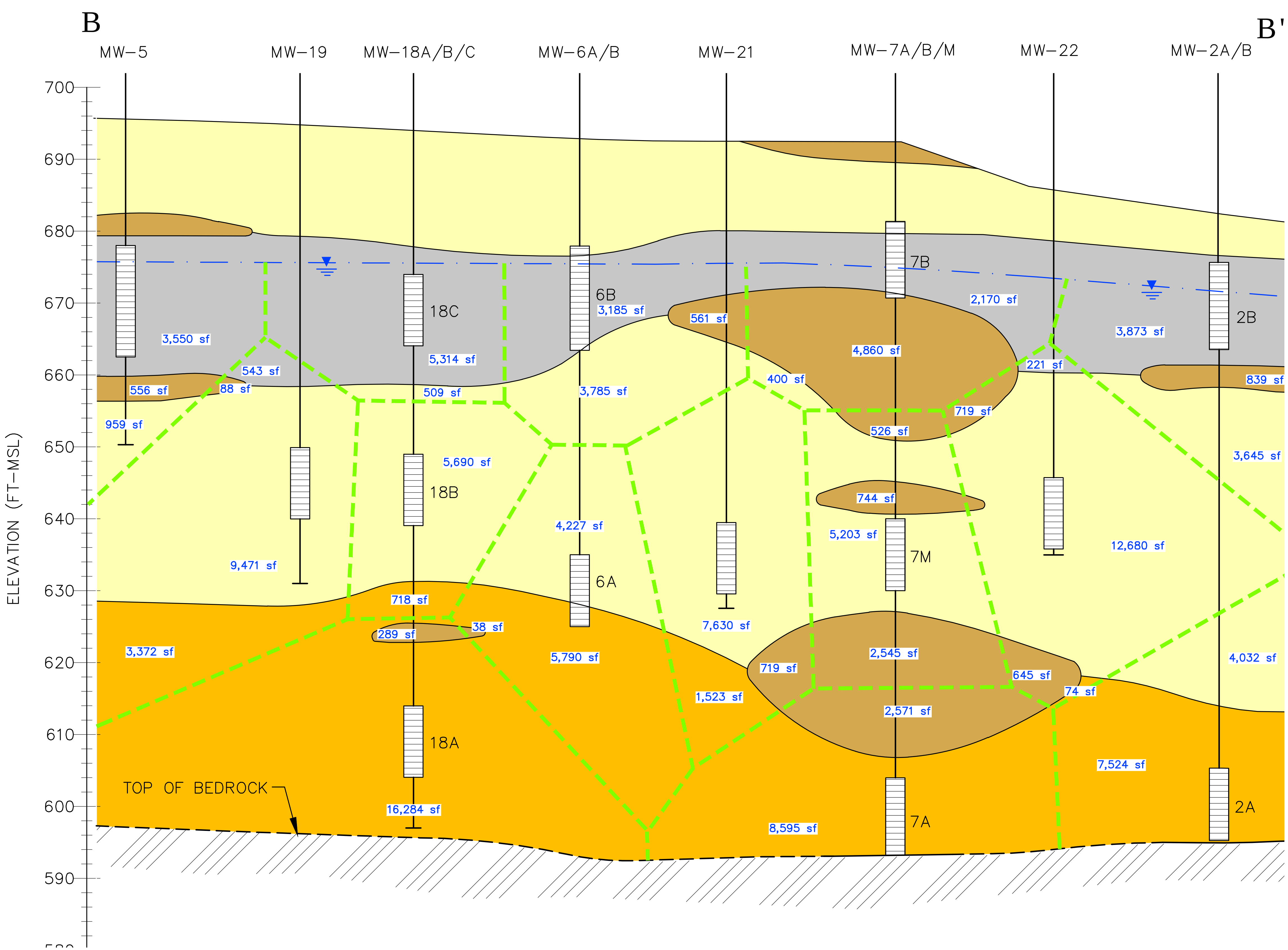
VERTICAL SCALE: 1" = 15'

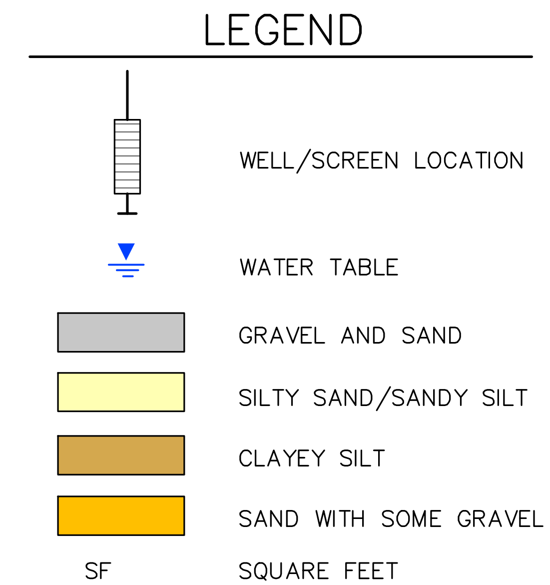
CROSS SECTION A–A' OF SOURCE AREAS TRANSECT

CORTESE LANDFILL SITE
NARROWSBURG, NEW YORK

Geosyntec consultants
COLUMBIA, MARYLAND

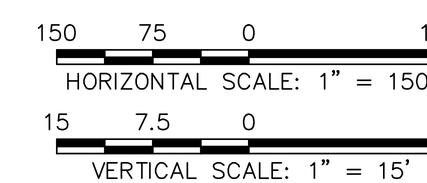
DATE:	JULY 2013
PROJECT NO.	MR0562
DOCUMENT NO.	
FILE NO.	05621102-3
FIGURE NO.	2





NOTES:

1. LOCATION OF CROSS SECTION SHOWN ON FIGURE 1.
2. WELL CLUSTERS ARE SEPARATE COMPLETIONS IN SEPARATE BOREHOLES BUT SHOWN ON ONE WELL SYMBOL FOR CLARITY.
3. GEOLOGIC AND EXISTING WELL CONSTRUCTION DATA FROM GOLDER AND GEOSYNTEC (VARIOUS).
4. CONDITIONS MAY VARY FROM THAT SHOWN BETWEEN EXISTING BORINGS.
5. MONITORING WELL PAIR MW–6A/6B ARE PROJECTED HORIZONTALLY TO CROSS–SECTION B–B'. THE SCREEN FOR MW–6A IS ALSO PROJECTED TO A SHALLOWER DEPTH IN ORDER TO MATCH THE DIVING PLUME CONCEPTUAL SITE MODEL.

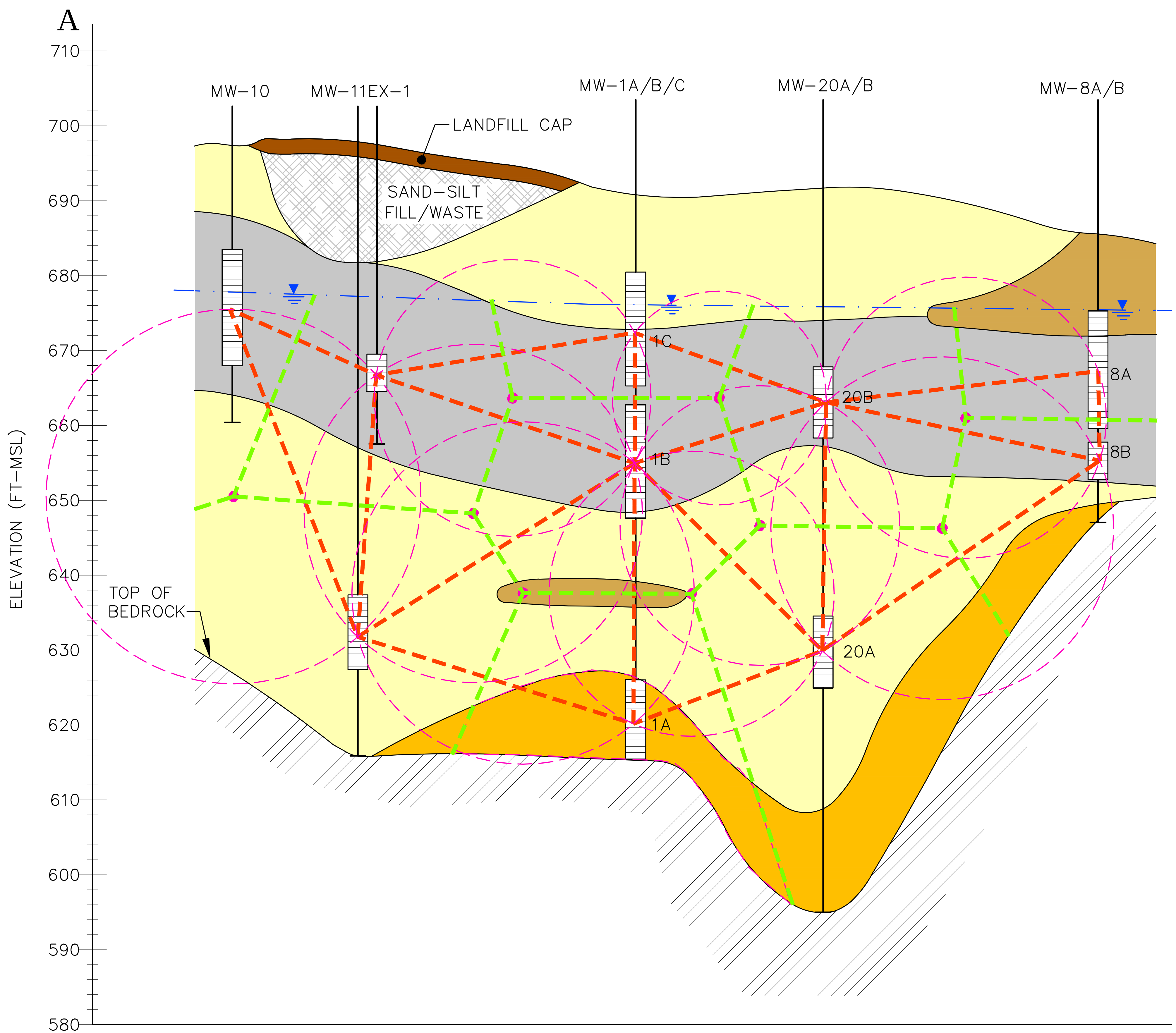


CROSS SECTION B–B' OF DOWNGRADIENT TRANSECT

CORTESE LANDFILL SITE
NARROWSBURG, NEW YORK

Geosyntec consultants
COLUMBIA, MARYLAND

DATE:	JULY 2014
PROJECT NO.	MR0562
DOCUMENT NO.	
FILE NO.	0562f1302–5
FIGURE NO.	3



LEGEND

- WELL/SCREEN LOCATION
- WATER TABLE
- GRAVEL AND SAND
- SILTY SAND/SANDY SILT
- CLAYEY SILT
- SAND WITH SOME GRAVEL
- CIRCUMSCRIBING CIRCLE
- DELAUNAY TRIANGULATION
- THIESSEN POLYGON
- CIRCLE CENTER

NOTE:

1. LOCATION OF CROSS SECTION SHOWN ON FIGURE 1.
2. WELL CLUSTERS ARE SEPARATE COMPLETIONS IN SEPARATE BOREHOLES BUT SHOWN ON ONE WELL SYMBOL FOR CLARITY.
3. GEOLOGIC AND EXISTING WELL CONSTRUCTION DATA FROM GOLDER AND GEOSYNTEC (VARIOUS).
4. CONDITIONS MAY VARY FROM THAT SHOWN BETWEEN EXISTING BORINGS.
5. DELAUNAY TRIANGLES WERE CONSTRUCTED FROM WELL SCREEN MIDPOINT.

150 75 0 150
HORIZONTAL SCALE: 1" = 150'

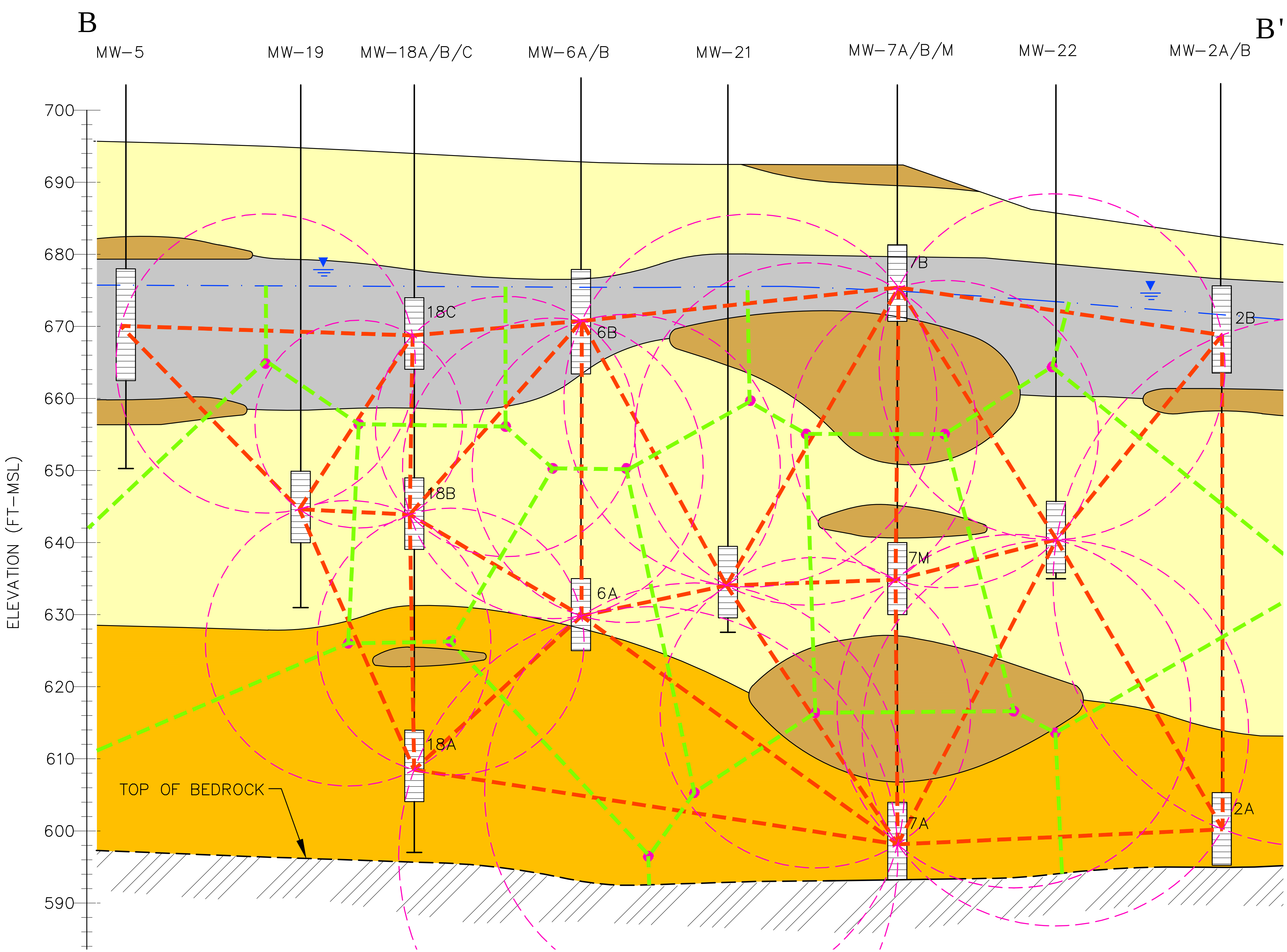
15 7.5 0 15
VERTICAL SCALE: 1" = 15'

DELAUNAY TRIANGULATION OF SOURCE AREAS TRANSECT

CORTESE LANDFILL SITE
NARROWSBURG, NEW YORK

Geosyntec consultants
COLUMBIA, MARYLAND

DATE:	JULY 2014
PROJECT NO.	MR0562
DOCUMENT NO.	
FILE NO.	0562f1302-5
FIGURE NO.	4



LEGEND

WELL/SCREEN LOCATION

WATER TABLE

GRAVEL AND SAND

SILTY SAND/SANDY SILT

CLAYEY SILT

SAND WITH SOME GRAVEL

CIRCUMSCRIBING CIRCLE

DELAUNAY TRIANGULATION

THIESSEN POLYGON

CIRCLE CENTER

NOTE:

1. LOCATION OF CROSS SECTION SHOWN ON FIGURE 1.
2. WELL CLUSTERS ARE SEPARATE COMPLETIONS IN SEPARATE BOREHOLES BUT SHOWN ON ONE WELL SYMBOL FOR CLARITY.
3. GEOLOGIC AND EXISTING WELL CONSTRUCTION DATA FROM GOLDER AND GEOSYNTEC (VARIOUS).
4. CONDITIONS MAY VARY FROM THAT SHOWN BETWEEN EXISTING BORINGS.
5. DELAUNAY TRIANGLES WERE CONSTRUCTED FROM WELL SCREEN MIDPOINT.
6. MONITORING WELL PAIR MW-6A/6B ARE PROJECTED HORIZONTALLY TO CROSS-SECTION B-B'. THE SCREEN FOR MW-6A IS ALSO PROJECTED TO A SHALLOWER DEPTH IN ORDER TO MATCH THE DIVING PLUME CONCEPTUAL SITE MODEL.

150 75 0 150

HORIZONTAL SCALE: 1" = 150'

15 7.5 0 15

VERTICAL SCALE: 1" = 15'

DELAUNAY TRIANGULATION OF DOWNGRADIENT TRANSECT

CORTESE LANDFILL SITE
NARROWSBURG, NEW YORK

Geosyntec consultants
COLUMBIA, MARYLAND

DATE:	JULY 2014
PROJECT NO.	MR0562
DOCUMENT NO.	
FILE NO.	0562f1302-5
FIGURE NO.	5

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APPENDIX B-2

MR0562F – CORTESE LANDFILL
ORP SHOCK CALCULATION PACKAGE

Geosyntec consultants

COMPUTATION COVER SHEET

Client: Cortese PRP Group **Project:** Cortese **Project #:** MR0562B **Task #:** 03

TITLE OF COMPUTATIONS HYDROGEN PEROXIDE REQUIRED FOR REDOX "SHOCK"

COMPUTATIONS BY:

Signature

Date

Printed Name and Title: Lauren Wellborn, Staff Engineer

ASSUMPTIONS AND PROCEDURES CHECKED BY: (Peer Reviewer)

Signature

Date

Printed Name and Title: Aron Krasnopoler, Project Engineer

COMPUTATIONS CHECKED BY:

Signature

Date

Printed Name and Title: Aron Krasnopoler, Project Engineer

COMPUTATIONS BACKCHECKED BY: (Originator)

Signature

Date

Printed Name and Title: Lauren Wellborn, Staff Engineer

APPROVED BY: (PM or Designate)

Signature

Date

Printed Name and Title: Robert Glazier, Associate

APPROVAL NOTES:

REVISIONS (Number and initial all revisions)

NO.	SHEET	DATE	BY	CHECKED BY	APPROVAL

HYDROGEN PEROXIDE REQUIRED FOR REDOX "SHOCK"

PURPOSE

An array of air sparging wells (ASWs) will be installed throughout former source areas at the Cortese NPL Site to deliver air to the saturated zone in order to promote volatilization and aerobic biodegradation. In order to mitigate the potential for iron fouling (i.e., iron precipitate crusting) of the ASWs, an initial application of hydrogen peroxide may be performed to rapidly change (i.e., shock) the groundwater redox regime from anaerobic to aerobic if the redox regime does not become aerobic in a short period of time after sparging begins. This is more likely to occur in the former IDDA 1b source area based on historical iron and manganese concentrations (Geosyntec, 2011). A total of 37 ASWs are planned for the former IDDA 1b source area with an assumed air sparging radius of influence (ROI) of 15 feet and a well spacing of 25 feet. The purpose of this calculation is to determine the dose of hydrogen peroxide required to meet the oxygen demand within one pore volume of the former IDDA 1b source treatment area. Spreadsheets of data used in the calculations are included at the end.

PROCEDURE

Pore volume calculation

As indicated by Figure 1, a cylindrical configuration of the influence zone for each injection well is assumed. The objective of the injection step is to dose sufficient peroxide to meet the chemical oxygen demand (COD) in the pore space of the treatment area.

The pore volume of groundwater can be calculated as

$$V = \varepsilon \cdot \pi \cdot r^2 \cdot h$$

Where V is the pore volume (ft^3), ε is the effective porosity, r (ft) is the influence radius, and h (ft) is the plume height at the injection well location. We estimate the average value of r as 15 ft and h as 5 ft based on the proposed screen interval of 2 feet.. The calculated pore volume is 1060 ft^3 or 30,015 L.

