OPERATION, MAINTENANCE, AND MONITORING PLAN

VOLUME 2

Gas and Subsurface Control Systems

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Volume 2 – Gas and Subsurface Control Systems
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The material and data in this report was compiled and/or prepared under the responsible charge, supervision, and direction of the undersigned.

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TABLE OF CONTENTS

TABLES

FIGURES

APPENDICES

DOCUMENTS INCORPORATED BY REFERENCE

- Gas System Monitoring Equipment Manual
    - Gem 2000 (or equivalent) Operating Manual
    - Water Level Meter User Manuals
    - Four-gas Personnel Monitoring Meters
    - Flame Ionization Detector
    - Fluke Temperature Probes
- Blackhawk Pump Operation Manual(s)
- QED Pump Operation Manual(s)
- Flare(s) Manufacturer's User Manuals
- Blower(s) Manufacturer's User Manuals
- Air Compressor(s) Manufacturer's User Manuals
- Caterpillar 1 Megawatt Backup Generator User Manual

1.0 INTRODUCTION

This document comprises Volume 2 of a three-volume Operation, Maintenance, and Monitoring Plan (OM&M Plan) for the Bridgeton Landfill, LLC (Bridgeton Landfill). The OM&M Plan consists of:

Volume 1 - General Requirements and Cap System
Volume 2 - Gas and Subsurface Control Systems (this volume)
Volume 3 – Leachate Management Systems

Volume 1 describes the history of the landfill as well as the OM&M Plan purpose, management structure, data collection and reporting, and procedures for modifications.

Certain reactions (also called a subsurface smoldering event or SSE) are believed to be occurring within portions of the landfill. The effects of the reactions produce untypical and stressful conditions on the gas collection and control system (GCCS) including:

- Elevated temperatures which require special construction materials.
- Reduction in methane concentrations (due to elevated temperatures) accompanied by production of hydrogen, volatile organics, and carbon monoxide; creating a non-typical blend of gases for the flares and other GCCS components,
- Drying of waste which results in a steam/water vapor front moving out, up, and away from the reaction which then condenses in the cooler surrounding waste mass, and gas extraction wells, resulting in increased leachate generation and obstruction of gas extraction well perforations,
- Higher-than-normal pressure immediately adjacent to the reacting waste mass, and
- Settlement under and/or adjacent to reacting waste mass, with the potential to create pinches, warps, and or breaks in the gas extraction well casings.

Each of these conditions results in operational and maintenance challenges. It is not known how long the SSE will continue or how long these conditions will exist, but it is believed the elevated temperatures and atypical gas quality could be present for many years. Therefore, special operating and maintenance procedures are, and will be, necessary for the GCCS until conditions allow for resumption of typical procedures.

As of this writing, the SSE is contained to the South Quarry. As a result, the GCCS and subsurface control conditions are very different in the (impacted) South Quarry and the (non-impacted) North Quarry. Throughout this volume, references will be made to these two situations where GCCS procedures differ as a consequence. Bridgeton Landfill has already prepared and submitted engineering plans for modifications to the North Quarry GCCS should it be necessary or appropriate based upon future site conditions. If those changes are implemented, this volume will be updated to reflect operation and maintenance of the modified system.

In addition, other subsurface control features have been installed (e.g. Gas Interceptor Wells or GIWs) in attempt to isolate and contain the SSE, and more features may be added (i.e. possible cooling devices) for this purpose. Operation and maintenance of existing features will be addressed in this volume and then revisions made to this volume when necessary.

The existing GCCS consists of a series of active gas collection wells and trenches which are connected via a network of vacuum distribution piping to two flare stations where the landfill gas is combusted. A schematic illustration of the GCCS is provided as Figure 1.

Since the gas and subsurface control systems at the landfill need to be modified frequently to adjust to the conditions caused by the SSE, specific component quantities, manufacturer models, ID numbers, etc. may not be referenced in this Volume 2 of the OM&M Plan. Instead, a current set of record documents and as-built drawings will be maintained in a dedicated file at the landfill office at all times. In addition, this volume references other documents that will be kept on site including: a Health and Safety Plan (specifically designed for activities related to this OM&M Plan), equipment operating manuals, etc.