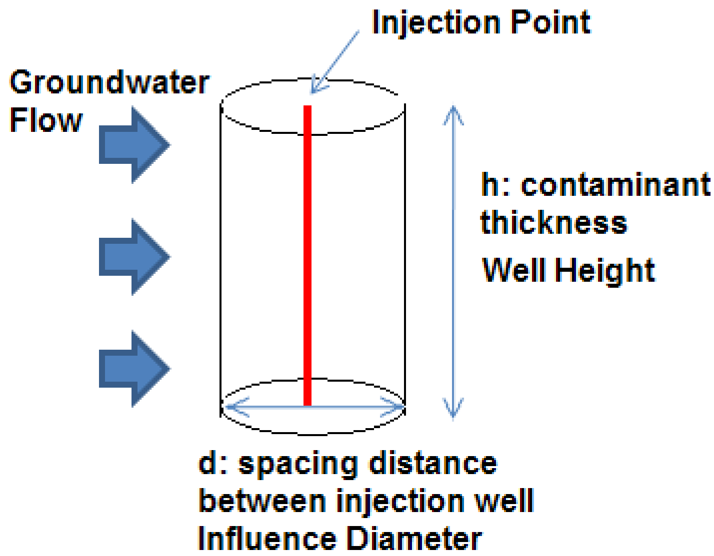


Figure 1: Conceptual Model of Injection Influence Zone

Oxygen Demand

In order to achieve aerobic conditions in the aquifer, we need to supply enough oxygen for aqueous-phase contaminant degradation and other untargeted consumption. Note that other significant non-aqueous source of oxygen demand, including NAPL and aquifer solids, are not included in this calculation since the intent is for a short-term “instantaneous” shock to the aqueous phase geochemical environment that is assumed to be sustained by subsequent air sparge operation. The major components of aqueous-phase oxygen demand in the source area are reduced forms of iron and manganese, which are oxidized according to the following equations:

$$4Fe^{2+} + 3O_2 + 8e^- = 2Fe_2O_3$$
$$Mn^{2+} + O_2 + 2e^- = MnO_2$$

Other organic compounds in groundwater will be oxidized simultaneously. Therefore, chemical oxygen demand (COD) is likely more representative of the total oxygen demand than iron and manganese.

Table 1 lists the sampling results for iron, manganese and COD in representative wells in the former IDDA 1b source area. The following equations were used to determine the oxygen demand for iron, manganese and COD. The results from these calculations are also provided in Table 1.

- Oxygen demand from iron: [$O_{2,\ Fe}$] (mg/L)
  Molecular Weight of Fe = 55.85 gram/mol
  [$O_{2,\ Fe}$] (mg/L) = [Fe^{2+}]g/L * mol Fe/g Fe * 3mol O_2/4mol Fe * 32g O_2/mol O_2 * 1g/1000mg

- Oxygen demand from manganese: [$O_{2,Mn}$] (mg/L)
  Molecular Weight of Mn = 54.94 gram/mol
  [$O_{2,Mn}$] (mg/L) = [Mn^{2+}]g/L * mol Mn/g Mn * mol O_2/mol Mn * 32g O_2/mol O_2 * 1g/1000mg

- Oxygen demand from COD : [$O_{2,\ COD}$] (mg/L)
  [$O_{2,\ COD}$] (mg/L) = [COD]

COD includes the oxygen demand from iron and manganese. Table 1 illustrates that approximately 20% of the oxygen demand is supplied by iron. Total oxygen demand will be considered to be equivalent to the COD.

Table 1 Representative Chemical Concentrations

	Fe	Mn	**COD**
Average Concentration (mg/L)	63.3	13.5	**125.6**
Oxygen Demand Per Component (mg O_2/L)	27.2	7.9	**125.6**
H_2O_2 Demand Per Component (mg O_2/L)	57.8	16.7	**267.0**

Note: Average monitoring data between May and October 2010 for Ex-1, S-1 and S-2
Molecular Weight: Fe – 55.8 g/mol; Mn - 54.94 g/mol; O_2 - 32.00 g/mol; H_2O_2 – 34.02 g/mol

Hydrogen Peroxide Dosing

Oxygen demand will be supplied using hydrogen peroxide. Oxygen is released by the decomposition of hydrogen peroxide as follows:

$$2H_2O_2 = 2\ H_2O + O_2$$

- [$H_2O_{2,\ Fe}$] (mg/L) = [O_2 Demand]g/L * mol O_2/32g O_2 * 2mol H_2O_2/mol O_2 * 34.02g H_2O_2/molH_2O_2 * 1g/1000mg

Table 1 illustrates the peroxide required to meet the oxygen demand. Complete conversion of hydrogen peroxide to oxygen is assumed.

Peroxide Requirements

The peroxide demand will be used to calculate the mass of H_2O_2 necessary to provide oxygen to area IDDA1B on a per well basis.

The total peroxide requirements per well are calculated by

$$m = V_1*C$$

Where m is the mass of H_2O_2 required, V_1 is the pore volume and C is the concentration of peroxide demanded.

$$m = (30{,}015 \text{ L})(267 \text{ mg//L}) = 8 \text{ kg}$$

With a factor of safety of 15%, the mass of H_2O_2 is

$$m = 1.15*(8 \text{ kg}) = 9.2 \text{ kg}$$

The required mass of peroxide per well is 8 kg. With a 15% safety factor, total mass is 9.2 kg/well. For the 37 wells in IDDA1b, a total of 340 kg of peroxide will be required.

The required volume of peroxide depends on the concentration of the H_2O_2 solution. Dilute solutions (3-10% by weight) will be considered for safety in handling and to minimize potential effects of heat and corrosion on the well materials. Table 2 lists the required volume of peroxide per well and the total required volume for 3% and 10% H_2O_2 solutions.

Table 2 Required H2O2 Dosing Volume

H_2O_2 Concentration (% by wt)	3	10
Density (kg/m^3)[1]	30	104
Dosing volume per well (L)	307	88
Total Dosing Volume (m^3)	11	3.3
Dosing time per well (min)	77	22
Total Dosing Time (hr)	47	14

For peroxide concentrations of 3%, the volume of peroxide solution required to meet the oxygen demand in IDDA1B is approximately 34 m^3. For a peroxide concentration of 10%, the volume of peroxide required is approximately 10 m^3.

[1] Hydrogen Peroxide Handling & Storage, http://www.solvaychemicals.com/Chemicals%20Literature%20Documents/Peroxygen/H2O2/h202_handling_and_storage_english.pdf

Dosing Time

The dosing time (t_1) required to deliver a given volume (V_2) at a given injection I can be expressed as:

$$t_1 = V_2/I$$

where I (gpm) is the injection rate, t_1 is the injection duration, V_2 is the volume of peroxide solution required. I is assumed to be 4 liters per minute (lpm). Per well and overall dosing times are presented in Table 2 for 3% and 10% H_2O_2 solutions.

APPENDIX C

As-Built Drawings

LEGEND

- PROPERTY BOUNDARY
- SITE BOUNDARY
- FENCE
- ELEVATION CONTOUR
- GV-1 PASSIVE GAS VENT
- PZ-1 PIEZOMETER
- GROUNDWATER MONITORING WELL
- SOIL BORING
- AIR SPARGING WELL
- SOIL VAPOR EXTRACTION WELL
- ABOVE GROUND PIPING
- UNDERGROUND PIPING
- GRAVEL UNDERLAIN WITH GEOTEXTILE

NOTES

1. BASED ON SOIL SAMPLING RESULTS DURING AIR SPARGING WELL INSTALLATION IN THE IDDA2 AND SEPTAGE LAGOON AREA, ACTIVE TREATMENT WAS DETERMINED TO BE UNNECESSARY. THE CONCRETE PAD FOR THIS AREA WAS NOT CONSTRUCTED.

50 25 0 50 100
SCALE IN FEET

REV	DATE	DESCRIPTION	DRN	APP

Geosyntec consultants
10220 OLD COLUMBIA ROAD, SUITE A
COLUMBIA, MARYLAND 21046 USA
PHONE: 410.381.4333

CORTESE LANDFILL PRP GROUP
NARROWSBURG, NEW YORK

TITLE:
SITE PLAN

PROJECT:
AS-BUILT SOURCE AREA REMEDIAL ACTION

SITE:
CORTESE LANDFILL NARROWSBURG, NEW YORK

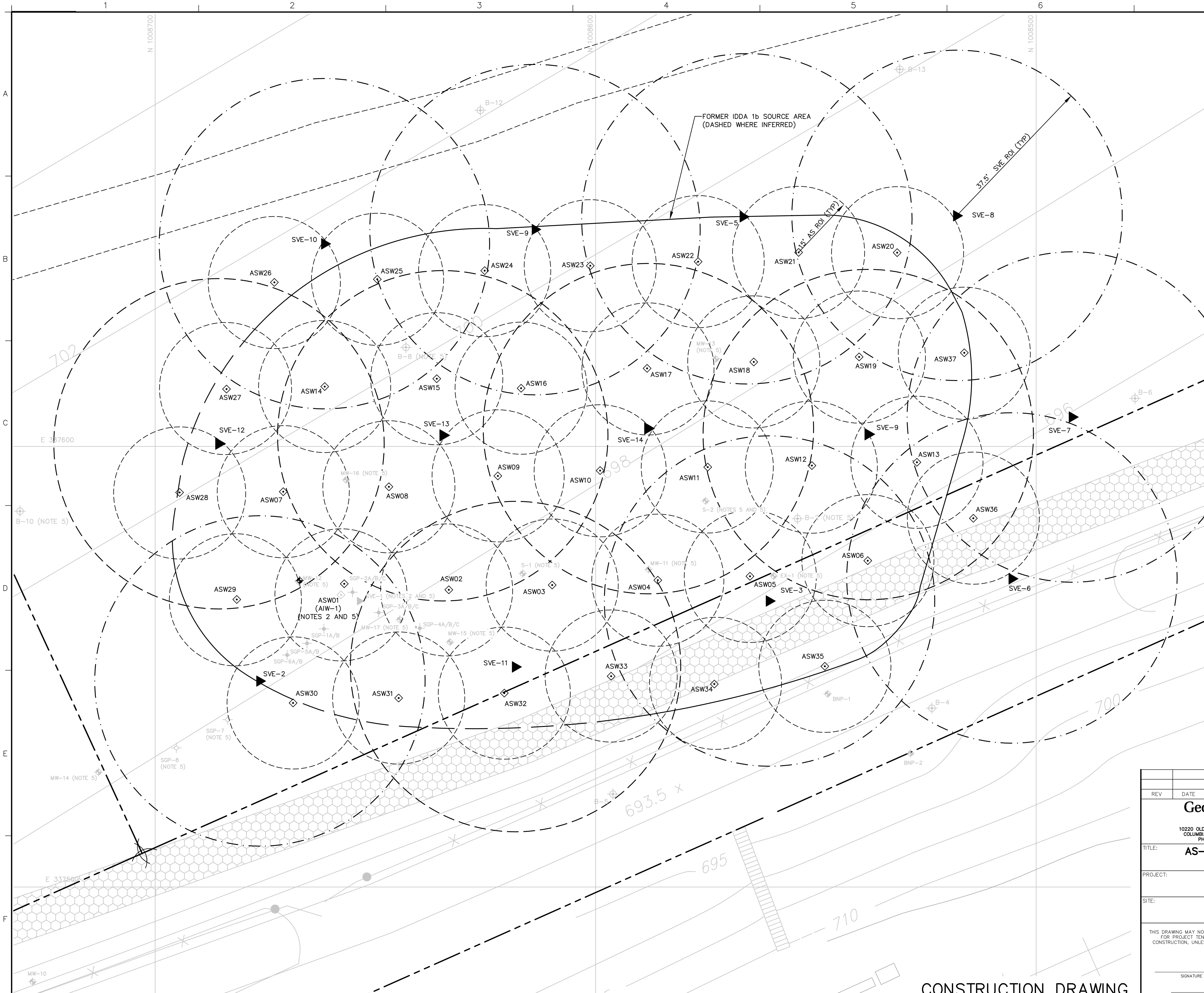
THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

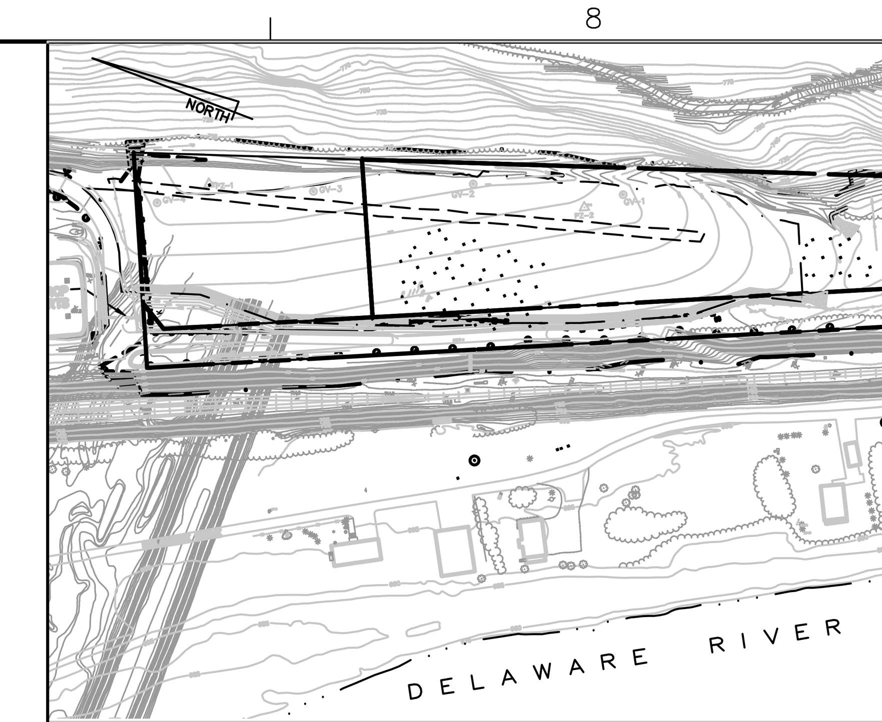
SIGNATURE

DATE

DESIGN BY:	AK	DATE:	SEPTEMBER 2013
DRAWN BY:	TSJ	PROJECT NO.:	MR0562B
CHECKED BY:	KWH	FILE:	0562-7c02
REVIEWED BY:	RMG	DRAWING NO.:	
APPROVED BY:	AK		G02

CONSTRUCTION DRAWING





LOCATION MAP

SCALE: 1" = 200'

NORTH

LEGEND

- LANDFILL PROPERTY BOUNDARY
- ELEVATION CONTOUR
- GROUNDWATER MONITORING WELL
- SINGLE SOIL GAS PROBE
- NESTED SOIL GAS PROBE
- SOIL BORING
- AS-BUILT AIR SPARGING WELL (ASW-01)
- AS-BUILT SOIL VAPOR EXTRACTION WELL (SVE-2)
- AIR SPARGING RADIUS OF INFLUENCE (AS ROI)
- SOIL VAPOR EXTRACTION RADIUS OF INFLUENCE (SVE ROI)

NOTES:

1. SEE DRAWING G02 FOR EXISTING SITE CONDITIONS DETAILS.
2. AIR SPARGING WELL ASW01 (AIW-1) AND SOIL VAPOR EXTRACTION WELLS SVE-1 AND SVE-2 WERE INSTALLED IN DECEMBER 2010 AS PART OF THE AS/SVE PILOT TEST. SVE-1 WILL NOT BE USED. ALL OTHER AIR SPARGING AND SOIL VAPOR EXTRACTION WELLS WERE INSTALLED DURING REMEDIAL CONSTRUCTION.
3. THE AS ROI AND SVE ROI ARE BASED ON THE RESULTS OF THE AS/SVE PILOT TEST CONDUCTED IN MARCH 2011 BY GEOSYNTEC CONSULTANTS, INC.
4. NO TREATMENT IS NECESSARY AT THE LOCATION OF FORMER IDDA 1a.
5. GEOSYNTHETIC CAP WAS REPAIRED AT SOIL BORING AND EXISTING WELL LOCATIONS. CAP REPAIRS AT WELL LOCATIONS INCLUDED INSTALLATION OF HDPE BOOT AND SKIRT. ALL OTHER AIR SPARGING AND SOIL VAPOR EXTRACTION WELLS THAT PENETRATED THE GEOSYNTHETIC CAP WERE COMPLETED WITH A HDPE BOOT AND SKIRT.

10 5 0 10 20

SCALE IN FEET

REV	DATE	DESCRIPTION	DRN	APP

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PHONE: 410.381.4333

CORTESE LANDFILL PRP GROUP

NARROWSBURG, NEW YORK

TITLE: AS-BUILT PLAN VIEW OF TARGET TREATMENT AREA – FORMER IDDA 1b

PROJECT: AS-BUILT SOURCE AREA REMEDIAL ACTION

SITE: CORTESE LANDFILL
NARROWSBURG, NEW YORK

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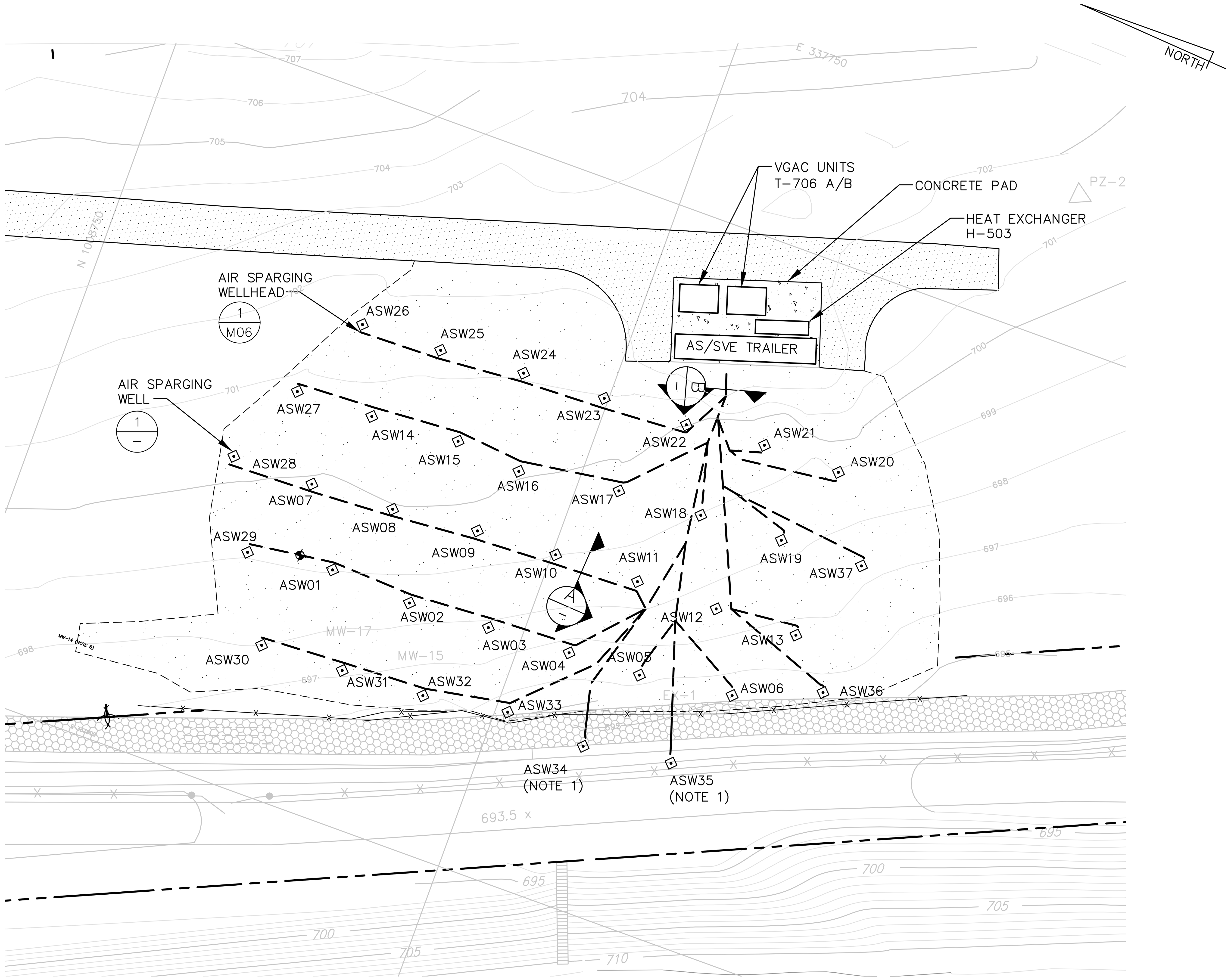
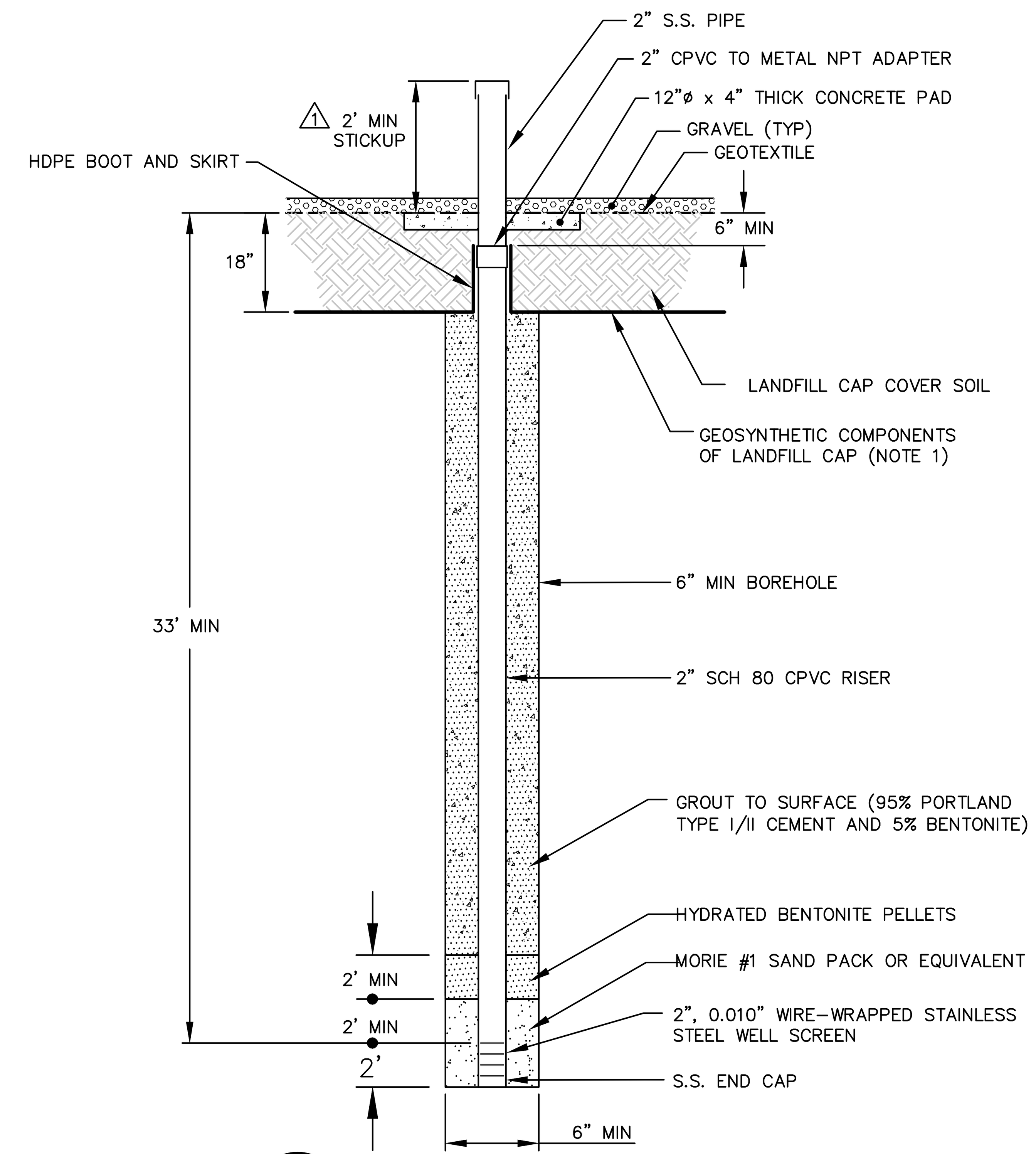
SIGNATURE

DATE

DESIGN BY:	AK	DATE:	SEPTEMBER 2013
DRAWN BY:	TSJ	PROJECT NO.:	MR0562B
CHECKED BY:	KWH	FILE:	0562-7G03
REVIEWED BY:	RMG	DRAWING NO.:	G03
APPROVED BY:	AK		

CONSTRUCTION DRAWING

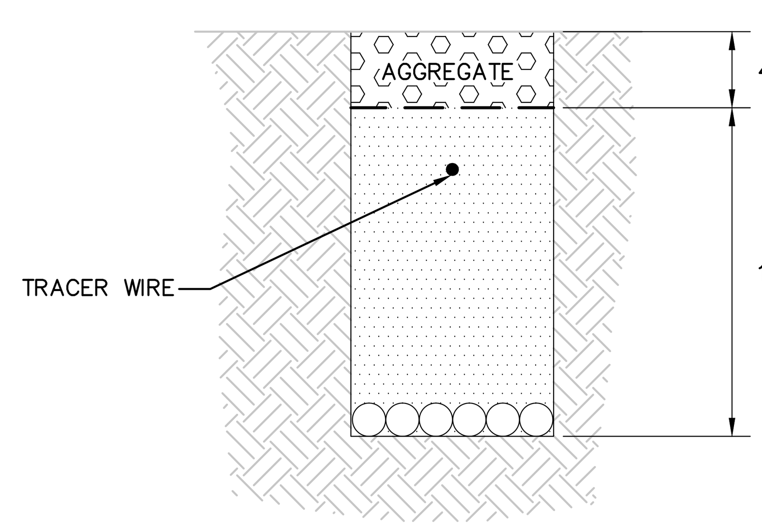




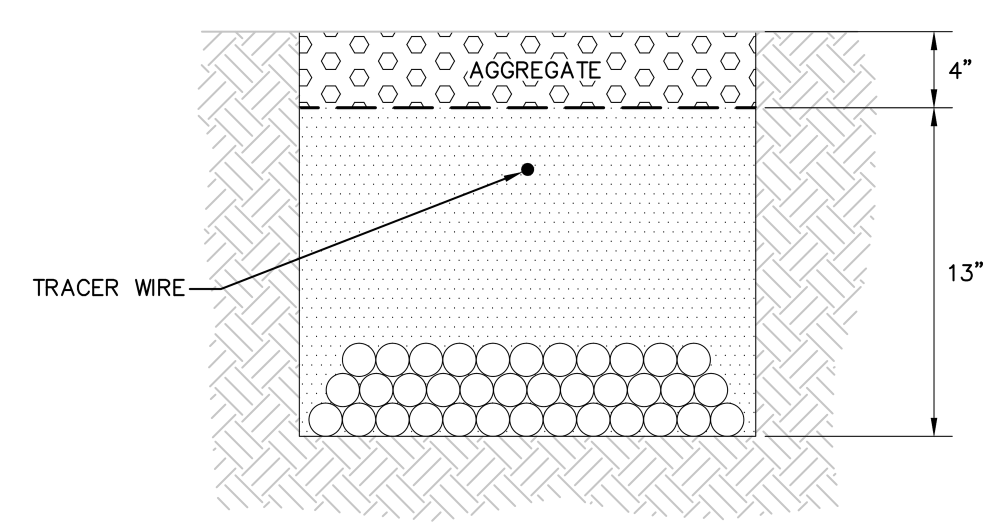
1 – DETAIL
AIR SPARGING WELL INSTALLATION
SCALE: NTS

NOTES:

1. AIR SPARGING PIPING WAS INSTALLED IN SHALLOW TRENCHES, PIPE SUPPORTS WERE NOT REQUIRED EXCEPT TO CROSS THE STORMWATER DIVERSION CHANNEL.



A – SECTION
AIR SPARGING TRENCH
SCALE: 1" = 0.5'



B – SECTION
AIR SPARGING TRENCH
SCALE: 1" = 0.5'

LEGEND

- LANDFILL PROPERTY BOUNDARY
- FENCE
- EXISTING GROUND ELEVATION CONTOUR
- AS-BUILT AIR SPARGING WELL
- ABOVE GROUND AIR DISTRIBUTION PIPING
- UNDERGROUND AIR DISTRIBUTION PIPING
- STONE UNDERLAIN WITH GEOTEXTILE

CONSTRUCTION DRAWING

REV	DATE	DESCRIPTION	DRN	APP

Geosyntec consultants
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COLUMBIA, MARYLAND 21046 USA
PHONE: 410.381.4333

CORTESE LANDFILL PRP GROUP
NARROWSBURG, NEW YORK

TITLE: AS-BUILT AIR DISTRIBUTION PIPING

PROJECT: AS-BUILT SOURCE AREA REMEDIAL ACTION

SITE: CORTESE LANDFILL
NARROWSBURG, NEW YORK

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DATE

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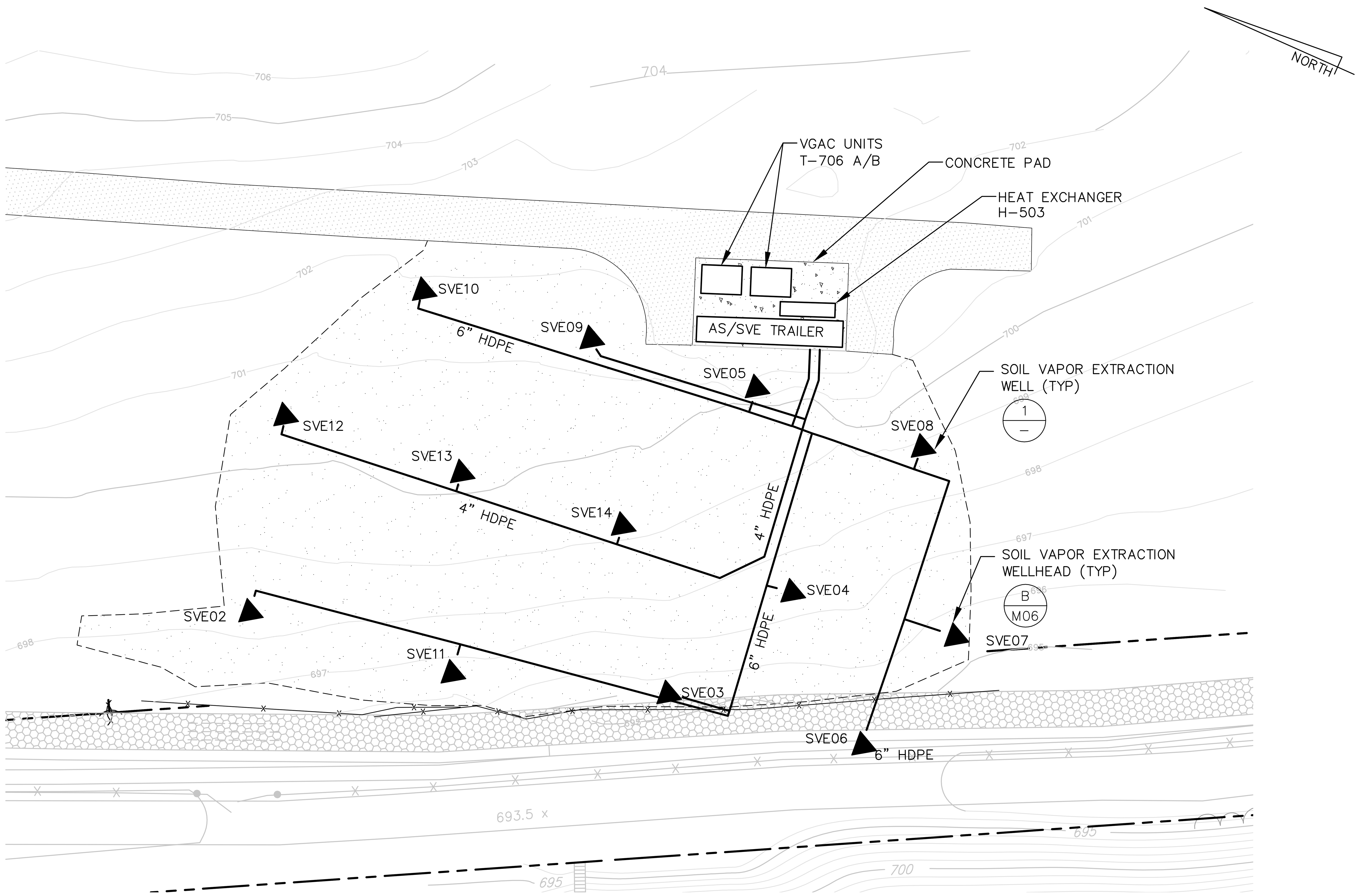
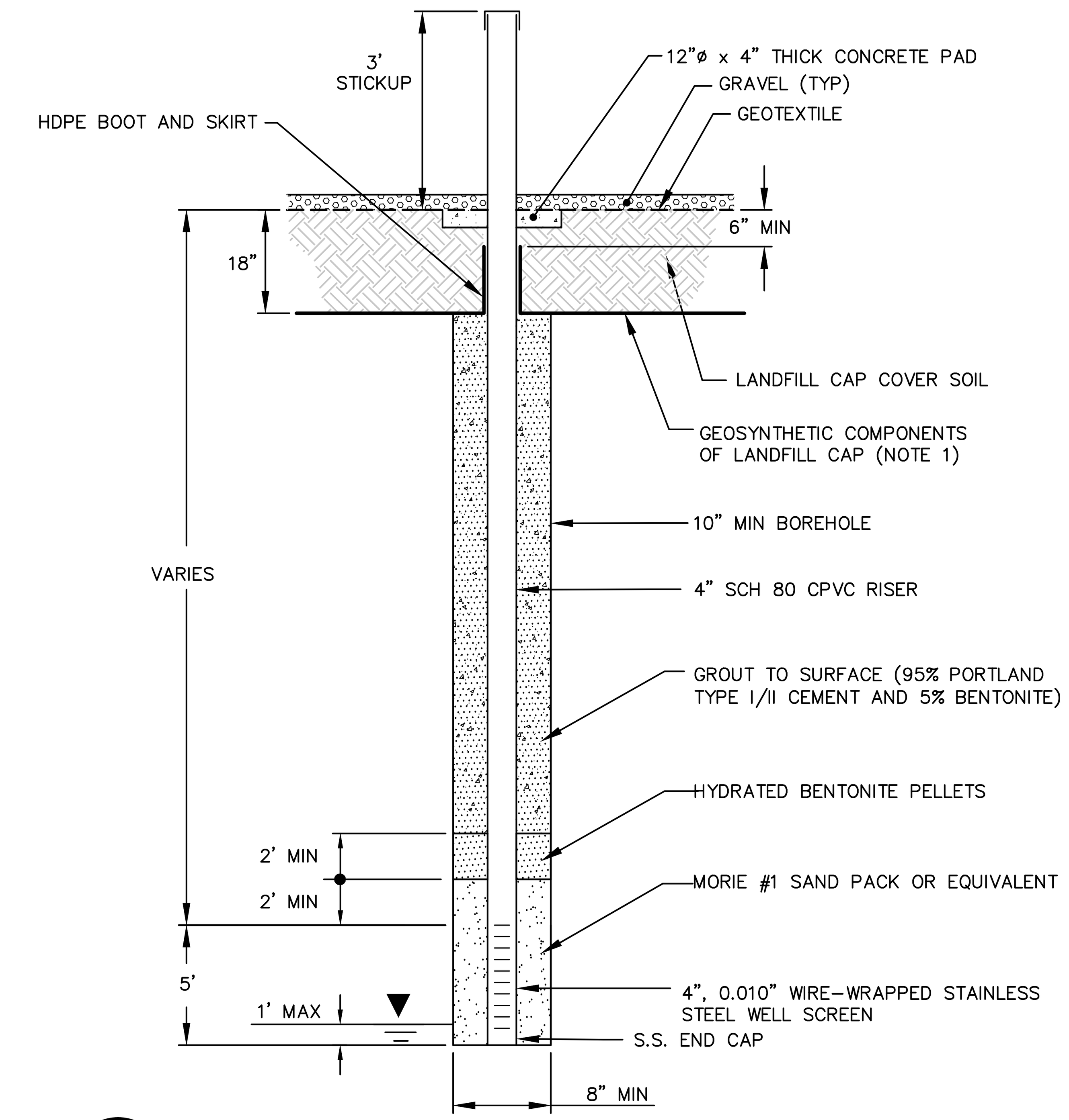
DRAWN BY:	TSJ	PROJECT NO.:	MR0562B
CHECKED BY:	KWH	FILE:	0562-7c04r1
REVIEWED BY:	RMG	DRAWING NO.:	
APPROVED BY:	AK		C04





1
–
DETAIL
SOIL VAPOR EXTRACTION VENT INSTALLATION
SCALE: NTS

NOTES:

1. EXISTING SITE CONDITIONS FROM FIGURE 2 "SITE PLAN, CORTESE LANDFILL CERCLA SITE, NARROWSBURG, NEW YORK" BY GOLDER ASSOCIATES, DATED 24 JANUARY 2008.

25 12.5 0 25 50
SCALE IN FEET

LEGEND

- LANDFILL PROPERTY BOUNDARY
- FENCE
- ELEVATION CONTOUR
- AS-BUILT SOIL VAPOR EXTRACTION WELL
- GRAVEL UNDERLAIN WITH GEOTEXTILE
- AS-BUILT SVE DISTRIBUTION PIPING

REV	DATE	DESCRIPTION	DRN	APP

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10220 OLD COLUMBIA ROAD, SUITE A
COLUMBIA, MARYLAND 21046 USA
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CORTESE LANDFILL PRP GROUP
NARROWSBURG, NEW YORK