2.0 OPERATION

A robust and unique system designed to prevent odors, minimize lateral gas migration, reduce internal temperatures, and minimize oxygen intrusion within the landfill has been installed at the site. This system includes the following components.

COMPONENT	PURPOSE
EVOH Flexible Membrane Liner (FML) Cap (South Quarry) and Final Clay Cover (North Quarry)	Contains gas within the landfilled waste, increases gas collection efficiency, reduces oxygen and liquid infiltration, and minimizes fugitive emissions.
Subcap (near-surface) Collectors	Capture and extract gas, liquids, and heat which is confined directly under the FML cap.
Perimeter Toe Collection Trench and Sumps	Installed at toe of EVOH FML cap for the collection of gas and liquid from the subcap collectors and at the perimeter cap termination.
Gas Extraction Wells (GEWs)	Collect and remove gas and heat from the waste.
Dual Phase Enhanced Gas Extraction Wells (GEWs)	Collect and remove gas from the waste and collect and remove leachate from the gas extraction wells.
Gas Interceptor Wells (GIWs)	Closely spaced gas extraction wells installed in parallel lines to intercept reaction gasses, remove heat, reduce pressure, and stop advancement of the SSE.
Condensate Traps (CTs)	Collect liquid that condenses within the gas collection lateral and header pipes. Condensate drains by gravity into the CT structures.
Phase Separation Vessels	Tanks that are used to collect hot saturated gas or gas from wells that are ejecting steam and/or liquid. The vessels allow gravity and condensation separation of the gas and liquid components.
Perimeter Extraction Wells (PEWs)	Located outside of the refuse limits for controlling landfill gas migration.
Gas Migration Interceptor Trenches	Provide cutoff and/or gas interception in areas that experience gas migration compliance issues.
Gas Conveyance Pipe Network	Connects all of the gas extraction and collection devices to the flare stations.
Stationary Air Compressors	Supply compressed air to operate the pneumatic operated dewatering pumps.
Pneumatic Distribution Pipe Network	Distributes the compressed air to the dewatering pumps.
Dewatering System Conveyance Pipe Network	Conveys the liquids recovered by the dewatering wells to the leachate collection system.
Other Gas Collection Devices	Collect gas from other structural elements of the landfill operating systems to minimize fugitive emissions.
Blower/Flare Stations	Provide the primary gas moving equipment and the combustion mechanism.

Figure 2 shows the location of the currently-active vertical gas extraction wells (GEW, GIW, and PEWs). Actual up-to-date as-built drawings and gas well as-builts will be kept at the landfill office and available for inspection. Appendix A contains typical details for many of those above-described components of the GCCS which may need periodic addition or repair.

2.1 GCCS Operation Monitoring Equipment

Operational measurements will be taken by a trained technician who is directly employed by Bridgeton Landfill or subcontracted to perform these services. Data collected in the field allows the operator to make immediate adjustments to gas wells for improving gas collection efficiency, and provides data which provides additional insight to the conditions existing within the landfill waste mass.

Measurements are made in the field at the wellhead sampling port using a GEM 2000 device manufactured by CES Landtec or equivalent using the procedures provided in Appendix B and C. This instrument provides temperature, pressure/vacuum, flow, methane, oxygen, and carbon dioxide readings. The device is calibrated according to the manufacturer's recommendations; calibration procedures for this instrument are provided in Appendix D. The GEM 2000 has the following accuracies within the referenced ranges.

- Temperature at 14 to 167˚ F range with + or – 0.4% accuracy (if gas temperatures exceed 167˚ F, an analog or digital temperature thermometer is inserted into the sample port and the temperature is manually input into the GEM 2000 data screen),
- Methane (CH_4) at 0 to 70% range by dual wavelength infrared cell with + or -3% accuracy,
- Carbon dioxide (CO_2) at 0 to 40% range by electrochemical cell at + or – 1% accuracy,
- Pressure at maximum – 70 inches water column vacuum and + or – 250 mbar from calibration pressure, and
- Ambient air temperature operating range is 32 to 104 degrees Fahrenheit (for operating temperatures outside these ranges, equipment will be swapped throughout the day and while in the field will be either shaded or insulated to keep the internal instruments within the manufacturer's recommended operating range).