TITLE: **SOIL VAPOR EXTRACTION DISTRIBUTION PIPING**

PROJECT: **AS-BUILT SOURCE AREA REMEDIAL ACTION**

SITE: **CORTESE LANDFILL NARROWSBURG, NEW YORK**

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DATE

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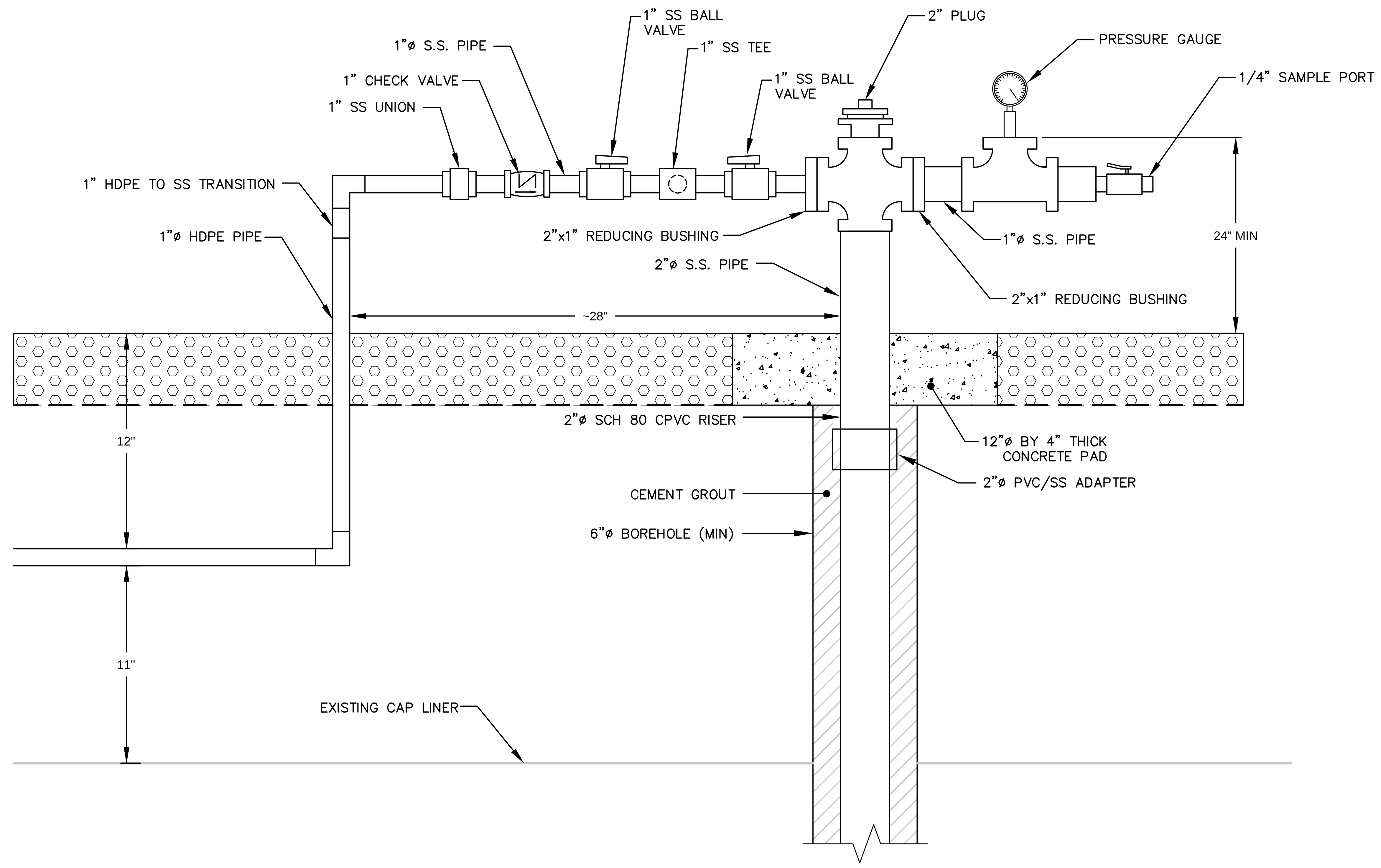
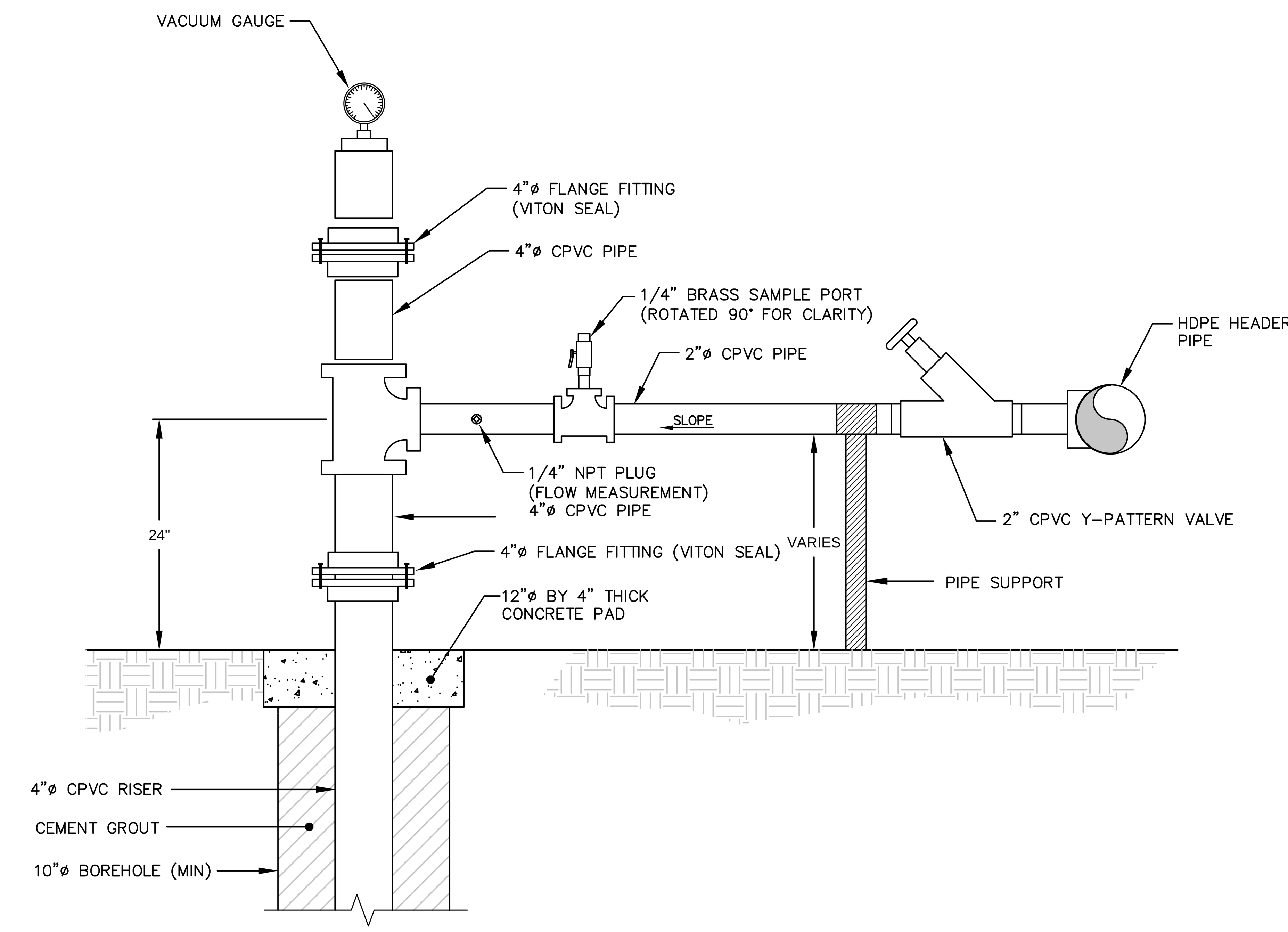
DRAWN BY:	TSJ	PROJECT NO.:	MR0562B
CHECKED BY:	KWH	FILE:	0562-7c05r1
REVIEWED BY:	RMG	DRAWING NO.:	
APPROVED BY:	AK		C05

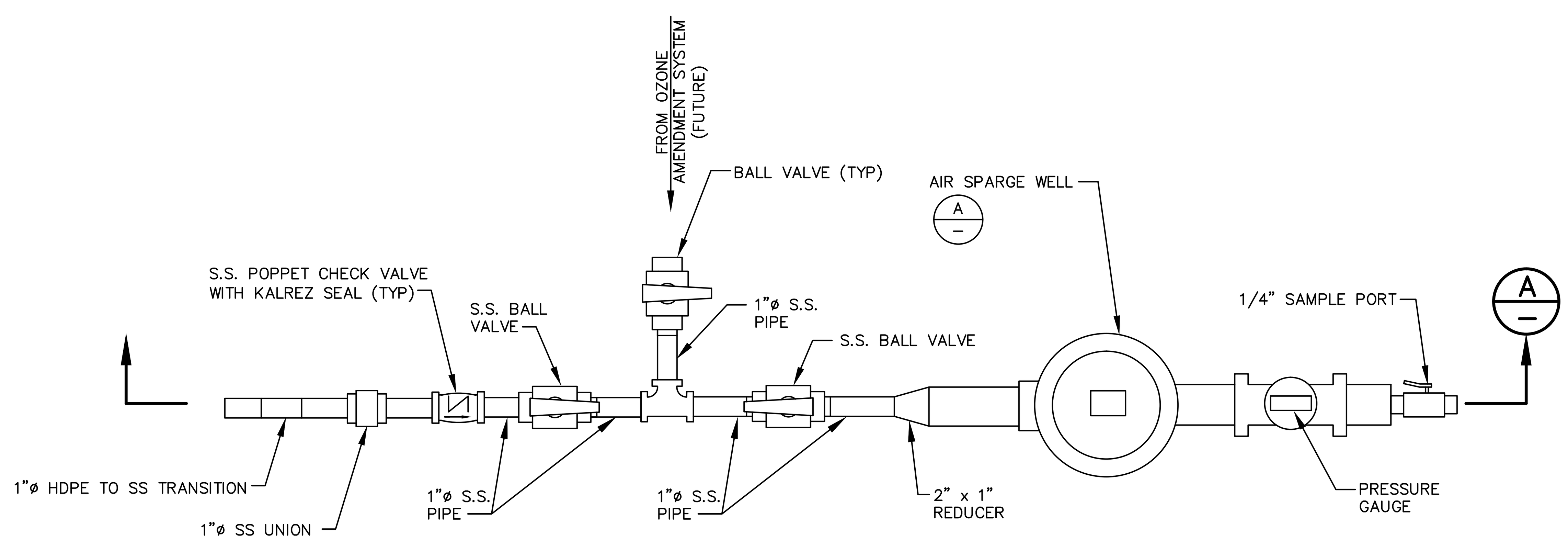
CONSTRUCTION DRAWING



A / C04 SECTION
AIR SPARGE WELLHEAD
SCALE: NTS



B / C05 SECTION
SOIL VAPOR EXTRACTION (SVE) WELLHEAD
SCALE: NTS



1 / C04 PLAN
AIR SPARGING WELLHEAD
SCALE: NTS

CONSTRUCTION DRAWING

REV	DATE	DESCRIPTION	DRN	APP

Geosyntec consultants
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COLUMBIA, MARYLAND 21046 USA
PHONE: 410.381.4333

CORTESE LANDFILL PRP GROUP
NARROWSBURG, NEW YORK

TITLE: AIR SPARGE WELL DETAILS

PROJECT: AS-BUILT SOURCE AREA REMEDIAL ACTION

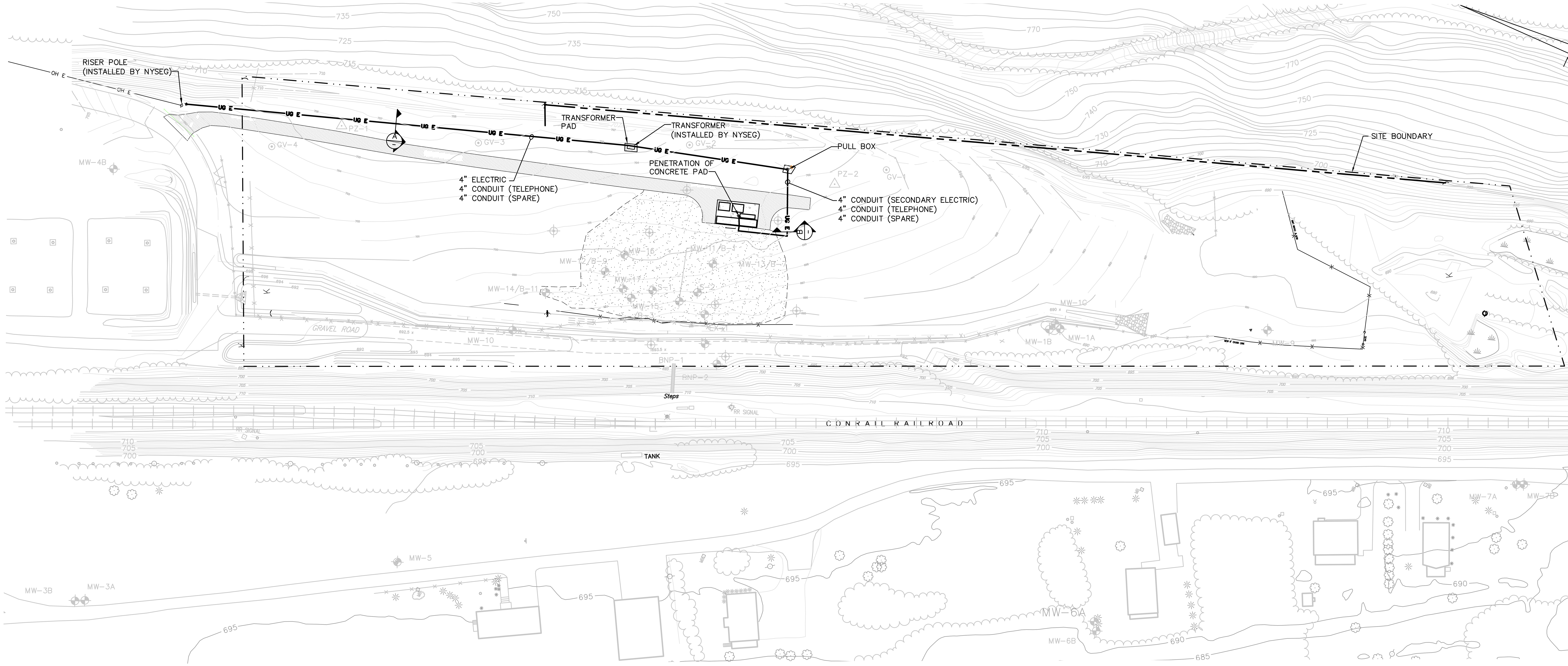
SITE: CORTESE LANDFILL
NARROWSBURG, NEW YORK

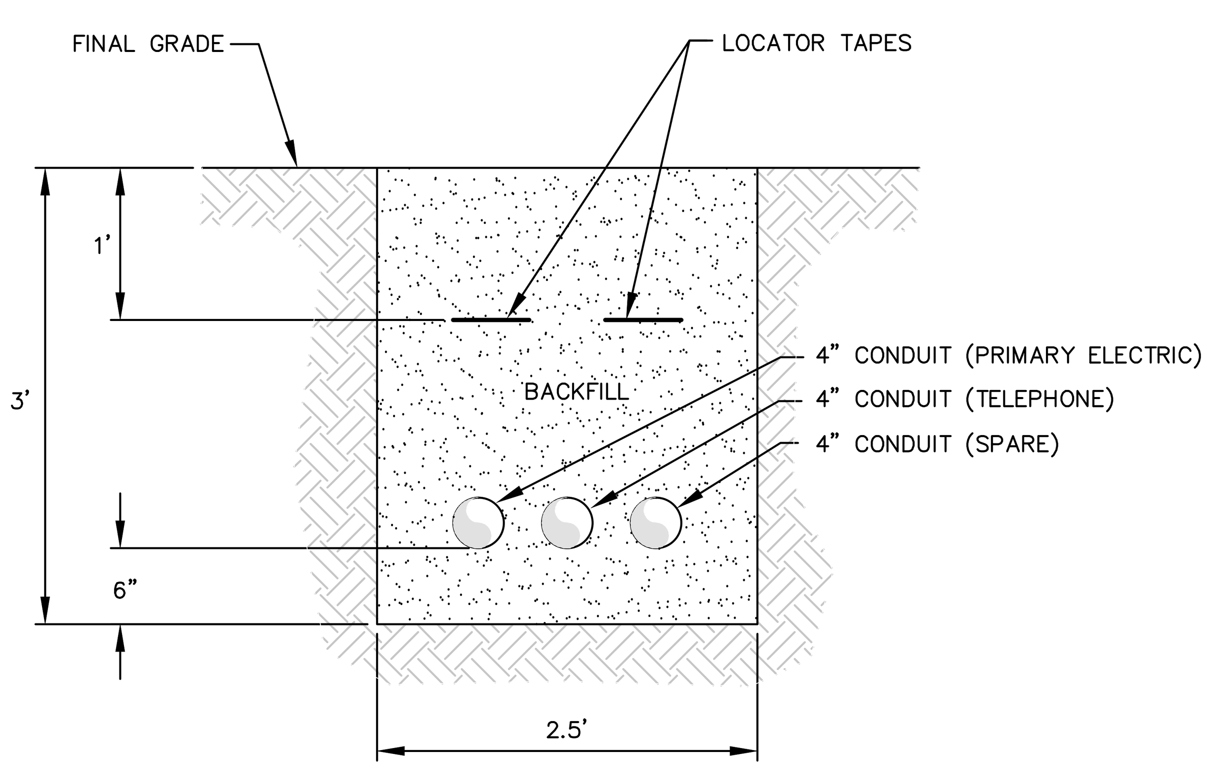
THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

SIGNATURE

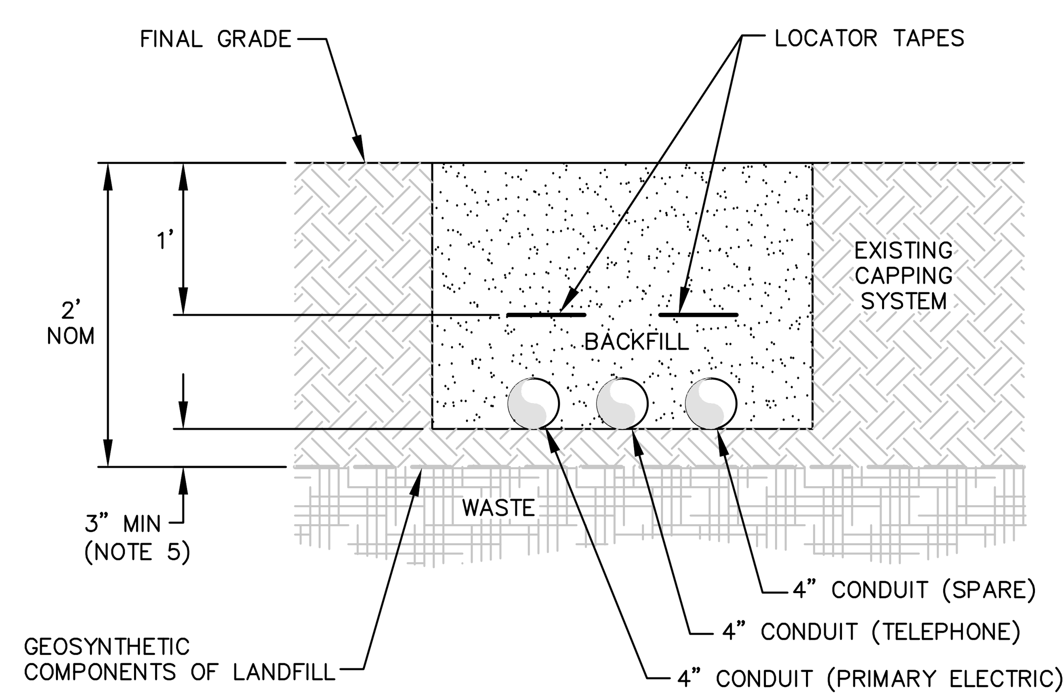
DATE

DESIGN BY:	AK	DATE:	SEPTEMBER 2013
DRAWN BY:	TSJ	PROJECT NO.:	MR0562B
CHECKED BY:	KWH	FILE:	0562-7m06r1
REVIEWED BY:	RMG	DRAWING NO.:	
APPROVED BY:	AK		M06





SECTION A
TRENCH NOT IN EXISTING CAPPING SYSTEM
NTS



SECTION B
TRENCH IN EXISTING CAPPING SYSTEM
NTS

LEGEND

- PROPERTY BOUNDARY
- SITE BOUNDARY
- FENCE
- ELEVATION CONTOUR
- GV-1 PASSIVE GAS VENT
- MW-10 MONITORING WELL
- SW-DRU SURFACE WATER SAMPLE POINT
- PZ-1 PIEZOMETER
- AS-BUILT SOIL VAPOR EXTRACTION WELL
- AS-BUILT AIR SPARGING WELL
- UG E AS-BUILT UNDERGROUND ELECTRICAL LINE
- OH E AS-BUILT OVERHEAD ELECTRICAL LINE
- GRAVEL UNDERLAIN WITH GEOTEXTILE

50 25 0 50 100
SCALE IN FEET

CONSTRUCTION DRAWING

REV	DATE	DESCRIPTION	DRN	APP

Geosyntec consultants
10220 OLD COLUMBIA ROAD, SUITE A
COLUMBIA, MARYLAND 21046 USA
PHONE: 410.381.4333

CORTESE LANDFILL PRP GROUP
NARROWSBURG, NEW YORK

TITLE: **AS-BUILT ELECTRICAL SITE PLAN**

PROJECT: **AS-BUILT SOURCE AREA REMEDIAL ACTION**

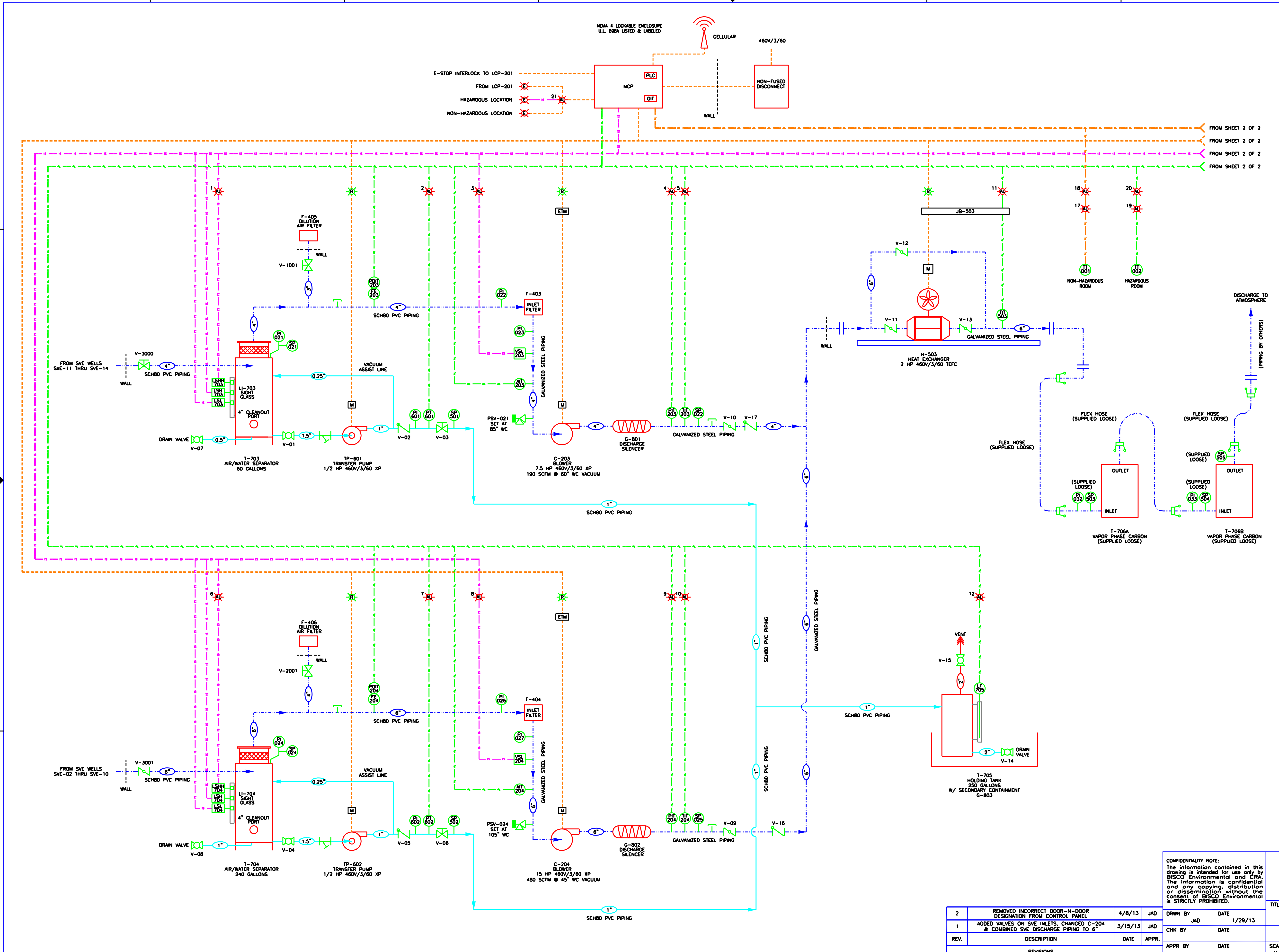
SITE: **CORTESE LANDFILL NARROWSBURG, NEW YORK**

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

SIGNATURE

DATE

DESIGN BY:	AK	DATE:	SEPTEMBER 2013
DRAWN BY:	TSJ	PROJECT NO.:	MR0562B
CHECKED BY:	KWH	FILE:	0562-7e01
REVIEWED BY:	RMG	DRAWING NO.:	
APPROVED BY:	AK		E01



LEGEND

AIT	LEL INDICATING TRANSMITTER
DPIT	DIFFERENTIAL PRESSURE INDICATING TRANSMITTER
ETM	ELAPSED TIME METER
FE	FLOW ELEMENT
FI	FLOW INDICATOR
JB	JUNCTION BOX
LCP	LOCAL CONTROL PANEL
LSH	LEVEL SWITCH HIGH
LSHH	LEVEL SWITCH HIGH HIGH
LSL	LEVEL SWITCH LOW
LT	LEVEL TRANSMITTER
M	MOTOR
MCP	MASTER CONTROL PANEL
OIT	OPERATOR INTERFACE TERMINAL
PDIT	PRESSURE DIFFERENTIAL INDICATING TRANSMITTER
PI	PRESSURE INDICATOR
PIT	PRESSURE INDICATING TRANSMITTER
PLC	PROGRAMMABLE LOGIC CONTROLLER
PT	PRESSURE TRANSMITTER
SP	SAMPLE PORT
T	TIMER
TIT	TEMPERATURE INDICATING TRANSMITTER
TT	TEMPERATURE TRANSMITTER
VSL	VACUUM SWITCH LOW
	BALL VALVE
	CHECK VALVE
	BUTTERFLY VALVE
	GATE VALVE
	PRESSURE REGULATER
	ROTAMETER
V XXX	SOLENOID VALVE
	UNION
	RELIEF VALVE
	WYE STRAINER
	CAMLOCK
	1/2" FNPT PORT WITH PLUG
AL	ALARM LIGHT
E	EMERGENCY STOP LIGHT
R	RUN LIGHT
	AIR LINE
	CONTROL LINE
IS	INTRINSICALLY SAFE LINE
	WATER LINE
AL	ANALOG LINE
AL	INTRINSICALLY SAFE ANALOG LINE

ALARMS

1. AIR/WATER SEPARATOR (T-703) HIGH HIGH LEVEL
2. TRANSFER PUMP (P-601) HIGH PRESSURE
3. SVE BLOWER (C-203) LOW VACUUM
4. SVE BLOWER (C-203) HIGH PRESSURE
5. SVE BLOWER (C-203) HIGH TEMPERATURE
6. AIR/WATER SEPARATOR (T-704) HIGH HIGH LEVEL
7. TRANSFER PUMP (P-602) HIGH PRESSURE
8. SVE BLOWER (C-204) LOW VACUUM
9. SVE BLOWER (C-204) HIGH PRESSURE
10. SVE BLOWER (C-204) HIGH TEMPERATURE
11. HEAT EXCHANGER (H-503) HIGH TEMPERATURE
12. HOLDING TANK (T-705) HIGH HIGH LEVEL
13. AIR SPARGE COMPRESSOR (C-201) HIGH TEMPERATURE
14. AIR SPARGE COMPRESSOR (C-201) LOW PRESSURE
15. AIR SPARGE COMPRESSOR (C-201) HIGH PRESSURE
16. AIR SPARGE COMPRESSOR (C-201) LOW FLOW
17. IDDA1b ENCLOSURE NON-HAZARDOUS ROOM LOW TEMPERATURE
18. IDDA1b ENCLOSURE NON-HAZARDOUS ROOM HIGH TEMPERATURE
19. IDDA1b ENCLOSURE HAZARDOUS ROOM LOW TEMPERATURE
20. IDDA1b ENCLOSURE HAZARDOUS ROOM HIGH TEMPERATURE
21. EMERGENCY STOP

REV.	DESCRIPTION	DATE	APPR.
2	REMOVED INCORRECT DOOR-N-DOOR DESIGNATION FROM CONTROL PANEL	4/8/13	JAD
1	ADDED VALVES ON SVE INLETS, CHANGED C-204 & COMBINED SVE DISCHARGE PIPING TO 6"	3/15/13	JAD

REVISIONS

BISCO Environmental
Soil & Groundwater Remediation Equipment
Taunton, Massachusetts 02780

TITLE
VAPOR EXTRACTION & AIR SPARGE SYSTEM
PROCESS & INSTRUMENTATION DIAGRAM

DRWN BY: JAD	DATE: 1/29/13
CHK BY	DATE
APPR BY	DATE

CONESTOGA-ROVERS & ASSOCIATES
CORTESE LANDFILL - FORMER IDDA1b

JOB NO. 13014

SCALE	SIZE	DWG NO.	SHEET	REV
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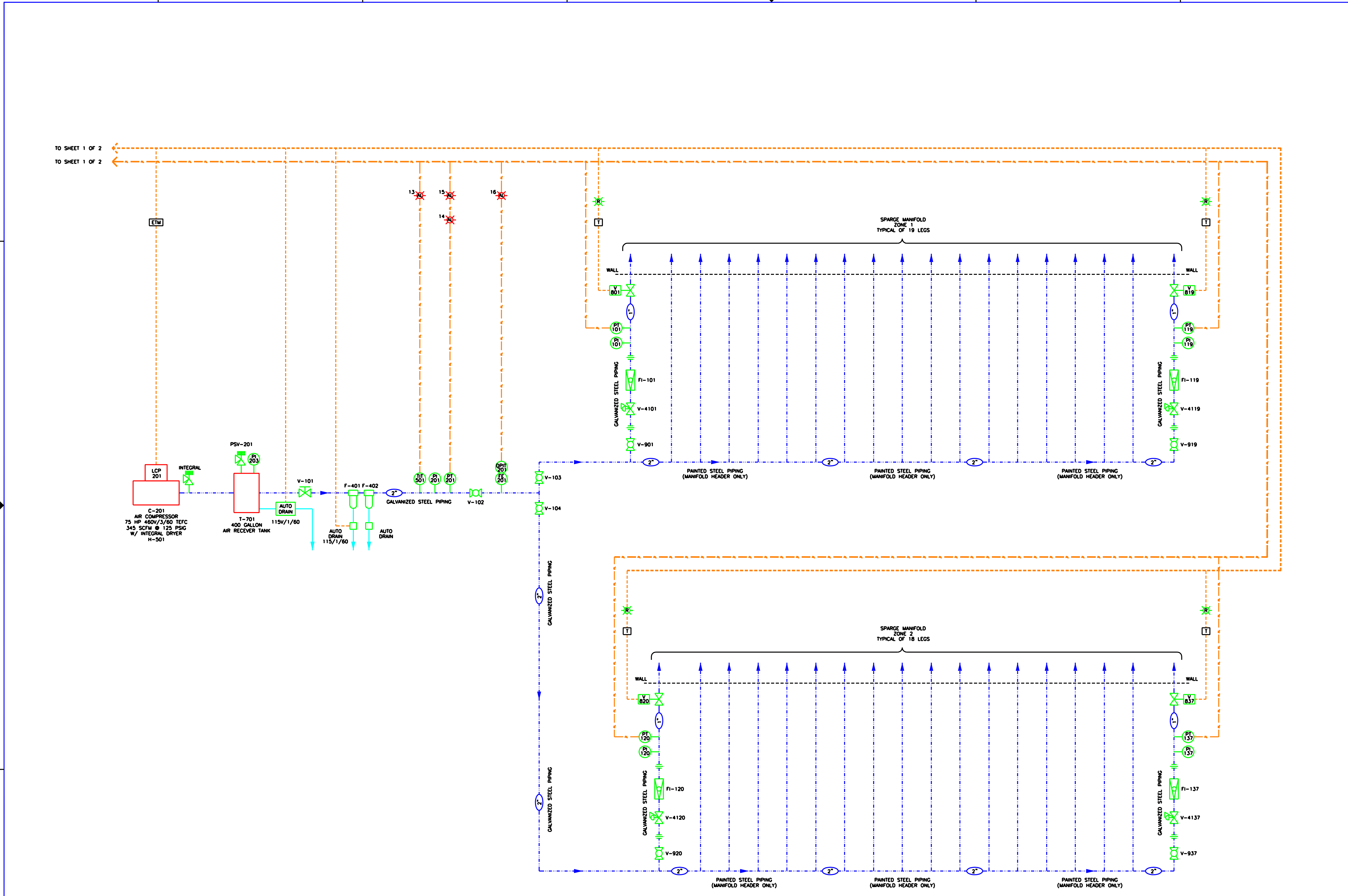

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PLC	PROGRAMMABLE LOGIC CONTROLLER
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TIT	TEMPERATURE INDICATING TRANSMITTER
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	CHECK VALVE
	BUTTERFLY VALVE
	GATE VALVE
	PRESSURE REGULATER
	ROTAMETER
	SOLENOID VALVE
	UNION
	RELIEF VALVE
	WYE STRAINER
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	1/2" FNPT PORT WITH PLUG
	ALARM LIGHT
	EMERGENCY STOP LIGHT
	RUN LIGHT
	AIR LINE
	CONTROL LINE
	INTRINSICALLY SAFE LINE
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	ANALOG LINE
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3. SVE BLOWER (C-203) LOW VACUUM
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5. SVE BLOWER (C-203) HIGH TEMPERATURE
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10. SVE BLOWER (C-204) HIGH TEMPERATURE
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12. HOLDING TANK (T-705) HIGH HIGH LEVEL
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19. IDDA1b ENCLOSURE HAZARDOUS ROOM LOW TEMPERATURE
20. IDDA1b ENCLOSURE HAZARDOUS ROOM HIGH TEMPERATURE
21. EMERGENCY STOP

BISCO Environmental
Soil & Groundwater Remediation Equipment
Taunton, Massachusetts 02780

REV.	DESCRIPTION	DATE	APPR.
2	REMOVED INCORRECT DOOR-N-DOOR DESIGNATION FROM CONTROL PANEL	4/8/13	JAD
1	ADDED VALVES ON SVE INLETS, CHANGED C-204 & COMBINED SVE DISCHARGE PIPING TO 6"	3/15/13	JAD

REVISIONS

DRWN BY JAD	DATE 1/29/13
CHK BY	DATE
APPR BY	DATE

TITLE
VAPOR EXTRACTION & AIR SPARGE SYSTEM
PROCESS & INSTRUMENTATION DIAGRAM

CONESTOGA-ROVERS & ASSOCIATES
CORTESE LANDFILL - FORMER IDDA1b

JOB NO. 13014

SCALE	SIZE	DWG NO.	SHEET	REV
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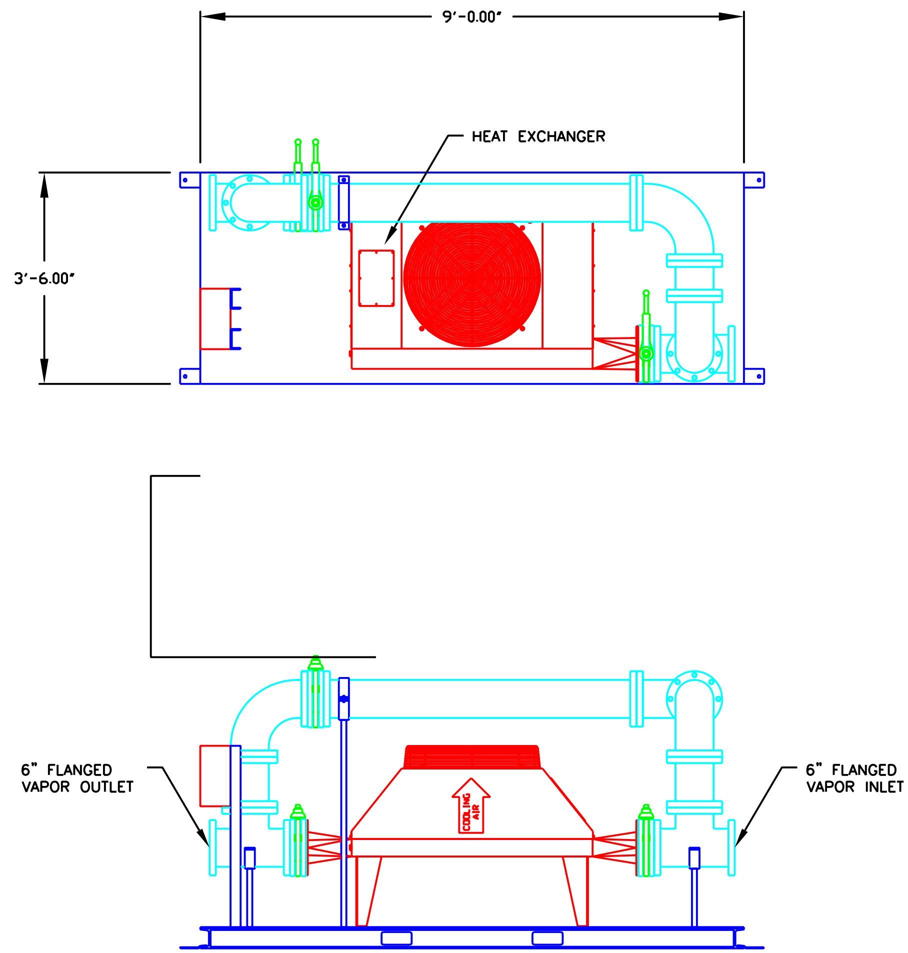


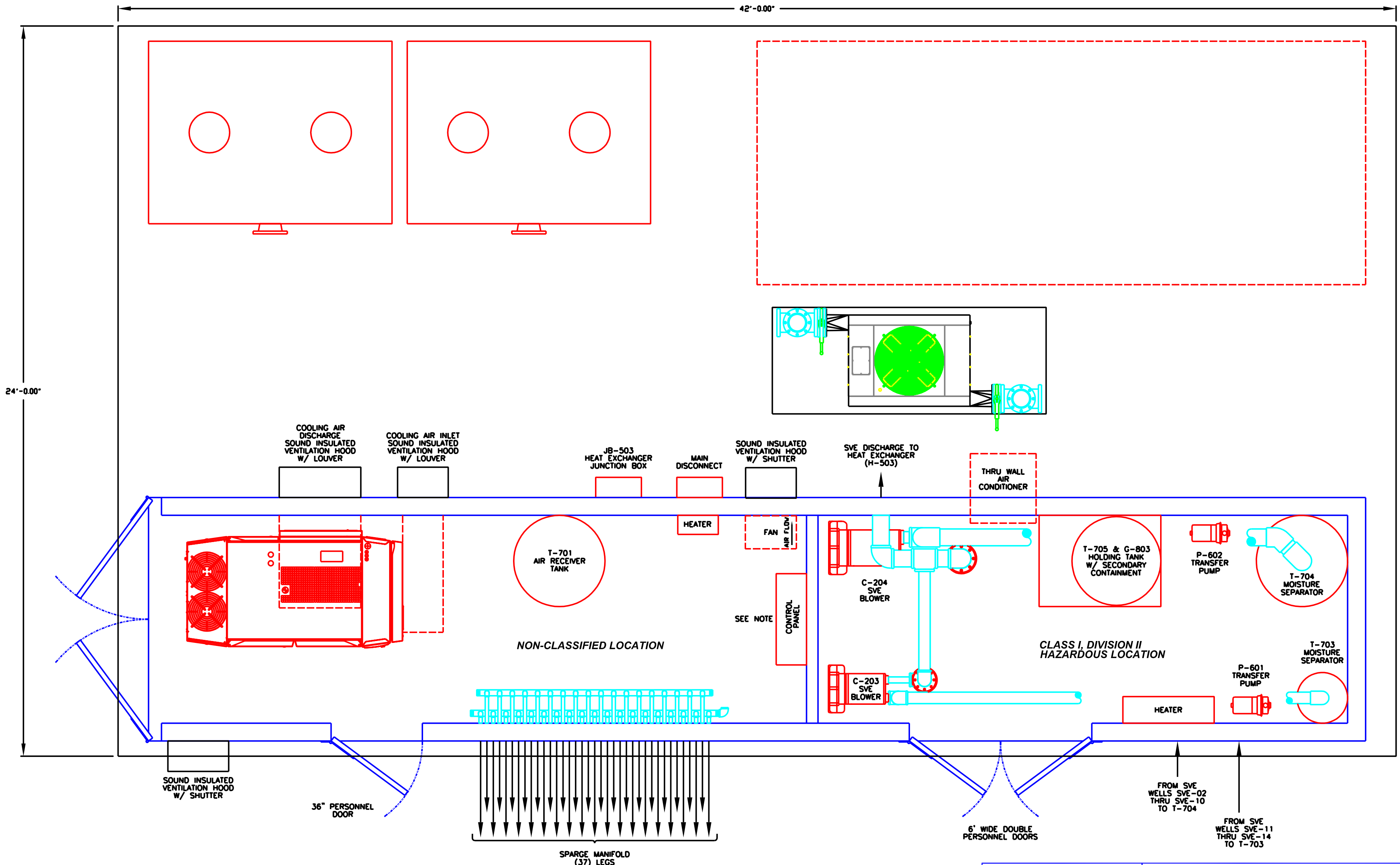
BISCO Environmental
Soil & Groundwater Remediation Equipment
Taunton, Massachusetts 02780

DRWN BY: JAD	DATE: 4/11/13	TITLE: HEAT EXCHANGER SKID LAYOUT
CHK BY:	DATE:	CONESTOGA-ROVERS & ASSOCIATES CORTESE LANDFILL – FORMER IDDA1b
APPR BY:	DATE:	JOB NO. 13014

SCALE	SIZE	DWG NO.	SHEET	REV
1"=20"	C	13014RSL-02	1 OF 1	

REV	DESCRIPTION	DATE	APPR

REVISIONS



NOTE: 3 FT. CLEARANCE REQUIRED IN FRONT OF PANEL.