Note that the GEM instruments are capable of measuring outside of the ranges shown but with a likely lesser degree of manufacturer-guaranteed accuracy. If it is known that values may fall outside of the ranges indicated, then calibration practices utilizing calibration gas concentrations closer to the expected reading may be used to increase accuracy for such situations.

At the end of each monitoring day, the GEM 2000 data is downloaded to a computer for data storage. The technician that collected the data will review his/her collected data to look for triggers, unusual trends, or anomalous readings that may not have been detected in the field.

Wellfield data will be stored in a database, and a copy of the original comma separated variable (csv) file will be maintained on a facility computer.

The operating manual for the GEM 2000 (or equivalent) meter and the Fluke digital thermometer will be retained in the "Gas System Monitoring Equipment Manual" binder in a dedicated file at the landfill office.

2.2 General GCCS Operation

Gas from the gas extraction points (gas extraction wells, subcap gas collectors, and other gas collection devices) flow through a network of lateral and header pipes and then to the blower/flare area as shown schematically on Figure 1 and on the typical drawings contained in Appendix A. The following sections describe the general requirements for operating the GCCS.

2.2.1 Operating Parameters

Gas Extraction Wells (GEWs)

Bridgeton Landfill strives to achieve the operating limits required by the New Source Performance Standards for Municipal Solid Waste Landfills (NSPS). However, the SSE makes temperature and pressure requirements non-achievable at many wells in the South Quarry area.

Parameter (at the Wellhead)	NSPS Requirement
Gas Temperature	≤131° F
Oxygen	≤5%
Pressure	≤0" wc

The technician will strive to maintain 131˚ F where possible; however, in areas where this threshold cannot be attained due to effects of the SSE, sufficient vacuum will be applied to the extraction point to maintain odor control and to reduce pressure or other heat-causing conditions under the cap and cover systems.

To assist compliance with the 5% limitation, and reduce the risk of ambient air intrusion into the waste mass, Bridgeton Landfill will use a goal of 2% oxygen as an upper limit for vertical extraction wells per the procedures outlined in the Gas Well Assessment Protocol – Oxygen > 2% protocol (contained in Appendix E). For wells which exceed 2% oxygen levels, personnel will operate to keep the oxygen content as far below 5% as possible. It should be noted that oxygen present in a gas wellhead during monitoring is not a certain indication that oxygen is present in the waste mass.

Sufficient and consistent vacuum must be applied to the wellfield. Bridgeton Landfill's goal is to maintain each extraction point in the gas collection system under negative gauge pressure. When zero or positive pressure is detected at a well head, and this pressure cannot be brought under vacuum with tuning adjustments (i.e. adjustments of the well control valve), investigation must be conducted to determine if an infrastructure problem exists and to identify the appropriate corrective action to bring the extraction well back to negative gauge pressure. Positive pressure will be investigated and diagnosed using the procedure contained in Appendix F.

Gas Interceptor Wells (GIWs)

The gas interceptor wells (GIWs) are closely spaced gas extraction wells installed in parallel lines to intercept reaction gasses and remove heat, thereby limiting or slowing advancement of the SSE. The same operating parameters exist for these wells as for the GEWs; however, the purpose of these wells is to maximize heat removal, so no particular effort is made to reduce wellhead temperature. Oxygen and pressure criteria are applicable to these wells.

Perimeter Gas Extraction Wells (PEWs)

Perimeter gas extraction wells (PEWs) are located outside of the waste mass and are intended to maintain a vacuum at the perimeter of the landfill, thereby minimizing offsite lateral gas migration. Perimeter gas extraction wells are designated on the as-built drawings with a "PGW" or "PEW" prefix. These gas extraction wells are subject to the NSPS standards and are therefore required to maintain wellhead gas temperature and gas pressure within certain ranges. However, since these wells are located outside the limit of waste and intentionally collect air from natural geologic formations, NSPS oxygen limits are waived.

Trench and Sub-Cap Gas Collectors

A number of other special features are employed to address the conditions related to the thermal event. These include: strip drains and near-surface collectors under the FML cap, perimeter collector trenches at the toe of the FML cap, surface collectors (bubblesuckers), and others that may be installed in the future. Details and locations of these sub-cap gas collectors are shown on the as-built drawings maintained at the site. The Environmental Manager has the discretion to add additional similar features as necessary to reduce fugitive emissions and improve constituent containment.

These features are considered to operate as enhancement to the integrity of the cap system (prevent ballooning, leachate ponding, etc.). As such, they may not subject to all NSPS requirements. However, gas quality data will be collected from these features to help determine if a cap breach has occurred or a cap integrity feature needs maintenance.

2.2.2 Identification and Response to Abnormal Conditions (North Quarry Only)

Bridgeton Landfill will use the "Gas Well Assessment Protocol for Non Typical Temperatures" (see Appendix G) when a temperature of 145˚ Fahrenheit is exceeded at a landfill gas extraction wellhead that has not previously experience such an elevated temperature. If a potential subsurface oxidation (SSO) event is suspected, the procedures contained in Appendix H will be employed.

2.2.3 Establishing Vacuum Set-Point

The vacuum set-point is an important part for maintaining the wellfield's overall "health." Vacuum should be maintained as low as possible while ensuring minimum acceptable negative pressure is available to the furthest points of the collection system. The vacuum set-point goals shall be as follows.

- Provide GCCS extraction consistency – vacuum is maintained consistently so balancing and tuning events are consistent,
- Prevent excessive air from entering the landfill – prevent "over pull" which damages anaerobic bacterial populations,
- Prevent "under pull" which does not allow the GCCS to capture all the gas being generated by the landfill, and could result in surface emissions, odors, and offsite gas migration,
- Minimize impact if GCCS pipeline, fitting, or joints fails – minimal vacuum prevents large amount of soil, trash, air and debris from entering the GCCS if a failure occurs.

A minimum system vacuum "set-point" and the set-point monitoring location will be established at the inlet to each prime mover. The vacuum set-point will be set based on the following:

- Input from the Bridgeton Landfill site technician staff,
- Other data, including engineering calculations and equipment performance limits and capacities,
- The monitoring location shall be representative of the vacuum applied to the wellfield.

Vacuum set-point, once established, will not be changed unless the Environmental Specialist or Environmental Manager proposes to adjust the set-point or a change is necessary for purposes of enhanced or more effective gas control.

2.3 GCCS Tuning Events

Valid and consistent wellfield data is critical to maintaining compliance, and is essential to making accurate tuning decisions. Without accurate data, improper tuning adjustments can lead to odor issues, migration issues and potentially long term damage to the gas producing bacteria population.

Before beginning the monitoring and tuning event, it will be verified that the collection system is operating at the vacuum set-point. Once the tuning event is started, the technician will strive to complete monitoring and tuning event for the entire wellfield in consecutive days unless the prime mover deviates from normal vacuum operating conditions. Initial and adjusted wellhead measurements shall be made in accordance with the procedure provided in Appendix B.

In addition to gas extraction wells, subcap wells, subcap gas collectors, and other primary extraction points, the following points shall also be measured during each tuning event:

- Inlet to control device prime mover (before and after tuning event),
- Point where vacuum is distributed to the wellfield piping (before and after tuning event), and
- At condensate and leachate sumps (vacuum reading only).

2.4 Data Management

Proper management of field data is critical. Accurate and complete records of all field collected data will be maintained, even when data appears to be anomalous. Detailed field data management procedures are contained in Appendix C.

2.5 Liquid Level Measurement

One of the major factors which can limit landfill gas extraction is the presence of liquids within a collection well. Liquid inhibits the collection efficiency of a landfill gas well by limiting the availability of gas to be pulled through the gravel pack and well casing perforations.