REVISIONS			
REV	DESCRIPTION	DATE	APPR

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BISCO Environmental
Soil & Groundwater Remediation Equipment
Taunton, Massachusetts 02780

TITLE: VAPOR EXTRACTION & AIR SPARGE SYSTEM COMPOUND LAYOUT

DRWN BY JAD — DATE 3/19/13
CHK BY — DATE
APPR BY — DATE

CONESTOGA-ROVERS & ASSOCIATES
CORTESE LANDFILL - FORMER IDDA1b

JOB NO. 13014

SCALE	SIZE	DWG NO.	SHEET	REV
1"=30'	C	13014RSL-02	1 OF 1	

APPENDIX D

Manufacturer’s O&M Manual and Equipment Specifications

(on CD)

APPENDIX E

Emergency Contact Information

(to be prepared by the O&M Contractor)

APPENDIX F

Standard Operating Guidelines

STANDARD OPERATING GUIDELINE
TEDLAR® BAG SAMPLE COLLECTION
Geosyntec Consultants, Inc.

TABLE OF CONTENTS

Page

1 INTRODUCTION

This standard operating guideline (SOG) describes methods for collection of gas samples of sufficient quality and quantity to evaluate the performance of the soil vapor extraction (SVE) system. Gas samples will be collected into Tedlar® sample bags from sampling ports within the SVE system for field screening using field instruments.

This document is divided into the following sections:

- Required Equipment (Section 2)
- Preliminary Activities (Section 3);
- Screening Samples (Section 4); and
- Documentation (Section 5).

2 REQUIRED EQUIPMENT

The following equipment and materials will be required:

- 1 liter (L) Tedlar® sample bags
- Vacuum Box
- Vacuum Pump
- ¼" OD Nylaflow tubing
- Photoionization Detector (PID) with 11.7 eV lamp
- Landfill Gas (LFG) Meter
- Calibration Gases
- Vacuum Gauges

3 PRELIMINARY ACTIVITIES

3.1 Orientation

Review the process and instrumentation diagram (P&ID) to identify the sample ports from which Tedlar® bag samples will be collected. The P&ID should be posted in the process equipment trailer.

Sample ports on each of the SVE wellheads of the wells, as well as on the air/water separators that are upstream of the SVE blowers, are expected to be under vacuum. Sample ports at the influent, midpoint and effluent of the vapor-phase granular activated carbon (VGAC) vessels are expected to be slightly pressurized. It is expected that the sample ports are fitted with barbed connections and have an associated pressure indicator or gauge.

3.2 Meter Calibration

The PID will be calibrated to span gas and according to manufacturer's instructions. Atmospheric air may be used as zero gas in areas of generally good air quality, but should be avoided in high traffic areas, smog areas, or areas with any noticeable odors.

The LFG meter will be calibrated for oxygen (O_2), methane (CH_4), and carbon dioxide (CO_2) according to manufacturer's instructions. Atmospheric air may be used as zero gas in areas of generally good air quality, but should be avoided in high traffic areas, smog areas, or areas with any noticeable odors.

4 SAMPLE COLLECTION

The following section presents the methods for sample collection from lines that are under vacuum (upstream of the SVE blower) or under pressure (downstream of the SVE blower). The pressure on the pressure indicator associated with the sampling port should be read and recorded prior to taking any sample in order to determine the appropriate method.

4.1 Lines Under Vacuum

In order to obtain a sample in a Tedlar® bag when the line is under vacuum, a vacuum or lung box is needed. The maximum vacuum that the SVE blowers can create on the line is five (5) inches of Mercury (in. Hg). The vacuum pump associated with the vacuum box should be sized to pull a greater vacuum than 5 in. Hg.

Place a new Tedlar® bag inside the vacuum box. Using a new piece of Nylaflow® tubing, connect one end of the tubing to the internal inlet port of the vacuum box and the other to the Tedlar® bag. Connect another piece of tubing from the external inlet port of the vacuum box to the sampling port to be sampled, using appropriate fittings and adapters. Open the valve on the bag after all connections are made.

Open the valve on the sampling port to be sampled. Operate the vacuum pump until the Tedlar® bag is filled. Typical bags have a 1 Liter capacity. The bag should be considered full when either the bag is filled with about 800 mL of sample or until the vacuum box pump is maxed out and bag will not fill with additional sample.

Once the bag is full, close the valve on the sampling port and stop the vacuum pump. Next, vent and open the vacuum box. Then, close the valve on the Tedlar® bag. Disconnect the bag from the tubing and remove the bag from inside the vacuum box. Connect the Tedlar® bag to each of the instruments starting with the PID then the LFG meter. Be careful not to use all of the sample air on one meter and close the valve between attaching meters to the bag. Readings on the meter should be allowed to stabilize before recording values.

Repeat process two additional times to get three readings from the sample port.

4.2 <u>Lines under Pressure</u>

The sample ports after the blower unit is expected to be slightly pressurized. A piece of tubing should be fitted to the sample port and connected to a Tedlar® bag. The connections should be tight. Open the valve on the Tedlar® bag, and then slowly open the valve on the sample port. Fill the bag with sample air until the bag is has approximately 800 mL of sample air. Close the sample port valve, then close the bag valve.

Connect the bag containing sample air to each of the instruments starting with the PID then the LFG meter. Be careful not to use all of the sample air on one meter and close the valve between attaching meters to the bag. Readings on the meter should be allowed to stabilize before recording values.

Repeat process two additional times to get three readings from the sample port.

If the sample port pressure is too low to fill the bag, then the method for sampling lines under vacuum in Section 4.1 should be used.

5 DOCUMENTATION

All field activities will be documented. Field documentation will include: instrument calibration information; date; time and location of readings; pressure readings; sampler's name; and series of field screening readings. A list of the sampling ports sampled and the sampling order for all samples will be recorded on the sampling field records.

For each sampling day, the following information will be recorded on the field forms or in the field notebook:

- name and number of project;
- name of field personnel;
- date and time of sampling event;
- list of the primary activities performed;
- identification of the sampling ports screened;
- time when screening samples were collected;
- all related information (weather, attendees, equipment problems, any departures from standard procedures and the reasons and responses) observed throughout the day;

- field instrument information and calibration data;
- time and readings for each sample port; and
- time and reading for each instrument calibration check.

APPENDIX G

O&M Forms

O&M INSPECTION FORMS
IN-SITU SOURCE TREATMENT

Cortese Landfill Site
Narrowsburg, New York

Site Name:	Cortese Landfill		**Project No.:**		
Address:	Narrowsburg, New York				
Date:		**Time:**	**Technician:**		
GENERAL:					
Safety Equipment Check:		HASP	Visible	Missing	
		O&M Manual	Visible	Missing	
Weather/Conditions:		Fire Extinguisher	Visible	Missing	
		Contact Information	Visible	Missing	
Test Call Out Box:		First Aid Kit	Visible	Missing	
Compound Condition:		System Diagram	Visible	Missing	
		Hearing Protection	Visible	Missing	
No. of Locks Changed:			**Electric Meter Reading:**		kWh

SVE SYSTEM: Blower C-203

Status on Arrival:	On / Off			**Status on Departure:**	On / Off
Hour Meter Reading CMP:					
Moisture Separator Level (T-703) Inches:				**Moisture Separator Pressure (PI-021) "H_2O:**	
Dilution Valve Position (F-405	**Closed**	**1/4**	**1/2**	**3/4**	**Open**
Post Moisture separator Flow (PDIT-203) "H_2O:				**CFM:**	
Pre-Inlet Filter Pressure (PI-022) "H_20:				**Post-Inlet Filter Pressure (PI-023) "H_2O:**	
Pre-Blower Temperature (TIT-203) ^{0}F:				**Post Blower Pressure (PIT-203) "H_2O :**	
PID Reading Pre Blower (SP-021) (PPM):				**PID Reading Post Blower (SP-022) (PPM):**	

SVE SYSTEM: Blower C-204

Status on Arrival:	On / Off			**Status on Departure:**	On / Off
Hour Meter Reading CMP:					
Moisture Separator Level (T-704) Inches:				**Moisture Separator Pressure (PI-024) "H_2O:**	
Dilution Valve Position (F-406	**Closed**	**1/4**	**1/2**	**3/4**	**Open**
Post Moisture separator Flow (PDIT-204) H_2O:				**CFM:**	
Pre-Inlet Filter Pressure (PI-026) "H_20:				**Post-Inlet Filter Pressure (PI-027) "H_2O:**	
Post-Blower Temperature (TIT-204) ^{0}F:				**Post Blower Pressure (PIT-204) "H_2O :**	
PID Reading Pre Blower (SP-024) (PPM):				**PID Reading Post Blower (SP-025) (PPM):**	

SVE SYSTEM: SVE LEGS 2 through 14

Well ID	**SVE-2**	**SVE-3**	**SVE-4**	**SVE-5**	**SVE-6**	**SVE-7**	**SVE-8**	**SVE-9**
Manifold	**ON / OFF**	**ON / OFF**	**ON / OFF**	**ON / OFF**	**ON / OFF**	**ON / OFF**	**ON / OFF**	**ON / OFF**
Vac ("H_2O)								
PID (ppm)								

Well ID	**SVE-10**	**SVE-11**	**SVE-12**	**SVE-13**	**SVE-14**
Manifold	**ON / OFF**	**ON / OFF**	**ON / OFF**	**ON / OFF**	**ON / OFF**
Vac ("H_2O)					
PID (ppm)					

SVE SYSTEM: Moisture Holding Tank/Heat Exchanger/Carbon Units

Condensate Tank (T-705) Level (Inches):					
Amount Drained (Gallons):					
Heat Exchanger (H-503) Operating:	**On**	**Off**	**Auto**		
Bypass valve Position (V-12):	**Open**	**1/4**	**1/2**	**3/4**	**Closed**
Temperature Post Heat Exchanger (TIT-503) ^{0}F:					

Carbon Vessel Measurements:

	Influent (PI-032 and SP-503)	**Mid-fluent (PI-033 and SP-504)**	**Effluent (SP-505)**
PID (PPM)			
Pressure ('H2O)			**NA**

Schedule Carbon Change Out: No Yes

SVE Maintenance Notes:

O&M INSPECTION FORMS
IN-SITU SOURCE TREATMENT

Cortese Landfill Site
Narrowsburg, New York

Site Name: Cortese Landfill		**Project No.:**
Address: Narrowsburg, New York		
Date:	**Time:**	**Technician:**

SPARGE SYSTEM C-201:

Status on Arrival: On / Off	**Status on Departure:** On / Off
Compressor Reservoir Pressure (PI-203):	
Main Temperature (TIT-501):	**Main Pressure (PI-201):**
Main Flow (DPIT-201):	

ASW01		**ASW02**		**ASW03**		**ASW04**		**ASW05**	
ON / OFF		**ON / OFF**		**ON / OFF**		**ON / OFF**		**ON / OFF**	
PI-101		PI-102		PI-103		PI-104		PI-105	
FI-101		FI-102		FI-103		FI-104		FI-105	
PIT-101		PIT-102		PIT-103		PIT-104		PIT-105	
ASW06		**ASW07**		**ASW08**		**ASW09**		**ASW10**	
ON / OFF		**ON / OFF**		**ON / OFF**		**ON / OFF**		**ON / OFF**	
PI-106		PI-107		PI-108		PI-109		PI-110	
FI-106		FI-107		FI-108		FI-109		FI-110	
PIT-106		PIT-107		PIT-108		PIT-109		PIT-110	
ASW11		**ASW12**		**ASW13**		**ASW14**		**ASW15**	
ON / OFF		**ON / OFF**		**ON / OFF**		**ON / OFF**		**ON / OFF**	
PI-111		PI-112		PI-113		PI-114		PI-115	
FI-111		FI-112		FI-113		FI-114		FI-115	
PIT-111		PIT-112		PIT-113		PIT-114		PIT-115	
ASW16		**ASW17**		**ASW18**		**ASW19**		**ASW20**	
ON / OFF		**ON / OFF**		**ON / OFF**		**ON / OFF**		**ON / OFF**	
PI-116		PI-117		PI-118		PI-119		PI-120	
FI-116		FI-117		FI-118		FI-119		FI-120	
PIT-116		PIT-117		PIT-118		PIT-119		PIT-120	
ASW21		**ASW22**		**ASW23**		**ASW24**		**ASW25**	
ON / OFF		**ON / OFF**		**ON / OFF**		**ON / OFF**		**ON / OFF**	
PI-121		PI-122		PI-123		PI-124		PI-125	
FI-121		FI-122		FI-123		FI-124		FI-125	
PIT-121		PIT-122		PIT-123		PIT-124		PIT-125	
ASW26		**ASW27**		**ASW28**		**ASW29**		**ASW30**	
ON / OFF		**ON / OFF**		**ON / OFF**		**ON / OFF**		**ON / OFF**	
PI-126		PI-127		PI-128		PI-129		PI-130	
FI-126		FI-127		FI-128		FI-129		FI-130	
PIT-126		PIT-127		PIT-128		PIT-129		PIT-130	
ASW31		**ASW32**		**ASW33**		**ASW34**		**ASW35**	
ON / OFF		**ON / OFF**		**ON / OFF**		**ON / OFF**		**ON / OFF**	
PI-131		PI-132		PI-133		PI-134		PI-135	
FI-131		FI-132		FI-133		FI-134		FI-135	
PIT-131		PIT-132		PIT-133		PIT-134		PIT-135	
ASW36		**ASW37**							
ON / OFF		**ON / OFF**							
PI-136		PI-137							
FI-136		FI-137							
PIT-136		PIT-137							

Filter Inspections:

Filter ID:	**Condition:**		**AS Maintenance Notes:**
SVE Filters	**Good**	**Poor**	
Dilution Air Filter F-405:			
Inlet Air Filter F-403:			
Dilution Air Filter F-406:			
Inlet Air Filter F-404:			
AS Filters	**Good**	**Poor**	
Air Filter 401 Condition:			
Air Filter 402 Condition:			

APPENDIX H

Remedial Work Element I –
1997 Operations and Maintenance Plan

OPERATION AND MAINTENANCE PLAN
REMEDIAL WORK ELEMENT I
CORTESE LANDFILL SITE
NARROWSBURG, NEW YORK

Prepared for:

Cortese Landfill PRP Group
c/o Waste Management, Inc.
4 Liberty Lane West
Hampton, NH 03842

March 1997

Project No.: 953-6252

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LIST OF FIGURES

LIST OF ATTACHMENTS

1.0 INTRODUCTION

1.1 Purpose

This Operation and Maintenance (O&M) Plan for the Cortese Landfill Site (Site) has been prepared in accordance with the Consent Decree for Remedial Design/Remedial Action (Consent Decree) entered into by the United States Environmental Protection Agency (USEPA) and the Cortese Landfill PRP Group (Group) in August 1995. This O&M Plan describes post-construction inspection, maintenance and environmental monitoring which are required to evaluate and ensure the integrity and proper function of Remedial Work Element I (RWE I) including the low permeability cover system, surface water control system, passive gas venting system, and the environmental monitoring system.

This Plan is comprised of the following major elements:

1. Inspection and Maintenance Plan;
2. Monitoring Plan; and
3. Health and Safety/Contingency Plan Overview.

In addition, the post-closure management structure and reporting requirements are provided. It should be noted that this O&M Plan is intended to be flexible to allow for modifications, as necessary, with USEPA approval, based on conditions encountered during post-closure activities. The O&M shall be implemented for 30 years after the landfill is closed unless otherwise approved by USEPA.

1.2 Site Description

The Site is located in the hamlet of Narrowsburg, New York, as shown on Figure 1. Various Site features described below are shown on Figure 2. The Site is bounded to the northeast by a steep bedrock escarpment and to the southwest by the Conrail railroad embankment. The northern edge of the Site lies approximately 70 feet south of the Narrowsburg Waste Water Treatment Plant. The Delaware River is approximately 400 feet southwest of the Site, beyond the railroad embankment. Six residences and the Narrowsburg Diesel Garage are located between the embankment and the Delaware River. A small borrow pit (White's Pond) and a small backwater area (the embayment) along the eastern shoreline of the Delaware River are located approximately 800 feet southwest of the Site.

The Site property boundary encompasses approximately 3.75 acres of land owned by Mr. John Cortese and another 1.53 acre parcel along the northern margin of the Cortese property owned by the Town of Tusten, which purchased the property from Mr. Cortese in 1973. The Site received municipal solid waste (MSW) from approximately July 1970 to July 1981 at an estimated rate of approximately 3,000 cubic yards per year. Disposal practices were poorly documented, such that records regarding the types and volume of wastes received are essentially non-existent. The extent of MSW has been assessed based upon geophysical surveys and test pits.

For a six month period in 1973 the Site apparently received industrial wastes including paint thinners, sludge, solvents, dyes, waste oil, and other petroleum products. Disposal of these wastes included the burial of drums in trenches. According to depositional testimony of the former landfill owner/operator and landfill employees, drums were disposed in three areas in the landfill. Initially, drums were emptied and/or crushed or mixed with MSW in a trench located in the northwest corner of the landfill. Subsequently, drums were segregated from MSW and were disposed intact in the main drum disposal area located in the center of the landfill (referred to herein as Intact Drum Disposal Area (IDDA) No. 1). Drums were also disposed intact in another area at the south end of the landfill (referred to herein as IDDA No. 2). Two septage lagoons, which also received industrial wastes, were located outside of the footprint of the landfill. The three drum disposal trenches and the two septage lagoons have been excavated. Drums and RCRA hazardous soils were transported off-Site for disposal. Contaminated soils excavated from these areas which are not RCRA hazardous wastes are contained beneath the landfill cover. Groundwater impacted by the landfill and the septage lagoons flows toward the Delaware River.

1.3 Remedial Systems

Remedial Work Element I consists of the following systems:

1. Low Permeability Cover System;
2. Surface Water Control System;
3. Passive Gas Venting System;

4. Site Security System; and
5. Environmental Monitoring System.

The following sections briefly describe each system.

Low Permeability Cover System

A low permeability cover system has been constructed over the entire landfill. The cover system consists of the following components from top to bottom:

1. 6-inch layer of vegetative soil;
2. 18-inch layer of cover soil (i.e., barrier protection layer);
3. Geocomposite drainage layer;
4. 40-mil Cover Seal® geomembrane;
5. 10 ounce per square yard (oz/sy) nonwoven geotextile gas transmission layer; and
6. Grading fill as necessary.

The cover reduces infiltration of precipitation into the landfill, promotes surface water drainage off the cover, and prevents direct contact with waste materials.

Surface Water Control System

The landfill is located in a basin with only internal drainage. The final cover grading and perimeter drainage channel around the landfill promote drainage of surface water away from the landfill to the adjacent wetlands at the Site. Riser pipes installed in wetland areas promote recharge of stormwater to groundwater.

Passive Gas Venting System

Given the age of the waste and a minimal closure cover for over 15 years, gas generation is expected to be low. The passive gas venting system functions to control the potential migration of residual landfill gas generated by the decomposition of waste. The gas venting system consists of four passive vents, a gravel-filled gas collection trench, and a 10 oz/sy nonwoven geotextile gas transmission layer.

Each passive vent consists of a 6-inch diameter schedule 80 PVC pipe with a screened interval 2-feet below the geomembrane of the cover system. Each vent is installed in a gas collection trench a minimum of 1-foot wide with AASHTO No. 57 stone wrapped in a 10 oz/sy nonwoven geotextile. Landfill gas which migrates upward to the bottom of the cover is transmitted through the 10 oz/sy nonwoven geotextile gas transmission layer to the gas collection trenches which lead to the passive vents. A geomembrane boot is installed around each of the four passive vents to prevent surface water from entering the waste.

Site Security System

In addition to the remedial actions described above, security of the Site will be provided by a 6-foot high chain-link fence that encloses three sides of the Site that are accessible by vehicle traffic. O&M vehicle access to the landfill is through a gate that crosses the landfill access road near monitoring well MW10. The security system will prevent unauthorized access of vehicles to the Site.

Environmental Monitoring System

The environmental monitoring system provides a means to evaluate the effectiveness of the other remedial systems in meeting the performance objectives of the remedy. The monitoring system includes groundwater monitoring wells/piezometers, surface water sampling stations at the Delaware River and perimeter gas monitoring probe stations. Locations and construction details for the environmental monitoring points are provided on Figure 2.