Fluid level measurement at a frequency described in Volume 1 of the OM&M Plan will be obtained on all accessible vertical gas extraction wells on a routine basis, or whenever a forensic investigation of a poorly-functioning gas well needs to be performed. Wells that are equipped with remote access laterals or have conditions which preclude safe access (excessive pressure or liquid ejection) cannot be measured. Procedures for obtaining liquid level measurements are contained in Appendix I.

Operating, maintenance, and calibration procedures for the Solinst, Heron, or other water level meter used for these measurements will be maintained in the “Gas System Monitoring Equipment Manual” binder in the Environmental Manager’s or appropriate Environmental Specialist’s office at the landfill.

2.6 Dual Phase Gas Extraction Wells (Dewatering)

The heat generated by the reaction causes waste to dry, which results in a steam/water vapor front moving out, up, and away from the reaction. This vapor condenses in the perimeter leachate collection system, cooler surrounding waste mass, and gas extraction wells. As a result, efficiency for many of the wells may be reduced because much of the perforated screen interval is chronically watered-in, reducing gas flow.

The term “dewatering” is used to describe the process of removing liquid from a gas extraction well. However, this function is quite different than the typical definition of dewatering where a saturated media is pumped to reduce a phreatic surface.

A gas extraction well should be equipped with a pump if gas flow from the well is severely restricted, or if less than 20% of the available well screen perforations are exposed. However, certain gas extraction wells at Bridgeton Landfill may be, or may become, non-accessible. These wells are designated as such based on the following criteria:

- A dummy (mock up replica of the different types of low flow dewatering pumps) could not be advanced to a sufficient depth, indicating a pump could not be installed in the gas extraction well,
- The gas extraction well is known to have a “stinger”, which is a device used to allow gas extraction from a compromised gas extraction well, but which obstructs physical access,
- The gas extraction well has a “remote” well head which prohibits direct access to the well for pump installation,
- Settlement can cause cracking and sinking adjacent to a gas extraction well within the synthetic capped area. This can temporarily hinder physical access, and
- Conditions at the gas extraction well are such that the downhole temperature is over the boiling point (212˚ F) allowing water to flash to steam and be ejected to the top of the wells. This phenomenon has been observed and described as “spitting.” (While not indicative of high internal gas pressures or water pressures adjacent to the well, the steam production can cause high pressures and unstable conditions *within* the well). This results in an unsafe condition for opening the gas well head, and prevents pump operation.

Components of the gas extraction well dewatering system are described in the following sections.

2.6.1 Low-Flow Dewatering Pumps

Pneumatic pumps are standard in the landfill industry, and have been deemed generally more desirable than electric pumps for this specific application, primarily due to their ability to operate at higher liquid temperatures, and the avoidance of an extensive electric distribution system on top of the landfill.

Two “low-flow” pump models are currently being used for this application. Low-flow pumps capable of delivering between 1 to 10 gallons per minute (gpm) are considered sufficient due to the expanded low sustained yield of liquid that can be extracted from a gas extraction well. In addition, higher yield pumps would allow fines in the waste to move into the well filter pack potentially affecting the liquid and gas yield of the gas extraction well.

The primary pump used at the site is the Pneumatic Piston Pump, manufactured by Blackhawk Technology Company. The pump driver is located above ground for simplified maintenance. This pump used a reciprocation motion to force liquid through a check valve at the pump intake. The Blackhawk pump is proven effective even where downhole temperatures exceed 160˚ F. This pump works continuously, even when the well has no liquid in it, and delivers up to approximately 3 gpm for a 2” diameter model and up to approximately 10 gpm for a 3” diameter model.

Operating and maintenance procedures for the Blackhawk pumps or other dewatering pumps will be maintained in the Environmental Manager’s or appropriate Environmental Specialist’s office at the landfill. In addition to the aforementioned products, Bridgeton Landfill will continue to research and develop other alternative pumping equipment, and may use alternate, equivalent equipment at its discretion.

2.6.2 HDPE Air Transmission and Liquid Force Mains (Dewatering “Infrastructure”)

Above-grade HDPE pipe is used to transmit compressed air from the compressors to the dewatering pumps. SDR 11 HDPE pipe is used to convey the pump discharge liquids to the leachate collection system. The HDPE liquid force mains vary in size depending on area served. The liquid transmission lines and pneumatic supply lines form a distribution network that covers the entire affected portion of the landfill.

2.6.3 Permanent Air Compressors

A permanent, skid-mounted, electric-powered air compressor system provides industrial quality compressed air to all of the gas extraction well dewatering pump locations. The location of the compressors and the pneumatic supply line network are shown on the as-built drawings available at the site.

Operating and maintenance procedures for the compressors will be maintained in the dedicated file at the landfill office.

2.6.4 Operation of Dewatering System

Operation of the pneumatic dewatering well pumps is almost completely automated after the initial set-up has been achieved. However, due to the harsh conditions in which the pumps operate, maintaining the dewatering system requires a dedicated effort and heavy maintenance regimen. On a daily basis, a certain number of the pumps will require repair or preventative maintenance. As a result, several of the pumps are typically inoperable at any given time. Spare parts are kept in inventory at the site for expeditious repair and replacement back into service.

2.7 Phase Separation Vessels

Large tanks or frac tanks may be used to separate liquid which condenses or is ejected from the hottest gas wells at the site. Liquid and condensate accumulated in the bottom of these tanks is pumped using pneumatic diaphragm pumps, while gas is extracted from the upper portion of the tanks and conveyed to the GCCS. Operating manuals for the pneumatic pumps are maintained in the Environmental Manager's or appropriate Environmental Specialist's office at the landfill.

2.8 Blowers and Flares

The landfill control devices consists of utility (candlestick) flares which provide thorough destruction of the gas by thermal oxidation. A user manual for each flare and its appurtenant components is retained in the dedicated file at the landfill office. General operation procedures for the blowers and flares are provided in Appendix O. Detailed procedures, parts lists, and troubleshooting guides are included in the manufacture's user manuals. The following provides a general description of the components of the flare assemblies.

Each of the major flare skid components is described in the following sections.

2.8.1 Flare Skid

For detailed operational procedures and parts list, consult the manufacture's user manual, which is incorporated by reference. The major components are described below, according to sequence in the landfill gas process flow.

2.8.2 Condensate Knock-Out Pot (KOP)

The purpose of the condensate KOP is to remove excessive moisture and large particles from the landfill gas flow stream, which might otherwise impact the blower or other sensitive components on the flare skid. The KOP consists of a polymer lined carbon steel vessel that provides a directional change and a decrease in landfill gas velocity, in addition to a stainless steel demister pad with fine filtration capability. A liquid drain is provided at the bottom of the KOP, and is connected to the flare station condensate sump via one-inch HDPE gravity drain line. The KOP has an external sight gauge, to allow monitoring of the condensate level in the KOP. The KOP drain is heat-traced to prevent freezing of liquid in cold temperatures.

2.8.3 Pneumatic Flare Inlet Valve

The purpose of the pneumatic inlet valve is to provide fail-safe shutdown of landfill gas flow to the flare during shutdown or alarm conditions programmed into the flare controls. Under most conditions, the pneumatic inlet valve will remain open when the flare skid blower and flare are energized.

The valve actuator consists of a pneumatically-operated butterfly valve which remains open when pressurized, and a return spring that closes the butterfly valve when the air pressure is released. The flow of air to the valve actuator is controlled by a solenoid valve and electrical limit switches on the butterfly valve. During operation of the flare, the solenoid valve is energized and it passes compressed air to the valve piston to compress the return spring and open the valve. When the flare system shuts down or power to the flare skid is disrupted, the solenoid valve is de-energized, which closes off the air supply, allowing the air in the piston cylinder to be released to the atmosphere and the spring to close the butterfly valve.

The pressure regulator located between the compressor and the actuated valve should be adjusted to maintain appropriate pressure to the pneumatic valve actuator. The manufacturer recommended operating pressure for the pneumatic valve actuator is contained in the operating manual at the site.

2.8.4 Blower

The flare skid includes four gas blowers that supply landfill gas to the flare. The purpose of the blowers is to provide the vacuum and pressure required to extract the landfill gas from the landfill and the pressure required to convey it to the flare. A check valve and a manual butterfly valve are located at the blowers and outlets for control of the landfill gas flow rate and isolation. The blowers' power supplies and controls are located at each end of the blower skid and labeled appropriately.