2.0 POST-CLOSURE MANAGEMENT STRUCTURE

The responsibilities and authority of the parties involved during post-closure activities are presented in Section 2.1. Additional training requirements for those individuals directly participating in the inspection, maintenance and monitoring activities are discussed in Section 2.2.

2.1 Responsibilities

The Group Project Manager will be responsible for ensuring the O&M Plan is properly implemented and the results are communicated directly to the USEPA. The Project Manager's responsibilities include:

1. Coordination of inspection, maintenance and monitoring activities;
2. Review and submittal of required reports and maintaining Site records;
3. Coordination and supervision of specialty contractors;
4. Preparation of budgets and cost development;
5. Ensuring properly trained staff are employed at the Site;
6. Acting as the Emergency Coordinator or appointing an Emergency Coordinator; and
7. Coordination with public agency personnel as required.

USEPA will be notified in writing of any change to the designated Project Manager. The Group may choose to utilize the services of various contractors to implement aspects of this O&M Plan. Contractor(s) responsibilities may include:

1. Conducting routine inspections and maintenance;
2. Performing maintenance and corrective actions as necessary;
3. Sampling and analyses;
4. Report preparation; and
5. Emergency response.

2.2 Training

The Group Project Manager shall be experienced in the management and implementation of operations and maintenance procedures at landfills including safety and emergency response procedures. The Group Project Manager is responsible for ensuring that properly trained staff are employed to work at the Site and for the selection of any contractor(s).

Personnel involved in the inspection, maintenance or monitoring shall be adequately trained to implement this Plan, which will include at a minimum the following:

1. Inspection techniques to assess potential problems and recognize if immediate action is required;
2. Operations of the remedial measures to conduct preventive and repair maintenance;
3. Sampling techniques including QA/QC procedures;
4. Reporting requirements including evaluation of monitoring data; and
5. Health and Safety requirements for on-site personnel (discussed in Section 6.0).

3.0 INSPECTION AND MAINTENANCE PLAN

The Inspection Plan will be used for routine inspections of the following components of the remedy in order to identify components requiring maintenance or repair:

1. Low permeability cover system;
2. Surface water control system;
3. Passive gas venting system;
4. Site security system; and
5. Environmental monitoring system.

Guidelines for inspection of each of these components are presented in the following subsections. For each component, the following is described:

1. Purpose of the inspection;
2. Reasonably anticipated inspection items; and
3. Inspection schedule (summarized in Table 1).

The Maintenance Plan will be used for scheduled maintenance of components of the remedy to ensure the continued effectiveness of the remedial systems. Repair maintenance will be performed in a manner and with materials as close as possible to those used during initial construction of the component under repair, unless otherwise approved by USEPA. Repairs will be carried out as soon as practical following discovery of the damage. The maintenance schedule is summarized in Table 1. If the repairs are significant such that the as-built drawings need to be modified, the maintenance report will include as-built drawings of the repairs certified by a Professional Engineer registered in the State of New York.

3.1 Low Permeability Cover System

3.1.1 Inspection Plan

A low permeability cover system was constructed over the landfill as described in Section 1.3. Reasonably anticipated items which could impact the effectiveness of the cover system include the following:

1. Insufficient vegetation resulting in erosion of the cover material by storm water runoff and/or wind;

2. Animal burrows;

3. Cracks or fissures in the cover resulting from excessive differential settlement;

4. Unauthorized damage or disturbances by personnel and/or equipment;

5. Large weeds or woody species whose roots may penetrate the cover material;

6. A train derailment adjacent to the Site which causes railroad equipment or transported goods to fall onto the Site and disrupt the cover.

The inspection will involve a Site walkover to search for the occurrence of the above items, with special emphasis as described below.

Integrity of the Cover System:

The landfill cover will be inspected for erosion, such as gullies, particularly on slopes and other places where erosion is most likely to occur. The cover will also be inspected for breaks in the soil due to differential settlement or animal burrows. Other damage to the cover system will also be noted.

Vegetative Cover:

The vegetation will be inspected for density, type, and damage caused by animals, personnel, equipment, erosion, leachate seepage, or gas migration. Areas with insufficient vegetation to prevent erosion (defined as having less than 75% coverage or having bare patches larger than one square yard) will be noted. Damaged, bare, or sparsely covered areas (as defined above) will be noted. Undesirable vegetation such as large weeds or woody species will be noted for removal.

Information gathered during the inspection of the cover system will be documented on the field inspection form shown on Figure 3. The cover system will be inspected annually in the spring in order to assess damages from the freeze-thaw cycle and stormwater runoff, including snowmelt. Additional inspections will be performed as deemed appropriate by the Group Project Manager (e.g., following a train derailment adjacent to the Site or following a 100-year flood).

3.1.2 Maintenance Plan

In order to ensure the continued effectiveness of the cover system, the following scheduled maintenance tasks will be performed:

1. Mowing of the vegetative cover annually, in the early summer; and
2. Annual removal of any debris, large weeds, and woody plant species from the cover.

Anticipated repair maintenance tasks identified by the inspection which may be necessary to ensure the continued effectiveness of the cover system are listed below:

1. Reseeding areas having insufficient vegetation;
2. Regrading, reseeding, and stabilizing areas damaged by erosion of the cover material by storm water runoff and/or wind;
3. Filling animal burrows;
4. Regrading, reseeding and stabilizing cracks or fissures of the cover material resulting from excessive differential settlement; and
5. Repair of any unauthorized damage or disturbances by personnel and/or equipment.

All scheduled maintenance and repair maintenance tasks performed for the cover system will be documented on the field maintenance form as shown on Figure 4.

3.2 Surface Water Control System

3.2.1 Inspection Plan

The surface water control system provides for collection and discharge of surface water that runs onto and off the Site. The system consists of drainage channels which collect runoff from the landfill cover (the landfill perimeter drainage channel), surface water from the escarpment (the diversion channel), and surface water from the Narrowsburg Waste Water Treatment Plant area north of the landfill. Surface water from most of the landfill cover and the escarpment flows to Wetland F in the southern portion of the Site and eventually discharges to the groundwater via infiltration through the ground surface as well as several groundwater recharge riser pipes. Surface water from the treatment plant area flows toward the paved access road and is conveyed by culverts under the road to Wetlands A and B located between the railroad embankment and the landfill at the northern end of the Site. Surface water from a very small portion of the landfill cover also flows to Wetlands A and B. The surface water in Wetlands A and B is also discharged to the groundwater via infiltration through the ground surface as well as several groundwater recharge riser pipes.

Reasonably anticipated items which could impact the effectiveness of the surface water drainage system include:

1. Erosion;
2. Animal burrows;
3. Differential settlement;
4. Excessive accumulation of leaves, silt, and sediment;
5. Encroachment of vegetation; and
6. Unauthorized blockage, damage or disturbances by personnel and/or equipment.

The inspection will involve a Site walk-over to search for occurrence of the above items. The drainage channels will be inspected for blockages caused by leaves, grass clippings, silt deposits, or excessive vegetative growth which could impede or change the course of flow and cause erosion along the edges of the channel lining or ponding of the water. Excessive encroachment of vegetation in riprap-lined areas which could modify the flow capacity of the channel will be recorded. Other damage from vandalism or disturbances by on-site personnel could decrease the effectiveness of the drainage channels. Groundwater recharge riser pipes will be inspected for structural integrity and blockages.

Information collected during the inspection of the surface water control system will be documented in the field inspection form shown on Figure 3. The surface water control system will be inspected annually in the spring in order to assess any damages from the freeze-thaw cycle or storm events. Additional inspections will be performed as deemed appropriate by the Group Project Manager.

3.2.2 Maintenance Plan

Scheduled maintenance of the surface water control system will include removal of leaves, grass clippings, excessive silt deposits, excessive vegetative growth, or any other debris from drainage channels or groundwater recharge riser pipes during the Spring inspection. The following common repair maintenance tasks are reasonably anticipated to be necessary to ensure the continued effectiveness of the surface water control systems:

1. Regrading, addition, and/or replacement of rip rap or desirable vegetation in the channels as a result of erosion, settlement or unauthorized damage; and

2. Replacement or repair of damaged groundwater recharge riser pipes.

Repair maintenance tasks performed for the surface water control system will be documented on the field maintenance form as shown on Figure 4.

3.3 Passive Gas Venting System

3.3.1 Inspection Plan

The gas collection system consists of four passive gas vents (6-inch diameter PVC pipes) installed in a gravel-filled gas collection trench. Also, a 10 oz/sy nonwoven geotextile serves as a gas transmission layer. The gas system functions to control the potential migration of residual landfill gas which might be generated by the decomposition of waste.

Items that could influence the effectiveness of the passive gas venting system include:

1. Blockages as a result of debris in the vents;

2. Birds or other animals nesting in the vents; and

3. Unauthorized damage to the vents.

The inspection of the passive gas vents will involve visual observation of the external integrity of the vent and the bird screen on the end of the vent. Physical damage to the vent such as kinks or bends which may impede gas flow will be noted. Evidence of blockages as a result of debris or nesting of animals within the gas vents which may restrict flow will also be noted.

Information collected during the inspection of the passive gas venting system will be documented on the field inspection form shown on Figure 3. The inspection of the passive gas venting system will be performed as part of the annual inspection.

3.3.2 Maintenance Plan

There are no scheduled maintenance requirements for the passive gas venting system. The anticipated repair maintenance tasks which may be necessary to ensure the continued effectiveness of the passive gas venting system are the following:

1. Repair or replacement of the passive gas vents or portions of the pipes if physical damage is noted which can decrease their effectiveness;
2. Removal of blockages such as grass clippings, leaves, birds or animals nests in the vents;
3. Replacement of bird screen at the end of the vent, if damaged; and
4. Regrading around vent to prevent ponding.

Repair tasks performed for the gas vents will be documented on the field maintenance form as shown on Figure 4.

3.4 Site Security System

3.4.1 Inspection Plan

Site security is provided by the Site security system as described in Section 1.3. The purpose of the security system is to prevent unauthorized access of vehicles onto the cover system. Periodic inspection of the Site security system is necessary to document and ensure the continued security of the Site.

Reasonably anticipated items which could reduce the effectiveness of the Site security system include:

1. Unauthorized damage or disturbances by personnel and/or equipment;
2. Excessive wear to the fence gate and/or lock;
3. Improper function of the fence gate and/or lock; and
4. Vandalism.

Inspection of the Site security system will consist of visual observations. The security fence will be inspected for damage such as holes or breaks. The gates and locks will be inspected for damage or excessive wear. The results of the inspection will be documented on the field inspection form shown on Figure 3. The integrity of the Site security system will be evaluated annually during the Spring.

3.4.2 Maintenance Plan

There are no scheduled maintenance requirements for the Site security system. The anticipated repair maintenance tasks which may be necessary to ensure the continued effectiveness of the Site security system are listed below:

1. Repairing of any holes, breaks or other unauthorized damage or disturbances by personnel and/or equipment to the security fence, gate or lock;
2. Replacement of the gate and/or lock if excessive wear prohibits proper functioning; and
3. Replacement of areas or sections of the security fence which have rusted significantly in order to prevent holes or breaks from developing in the fence.

All repair tasks performed for the Site security system will be documented on the field maintenance form as shown on Figure 4.

3.5 Monitoring System

3.5.1 Inspection Plan

The purpose of the monitoring system is to monitor groundwater, surface water, and landfill gas in the vicinity of the Site. A total of 16 groundwater monitoring wells and 2 piezometers are present on and around the site as part of the long-term monitoring system. All monitoring wells at the Site included as part of the monitoring system will be inspected. Monitoring well locations are illustrated on Figure 2. The periodic inspection of the groundwater monitoring wells is necessary to document and ensure their continued effectiveness as valid monitoring points.

The following are those reasonably anticipated items which may impact the effectiveness of the groundwater monitoring wells:

1. Damage to the protective casing or lock;
2. Damage to the surface seal;
3. Evidence of vandalism;

4. Damage to the internal casing;

5. Blockages resulting from objects fallen into the well or bent casing; and

6. Damage to the dedicated sampling equipment.

The inspection of the groundwater monitoring wells will involve visual observation of the external integrity of the well. The protective casing will be inspected for excessive rust and any damage as a result of vandalism. The lock will be checked to verify that it is in good working condition. The surface seal shall be inspected for cracks and damage as a result of freeze/thaw. The internal casing/protective casing annulus will be checked for blockages as a result of kinks or bends. The area should be free of debris and animals. The internal casing should also be inspected for blockages at depth during well sampling. The area around the monitoring well shall be inspected for drainage and accessibility.

Information gathered during the inspection of the groundwater monitoring wells will be documented on the field inspection form as shown on Figure 5. The groundwater monitoring wells will be inspected during each monitoring event.

3.5.2 Maintenance Plan

There are no scheduled maintenance requirements for the monitoring system. Anticipated repair maintenance tasks which may be necessary in order to ensure the continued effectiveness of the groundwater monitoring wells include:

1. Replacement or repair of surface seal;

2. Replacement or repair of protective casing;

3. Replacement of the well;

4. Removal of vegetation to maintain access;

5. Replacement of the lock; and

6. Replacement or repair of dedicated sampling equipment.

Repair tasks performed for the groundwater monitoring wells will be documented in the field maintenance form as shown on Figure 4.

4.0 ENVIRONMENTAL MONITORING PLAN

The purpose of the environmental monitoring plan is to evaluate the effectiveness of RWE I and RWE II. The results of the monitoring well be used, among other things, to track the progress in achieving the groundwater performance standards and may be used in petitioning for Contingency Measures and/or alternative performance standards. The environmental monitoring plan is consistent with the requirements of 6 NYCRR Part 360 and the SOW.

The Hydrogeologic Investigation, which was initiated in 1995 as a Pre-Design task for RWE II, will be terminated upon approval of the Remedial Construction Report for RWE I. At that time, O&M for RWE I will begin in accordance with this O&M Plan. The groundwater and surface water monitoring program under this O&M Plan will be identical to that of the Hydrogeologic Investigation until the Preliminary Design Report for RWE II is submitted to USEPA. Any modifications to the groundwater and surface water monitoring program for the remainder of the O&M period will be submitted to USEPA for approval prior to implementation. The monitoring program specified for the Hydrogeologic Investigation is presented below along with new landfill gas monitoring protocol.

4.1 Purpose

Specific objectives for the environmental monitoring plan are as follows:

- to generate data for the design of RWE II;
- to assess the groundwater quality trend(s) at downgradient wells and surface water collection points; and
- to assess the effectiveness of the Removal Action and RWE I for controlling potential off-site migration.

4.2 Groundwater Monitoring

Groundwater samples will be collected from eight (8) monitoring wells at the Site to monitor groundwater quality changes resulting from implementation of the Removal Action and Remedial Work Element I. Some of these data will also be used to form a new design basis for Remedial Work Element II. The eight monitoring wells include MW-1B, MW-1C, MW-2B, MW-6A, MW-6B, MW-7B, MW-9, and MW-10. The locations of these wells are shown on

Figure 2. These locations include downgradient monitoring wells screened in the upper sand and gravel unit. Well MW-6A which is screened in a deeper unit but consistently produced concentrations of VOCs similar to well MW-6B (screened in the upper sand and gravel unit), is included. Monitoring wells MW-1B, MW-1C, and MW-10 which are located at the downgradient edge of the landfill, will be used to establish a design basis for the groundwater treatment system.

Well MW-4B is not included in the monitoring program because the background groundwater quality database documented in the Phase II RI report for the three monitoring events at MW-4B is adequate for use in design of Remedial Work Element II and for tracking beneficial affects realized by the implementation of the Removal Action and Remedial Work Element I. Wells MW-1A, MW-3A, MW-3B, MW-5, MW-8A and MW-8B have not been included because they are located outside the area affected by the Site. Wells MW-2A and MW-7A have not been included because they are located in deeper zones of the aquifer which are not the dominant groundwater transport pathways from the Site.

4.2.1 Groundwater Sampling Procedures

The monitoring wells will be purged and sampled using existing dedicated Well Wizard® sampling pumps. If the pumps are inoperative or otherwise not useable (e.g., water level is below the pump intake), a disposable decontaminated Teflon bailer attached to Teflon coated stainless steel leader wire and new, dedicated polypropylene rope will be used for purging and sampling. Groundwater sampling procedures are presented in detail in Attachment A and are summarized below.

Initially, the depth to the static water surface will be measured with an electronic water level indicator to the nearest 0.01 foot. The well will then be purged until field measurements (i.e., pH, temperature, specific conductance, dissolved oxygen, and turbidity) have stabilized to within 10% for two successive well volumes or until the well is dry. The 10% stability criteria does not apply to turbidity measurements less than 50 NTUs. A well volume is defined as the standing water column in the well casing. The volume of water evacuated, as well as the field measurements will be recorded for each successive well volume purged.

Once the well has been purged, samples will be collected within three (3) hours using the Well Wizard® sampling pump (or a Teflon bailer if necessary). If the well is pumped dry and is slow to recover, the well will be sampled as soon as it has recovered enough to fill the sample bottles, or within 24 hours, whichever occurs first.

Groundwater samples will be analyzed for one or a combination of the following:

- VOCs;
- SVOCs;
- metals (iron, arsenic, and manganese)(unfiltered); and
- leachate parameters (ammonia, chemical oxygen demand, chloride, nitrate/nitrite, sulfate alkalinity and total organic carbon).

The preferred order of groundwater sample collection at each monitoring well, as applicable, is as follows:

1. field measurements (pH, temperature, specific conductance, dissolved oxygen, and turbidity);
2. VOCs;
3. SVOCs;
4. metals; and
5. leachate parameters.

If inadequate water is available to fill all sample bottles, VOC and metals samples should be given priority, in that order, followed by SVOCs and leachate parameters.

Pre-preserved sample bottles will not be used. Care will be taken while obtaining VOC samples to minimize aeration and loss of VOCs. The pump flow rate will be reduced to less than 100 milliliters per minute during collection of samples for potentially volatile analytes (VOCs, TOC, ammonia). There will be no head space or air bubbles in the VOC vials, and the vials will be inverted and tapped lightly to check for air bubbles.

QA/QC samples will include one field duplicate and two VOC trip blanks (or one per day, whichever is greater). Equipment rinsate blanks are not necessary, as all monitoring wells have dedicated sampling pumps. However, if a bailer is used in lieu of an inoperative/not useable sampling pump, an equipment rinsate blank will be collected. Triple sample volume will be included at one well (preferably MW-1B) for MS/MSD analysis.

4.2.2 Groundwater Level Measurements

The depth to groundwater will be measured in all 18 existing groundwater monitoring wells at or near the Site, as well as in the two newly installed piezometers, to confirm groundwater flow direction and vertical flow gradients. The locations of the wells and piezometers are shown on Figure 2. Water levels will be measured during the same day, if reasonably possible, and prior to any purging or sampling. The water level meter used for recording water levels will have the depth graduations checked with an independent measuring tape for calibration before field use.

Prior to each water level measurement, the well identification number, measuring device type and serial number, date, and time will be recorded. The water level meter will be rinsed with distilled water prior to each use. The water level meter probe will be lowered into the monitoring well/piezometer and stopped at the depth where the meter indicates a completed circuit. The depth to water will be then be recorded to the nearest 0.01 foot relative to the top of the inner casing.

4.3 Surface Water Monitoring

A total of three (3) surface water samples will be collected. Samples will be collected from Delaware River sampling stations DRU and DRD, and the Delaware River embayment area sampling station SW-12. These locations are shown on Figure 2.

Surface water samples will be collected by direct immersion of sample bottles if possible. If not, a smaller sample bottle supplied by the laboratory and constructed of the same material (i.e. polyethylene or glass) will be used as a transfer vessel to distribute the sample into the various sample bottles. If the water is too shallow to allow the sample bottles to be immersed, a hole will be dug with a properly cleaned scoop or shovel to allow for complete immersion of the sample bottle. Samples will be collected after any visually-identified turbidity due to digging has dissipated. The schedule for sampling will be planned such that potential impacts from discharges from the wastewater treatment plant do not appear in only one sample (e.g., only DRD).

Surface water sampling will be performed at the downriver location (DRD) first, then proceed to the more upriver locations (SW-12 and then DRU, respectively). During sampling, the sample bottle will be held with the opening pointing upriver and the sampler will stand downriver of the bottle.

Surface water samples will be analyzed for the following parameters:

- VOCs;
- SVOCs;
- metals (iron, arsenic, and manganese)(unfiltered); and
- total suspended solids (TSS).

QA/QC samples will include one field duplicate and one VOC trip blank per day. Triple sample volume will be collected at one location (preferably the Delaware River embayment sample SW-12) for MS/MSD analysis.