2.8.5 Air Compressors

The air compressor provides the pressure needed to open the pneumatic fail-close valve on the inlet to the flare and to supply air to the pneumatic condensate pump station. In the event of a power outage or system malfunction, the air compressor will shut down and cease to provide pressure to valves, such as the flare inlet, allowing them to close until the issue has been resolved. Upon power restoration, the compressor will automatically restart.

2.8.6 Pilot Burner Control

The purpose of the pilot burner control is to determine that a sufficient pilot flame is present to ignite a landfill gas stream. When the flare system is first energized, propane from a storage tank is supplied to a pilot burner where it is ignited by a high voltage sparker assembly. Upon spark ignition at the pilot burner, the pilot flame thermocouple begins transmitting the flame temperature to a recorder/controller. Once a specified preheat is reached, the landfill gas blower is activated and the pneumatic flare inlet valve is opened. The pilot gas flame will remain on until a minimum operating temperature is measured by the thermocouple, at which time the pilot flame will turn off. If the pilot flame thermocouple cannot attain the minimum specified operating temperature within a set time interval (commonly around 300 seconds), the blower will automatically shut down and the pneumatic valve will close. A sustained low pilot flame temperature may indicate that the gas may not have ignited.

2.8.7 Operation During Power Failure

The facility has two emergency generators which automatically activate in event of a power grid failure. In some cases, a delay causes a brief flare shutdown causing a pneumatically actuated landfill gas valve to close. Upon the restoration of electrical power, the flare will make three (3) attempts to restart automatically.

2.8.8 Landfill Gas Flow Meter

A flow meter is installed, to allow gas flow measurement, indication, totalizing, and recording. The flow meter output is integrated over time, and both continuous flow rate and total flow is recorded on a digital continuous data recorder enclosed on the flare skid control rack.

2.9 Cooling System

[This section is reserved for the potential installation of cooling system and will be updated with plans and procedures as appropriate if and when applicable in the future].

3.0 MAINTENANCE

Regular inspection and maintenance of GCCS components is necessary to consistently and reliably operate the system. Maintenance procedures are intended to be preventive in nature and to identify problems before they impact the performance of the GCCS or its components. Failure to perform proper inspections and maintenance may result in failure of system components which will make the GCCS less efficient than it should be. Appropriate spare part inventories will be maintained at all times. All maintenance activities shall be performed using good housekeeping practices: all parts, debris, scrap, and tools should be promptly removed to prevent damage to the temporary FML surface.

3.1 Well Decommissioning and Replacement

Elevated temperatures, higher-than-normal settlement, and other conditions can cause wells to pinch, excessively bend, or break below the ground surface. When this occurs, the compromised gas well should be properly decommissioned using the procedure described in Appendix J. Replacement of the gas well, when necessary, will include the requirements contained in Appendix K.

3.2 Gas Extraction Wellheads

The landfill gas collection wellhead is a focal point for GCCS maintenance, as it is the point where flow is regulated and performance is monitored and demonstrated. Improper maintenance can result in non-compliant readings and/or improper balancing and tuning. Each wellhead will be inspected during the tuning and monitoring event. Detailed procedures for inspecting and maintaining the gas extraction wellheads are included in Appendix L.

3.3 Gas Extraction Well Pumps

Inspect pump operation at each well tuning in accordance with the procedures contain in Appendix M. Inoperable pumps will be pulled and repaired on location, or shipped to manufacturer for overhaul. An inventory of spare parts will be maintained on site.

3.4 Air Compressors

During each monitoring event, check and top off the oil level and check and clean the air filters. Perform the following on a monthly basis.

- Inspect and adjust belts,
- Record hour meter information, if equipped,
- Inspect air dryer, if equipped, and
- Manually bleed liquid from system components.

See Appendix N for procedures.