4.4 Field Measurements

Field measurements of temperature, pH, specific conductance, dissolved oxygen, and turbidity will be completed at the time of groundwater and surface water sample collection, as appropriate. During groundwater sampling, measurements will be taken prior to purging and after each well volume is extracted. During surface water sampling, the measurements should be taken in-situ just prior to sampling, if possible. The procedures to be used are included in Attachment A.

4.5 Schedule

Monitoring will be performed three times per year in the Fall (end of dry season) in the Spring (end of wet season), and in the Summer (between wet and dry season).

4.6 Gas Monitoring

The waste in the landfill is not expected to generate large amounts of methane because the waste is over 25 years old and has been moist during that time. Explosive gases were not a problem during excavation of drums from the landfill during 1996. Therefore, potential migration of landfill gas will be monitored on a quarterly basis for the first year of the O&M period for RWE I. Explosive gases will be monitored at a depth of 3 feet below ground surface using soil gas barhole probes along the perimeter of the landfill in the areas shown on Figure 2. If the concentration of explosive gases are less than 25% of the lower explosive limit (LEL) for methane, and are not increasing during the 1-year period, then gas monitoring will be terminated.

5.0 REPORTING AND RECORDKEEPING

The following sections describe reporting procedures for inspection, maintenance, and monitoring activities during the post-closure period. The results of these activities will be summarized in an Annual Report submitted to USEPA and NYSDEC. The Annual Report will be submitted within 90 days following the end of the reporting period.

5.1 Inspection Reporting Procedures

All inspection activities described in Section 3.0 of this O&M Plan will be documented by the entity responsible for performing the various inspections. Inspection evaluation reports will summarize the inspection activities and clearly identify any repair maintenance required based upon the inspection.

5.2 Maintenance Reporting Procedures

All scheduled maintenance and repair activities described in Section 3.0 of this O&M Plan will be documented by the Group or the Contractor(s) responsible for performing the various maintenance activities. As described in Section 3.0, if significant repairs require modification of the as-built drawings, the as-built drawings will be revised and certified by a registered Professional Engineer in the State of New York.

5.3 Environmental Monitoring Reporting Procedures

Groundwater, surface water, and gas monitoring data will be submitted on a yearly basis with a summary of an evaluation of the data and recommendations for future monitoring. The QA/QC information will be maintained with the Site Records described in Section 5.5.

5.4 Incident Reporting Procedures

Due to the passive nature of the RWE I components and the prior removal of the principal source areas, emergency response situations are not expected to arise. However, if an emergency situation or failure of any one of the existing Remedial Systems is discovered during an inspection, maintenance, or monitoring activity, the Contractor(s) will notify the Group Project Manager or Emergency Coordinator immediately. The Group will report the incident to USEPA within 24 hours. The Group will submit a description of proposed corrective actions for USEPA approval within 30 working days of reporting the incident.

5.5 Recordkeeping

Site records will be kept by the Cortese Landfill PRP Group, in care of Waste Management Inc.

Cortese Landfill Project Manager
Waste Management, Inc.
4 Liberty Lane West
Hampton, New Hampshire 03842
(603) 929-3443

6.0 SAFETY PLAN

Routine post-closure activities at the Site will be covered under the Health and Safety Contingency Plan (HSCP) for the Cortese Landfill Site. The HSCP shall be prepared by the O&M contractor(s) in accordance with the minimum requirements presented in Attachment B. All personnel on the Site performing routine inspections, maintenance or monitoring activities will be properly trained for these activities and will be made aware of the proper health and safety measures associated with these tasks. Each contractor shall have a designated site health and safety coordinator responsible for assuring the designated procedures are implemented.

All health and safety equipment will be supplied by the contractor performing the work and will be available on Site during inspection, maintenance and monitoring activities as indicated for the particular work in the HSCP. Equipment will be easily accessible and located as close as practical to the work area. The equipment will be maintained in a "ready-to-use" condition. All equipment used will be properly decontaminated, cleaned, refilled, or replaced as necessary or required by the manufacturers' instructions. All personnel will be familiar with proper procedures for operating and cleaning the equipment.

Personnel performing such activities as sampling, confined space entry, or any intrusive work shall be 40-hour OSHA Health and Safety trained in accordance with 29 CFR 1910 and 1926. At a minimum, these personnel will be briefed regarding existing Site conditions. It will be the responsibility of the contractor(s) to ensure that all employees adhere to the HSCP along with all local, State, and Federal regulations while on-site.

6.1 Organizational Structure and Responsibilities

The Group Project Manager will be responsible for personnel, equipment, policies, and procedures for all inspection, maintenance, monitoring, operating, and other activities at the Site. The Group Project Manager will serve as or appoint the Emergency Coordinator. Additional responsibilities of the Group Project Manager include, but are not limited to, the following:

- Identification of materials or wastes handled (materials inventory);
- Identification of potential hazard sources (risk assessment);
- Establishment of emergency reporting procedures;

- Establishment of visual inspection program;
- Review of past incidents, spills, and countermeasures utilized;
- Coordination and implementation of the goals of the Health and Safety Contingency Plan;
- Coordination of activities for emergency response;
- Notification of appropriate authorities;
- Establishment of employee training/educational programs;
- Periodic review and update of the Safety Plan portion of this O&M Plan; and
- Serve as or appoint one or more emergency coordinators.

The Emergency Coordinator will be responsible for coordinating all emergency response measures to minimize or prevent harm to human health and the environment in the event of a fire, explosion, emission, and/or discharge of hazardous materials. In the event of an imminent or actual emergency situation, the Emergency Coordinator will perform the following tasks:

1. Verify that all on-site personnel are aware of the condition;
2. Identify the problem and assess the environmental and health hazards;
3. Contact the emergency response agencies;
4. Take all reasonable measures to stabilize the situation; and
5. Continue to monitor the situation after stabilization.

In the event of an emergency, adequate space will be maintained to allow the unobstructed movement of emergency personnel and equipment on-site. The Emergency Coordinator will ensure that all access roads are kept free of obstructions during an emergency situation.

If response to an on-site incident requires assistance from outside emergency support agencies (police, fire department, medical emergency response teams), the Emergency Coordinator will contact the appropriate agency. The Emergency Coordinator will have immediate and full responsibility and authority to engage the services required. If conditions warrant, the Emergency

Coordinator will relinquish control of the situation to the appropriate agency official upon arrival on-site.

During an emergency, the Emergency Coordinator will take reasonable measures necessary to ensure that fire, explosion, emission, or discharge do not occur, reoccur, or spread. These measures will include, where applicable, terminating activities or operations, collecting and containing released materials, and removing or isolating containers.

If Site operations and activities cease in response to a fire, explosion, emission, or discharge, the Emergency Coordinator will ensure that adequate monitoring is conducted for leaks, pressure build-up, gas generation, or ruptures in valves, pipes, or other equipment, where appropriate.

After an emergency, the Emergency Coordinator may need to determine what treatment or disposal of contaminated soils or waste from an emission, fire, discharge, or explosion is necessary. He will ensure that all necessary cleanup procedures are completed. Following an incident and response actions, the Emergency Coordinator will submit a report to the Agencies detailing the incident. An emergency notification form should be completed (see Figure 7).

In the event of fire, explosion, emission, and/or discharge of hazardous materials, the individual who observes the event will report the condition to the Emergency Coordinator who will contact the appropriate emergency agency, if necessary. If the Emergency Coordinator is unavailable, the senior individual on-site will act as the Emergency Coordinator until the Emergency Coordinator becomes available.

A list of persons and their phone numbers to be contacted in the event of an emergency (refer to Table 2) will be available to the O&M Contractor and posted in the Town Hall and in the Narrowsburg Wastewater Treatment Plant Building.

6.2 Emergency Services

If response to an on-site incident requires assistance from outside emergency support agencies (police, fire department, medical emergency response teams), the Emergency Coordinator will contact the appropriate agency. The Emergency Coordinator will have immediate and full responsibility and authority to engage the services required. If conditions warrant, the Emergency

Coordinator will relinquish control of the situation to the appropriate agency official upon arrival on-site.

A list of contacts and emergency services is provided below in case an emergency situation arises. This list and a map showing the locations of the Site and hospital will be carried in the O&M Contractor's vehicle and posted in conspicuous locations in the Town Hall and in the Narrowsburg Wastewater Treatment Plant Building. The 911 emergency system is operational in the Site's immediate area.

1.	Town of Tuston Police Department	914/252-3212
2.	Town of Tuston Fire Department	914/252-3246
3.	Narrowsburg Ambulance	914/252-3321
4.	Wayne Memorial Hospital	717/253-8100
5.	USEPA Project Manager - Mark Granger	212/637-3955
6.	PRP Group Project Manager - David Moreira	603/929-3443

The Emergency Coordinator will give the following information to the agency:

1. Name and telephone of person reporting the incident;
2. Name and address of the Site;
3. Time and type of incident (e.g., fire, discharge);
4. Name and quantity of material(s) involved, to the extent known;
5. The extent of injuries, if any; and
6. The possible hazards to human health or the environment.

Final approved copies of this Safety Plan will be submitted to the local police, fire and health departments, and the local hospital and rescue or ambulance squad.

6.3 Evacuation Plan

It is not anticipated that evacuation of the Site will be necessary. In general, evacuation will be limited to the immediate area surrounding the emergency situation. If the Emergency Coordinator determines that Site evacuation is necessary, the following evacuation procedures will be implemented:

1. Notify all on-site personnel;
2. Personnel will secure equipment and materials and place them in safe areas;
3. Personnel will evacuate via Site access roads (unless obstructed);
4. Personnel will reassemble at the uphill portion of the paved access road away from the incident;
5. Emergency Coordinator will account for all personnel;
6. Emergency Coordinator will notify the appropriate emergency response agency; and
7. Personnel will not reenter the area until it is determined to be safe by the Emergency Coordinator or an appropriate official.

The evacuation procedures outlined above will be communicated to all personnel.

6.4 Amendments to the Safety Plan

The Health and Safety/Contingency Plan will be amended and submitted to USEPA for review, as necessary.

7.0 PLAN MODIFICATION PROCEDURES

During the post-closure period, a designee of the Group will continuously evaluate the inspection, maintenance, and monitoring activities described in this O&M Plan. Modifications may be appropriate (e.g. reduction in monitoring frequency) based on changes in Site conditions or previous data and information collected. As such, a written detailed description of the proposed change(s) will be submitted for USEPA review. Modifications to this O&M Plan will be implemented upon receipt of approval from USEPA.

REFERENCES

Golder Associates Inc., Remedial Design Work Plan, Cortese Landfill Site, Narrowsburg, New York, May 1996.

United States Environmental Protection Agency, Consent Decree for Remedial Design/Remedial Action, Cortese Landfill, August 1995.

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TABLE 1
SITE INSPECTION, MAINTENANCE, AND MONITORING PLAN SUMMARY
CORTESE LANDFILL
NARROWSBURG, NEW YORK

Item	Interval (Years) of Post-Closure Period	Inspection Frequency(2)	Maintenance Frequency	Monitoring Frequency
Low Permeability Cover System	0-30	Annually	Annually See Note 2	N/A
Surface Water Control System	0-30	Annually	See Note 2	N/A
Passive Gas Venting System	0-30	Annually	See Note 2	Quarterly(3)
Site Security System	0-30	Annually	See Note 2	N/A
Groundwater Wells and Surface Water Monitoring Points	0-30(1)	Trimesterly	See Note 2	Trimesterly(1)

__Notes:__

1. The groundwater, surface water, and gas monitoring may be discontinued if it indicates that there is not an unacceptable risk to human health or the environment. See Attachment 1 for details of monitoring program.
2. Repair maintenance of the indicated items will take place when a deficiency in noted during inspection.
3. For first year of operation and maintenance.

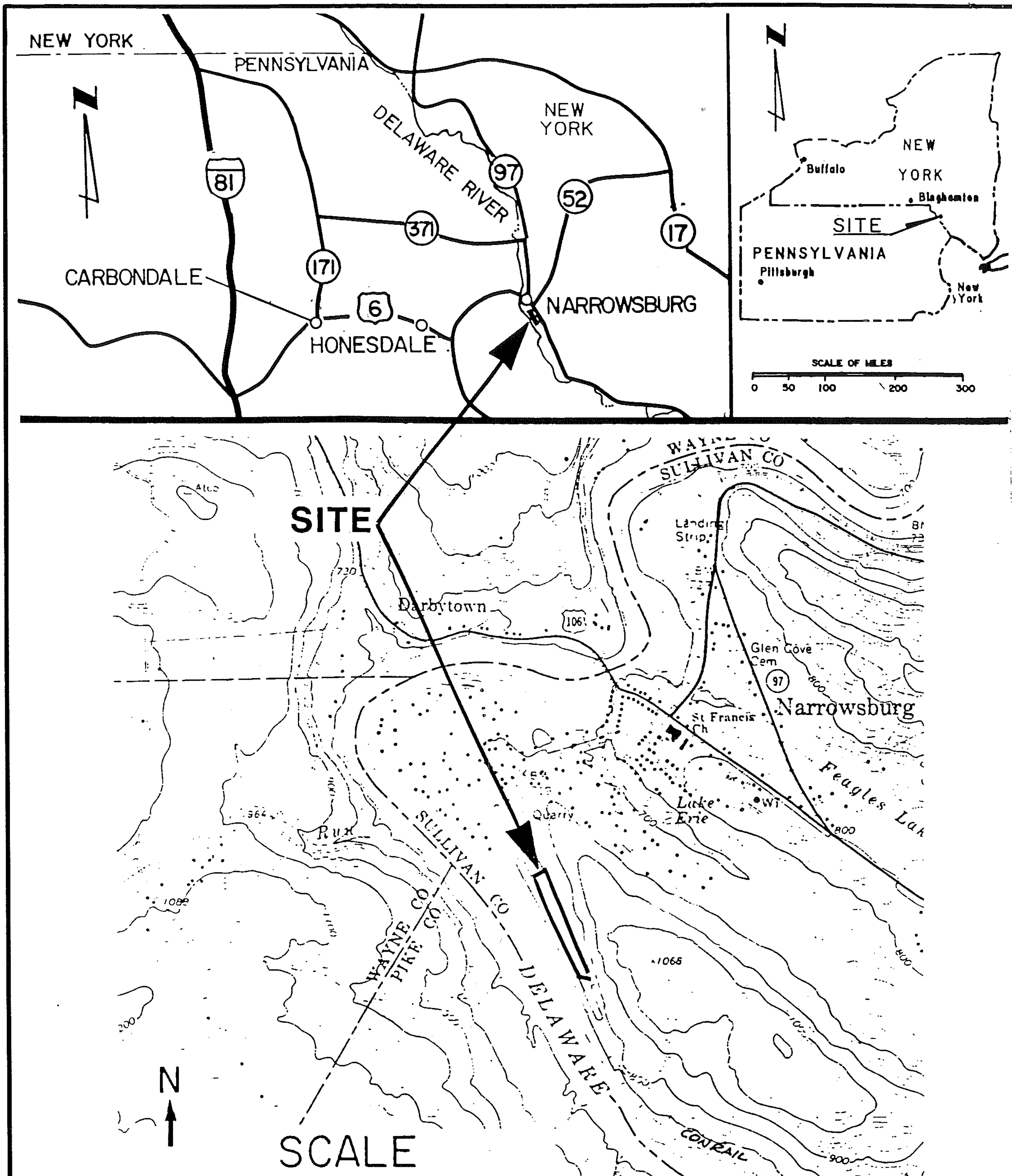
TABLE 2
EMERGENCY RESPONSE CONTACTS
CORTESE LANDFILL
NARROWSBURG, NEW YORK

In case of emergency, contact in the following sequence:

Dave Moreira - PRP Group Project Manager	(603) 929-3443.
Mark Granger - USEPA Project Manager	(212) 637-3955

EMERGENCY SERVICES:

Narrowsburg Police Department	(914) 252-3212
Narrowsburg Fire Department	(914) 252-3246
Narrowsburg First Aid Emergency	(914) 252-3321
Wayne Memorial Hospital	(717) 253-8100
USEPA Region II	(212) 264-0503



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NOTE:
TAKEN FOM USGS 7.5 min. QUADRANGLE:
NARROWSBURG, N.Y.-P.A.

JOB No.:	953-6252	SCALE:	AS SHOWN	CORTESE LANDFILL SITE LOCATION PLAN
DR BY:	WCM	DATE:	02/11/97	
CHK BY:	DLA	FILE No.:	NY02-405	
REV BY:	RMG	DR SUBTITLE:	04	

Golder Associates | CORTESE LANDFILL | FIGURE 1

FIGURE 3
POST-CLOSURE ANNUAL INSPECTION FORM
CORTESE LANDFILL
NARROWSBURG, NEW YORK

DATE ____________________

INSPECTOR ____________________

INSPECTION (Circle one): ANNUAL
OTHER ________________

ITEM	ADEQUATE	NEEDS ATTENTION	COMMENTS (NOTE IF REPAIR MAINTENANCE REQUIRED)
I. PROTECTIVE COVER SYSTEMS			
A. General condition of cover material			
B. Settlement control			
C. Erosion control			
D. Animal burrows			
E. Large weeds or woody species			
F. Vegetation			
G. General conditions of access roads			
II. SURFACE WATER DRAINAGE SYSTEMS			
A. General condition of channels			
B. Settlement control			
C. Erosion control			
D. Animal burrowing			
E. Flow capability			
F. Rip rap protection			
G. Vegetation control			
H. Integrity of groundwater recharge riser pipes			
I. Structural integrity of culverts			
III. PASSIVE GAS VENTING SYSTEM			
A. General condition of each vent			
B. Vent visibility			
C. Drainage and accessibility			
D. Venting capability			
IV. SITE SECURITY			
A. Security Fence			
B. Gate and lock			

Clearly Identify Areas Needing Attention (Reference Item No.) on the Site Plan.

FIGURE 4
POST CLOSURE MAINTENANCE/REPAIR FORM
CORTESE LANDFILL
NARROWSBURG, NEW YORK

DESCRIPTION OF MAINTENANCE/PROBLEM: ______________________________

____

____

DATE PROBLEM IDENTIFIED: __________

MAINTENANCE/REPAIR TAKEN TO RESOLVE PROBLEM (Identify Locations of Maintenance on Site Plan):

____

____

____

____

____

____

DATE COMPLETED: __________

INSPECTOR: __________

FIGURE 5
MONITORING WELL
POST-CLOSURE INSPECTION FORM
CORTESE LANDFILL
NARROWSBURG, NEW YORK

DATE ____________________ INSPECTION (Circle one): TRIMESTERLY
OTHER____________

INSPECTOR ____________________ MONITORING WELL NO.:__________________

	YES	NO	ACTION REQUIRED
A. Location/Identification			
1. Is well readily accessible?	______	______	______________
2. Is well in a protected area or in a vulnerable traffic area?	______	______	______________
3. Is well situated outside a low point or ponded water?	______	______	______________
4. Is well head area free of waste, stored chemicals, etc.?	______	______	______________
5. Is well flagged or painted?	______	______	______________
6. Is well labeled inside and outside?	______	______	______________
B. Surface Seal			
1. Is concrete surface seal in good condition (i.e., no cracks)?	______	______	______________
2. Is the seal secure against the casing and ground surface?	______	______	______________
3. Is the seal sloped away from the well head?	______	______	______________
C. External Casing			
1. Does well have external casing in good condition (i.e., no cracks)?	______	______	______________
2. Is external casing locked?	______	______	______________
3. Is lock in good condition (i.e., no severe rust)?	______	______	______________
4. Is casing/annulus in good condition and free of water/animals/debris?	______	______	______________
D. Internal Casing			
1. Is internal casing at least 1 foot above ground?	______	______	______________
2. Is casing tight horizontally/vertically/rotationally?	______	______	______________
3. Is casing free of animals/debris/kinks or bends?	______	______	______________

FIGURE 6
EMERGENCY NOTIFICATION RECORD
CORTESE LANDFILL
NARROWSBURG, NEW YORK

Inspector identifying emergency: ______________________________

Date of identification of emergency: ______________________________

Description of emergency: ______________________________

____

____

____

____

Person(s) notified: ____

Date of notification: ____________________

Signature of inspector and date: ______________________________

List of persons to be notified:

1. PRP Group representative: ______________________________

   Address: ______________________________

   Telephone number: ______________________________

2. Emergency Agency representative: ______________________________

   Address: ______________________________

   Telephone number: ______________________________