3.5 Blowers and Flares

Currently, two flare systems are in place and utilized at the Bridgeton Landfill. However, additional or replacement flares may be mobilized and placed to optimize gas extraction and fugitive emission control. Major components of the flare systems include:

- Blowers to provide vacuum to the wellfield and move gas to the flare flame,
- Flow meter for providing continuous monitoring of landfill gas delivered to the flare,
- Instrument controls which automate and control the flare operation,
- Demister pads which minimize the amount of liquid droplets delivered to the flare,
- Liquid seals which provide a barrier between the ignited gas and the blower and instrument controls, and
- Autodialer system that notifies Site Personnel if a system error has occurred.

A thermal event provides special operation and maintenance challenges to a flare system including decrease in methane content, increase in hydrogen content, increase in gas moisture content, and the formation of a tar-like substance on components designed to filter particulates within the gas. Procedures for inspecting and maintaining these systems are provided in Appendix O.

Presence of excess hydrogen gas in the gas stream flow to a flare presents the possibility of a back-flash (deflagration) due to the higher explosivity of hydrogen relative to methane. For this reason, samples will be taken and analyzed (analysis will be by laboratory testing method ASTM D-1946 for reporting reformed gases including hydrogen, carbon monoxide, carbon dioxide, methane, and oxygen). Landfill gas samples for the analysis of reformed gases will be collected using summa canisters to be filled directly by using the negative pressure provided in the canister; the sampling frequency is provided in Volume 1 of this OM&M Plan. The Environmental Manager will work with the flare manufacturer to determine if the hydrogen content is within safe limits and, if not, to add an anti-deflagration devise or take other safety precautions.

The fraction of hydrogen will be combined with the flow volume at the flare to determine the quantity of hydrogen collected from the landfill as another potential indicator of the condition of the thermal event.

Landfill gas blowers require regular inspection and maintenance to extend life and reliable operation. This equipment operates on a 24/7 basis under harsh conditions and requires a great number of precisely moving and calibrated parts. Detailed manufacturer’s operation and maintenance manuals for the blower and flare systems are found at the facility and are incorporated into this OM&M Plan by reference. Routine requirements of the OM&M personnel are described in Appendix O.

The Environmental Specialist shall keep an inventory of spare parts on-site for the GCCS. Consult the site-specific OM&M manual(s) for each system component to guide the recommended spare parts inventory. When parts are used from the inventory, replacement spares shall be ordered immediately.

At a minimum the spare parts inventory shall include, but is not limited to the following:

<u>Control System</u>

- Drive belts,
- Two thermocouples of each type/size present on control device,
- Propane for pilot system,
- Compressed Gas (nitrogen or compressed air) for pneumatic valve operation,
- Two flexible shaft couplers,
- Blower bearing set (front and back) for each blower on-site,
- Indicator light bulbs, and
- Media for recording device.

<u>Collection System</u>

- Flex hoses,
- Flex hose powerlock clamps,
- Sample ports (brass hose barbs or plastic quick connect fittings),
- Sample port stoppers (silicone plugs) if using hose barb equipped wellheads,
- Wellheads,
- Rubber (Fernco) couplers,
- Band clamps, Gaskets,
- Spool pieces (6-inch SDR11 HDPE or other site-specific material, and
- Bolt kits

3.6 Condensate Management System Inspection and Maintenance

Condensate forms when moist, warm landfill gases cool within the gas collection piping. This condensed liquid (condensate) is conveyed and trapped in special condensate sumps and then managed as leachate. The condensate management system includes condensate sumps, flare knock-out pots, pumps, and piping. Procedures for inspecting and maintaining these systems are provided in Appendix P.

3.7 Collection and Conveyance Piping

Extracted landfill gas is conveyed to control devices (flares) by a network of lateral and header piping. Some of this piping is below ground and some is above ground. Flow through the pipe network is controlled by a series of valves. In areas where an elevated level of settlement or where temporary FML cap is installed, it is preferred for piping to be located above ground.

Maintaining a sufficient and consistent vacuum throughout the collection and conveyance piping is fundamental for effective gas collection. Landfill settlement, aggravated by the thermal event, can result in low spots ("bellies") that trap condensate and impede gas extraction, or result in an increased frequency of structural compromises.

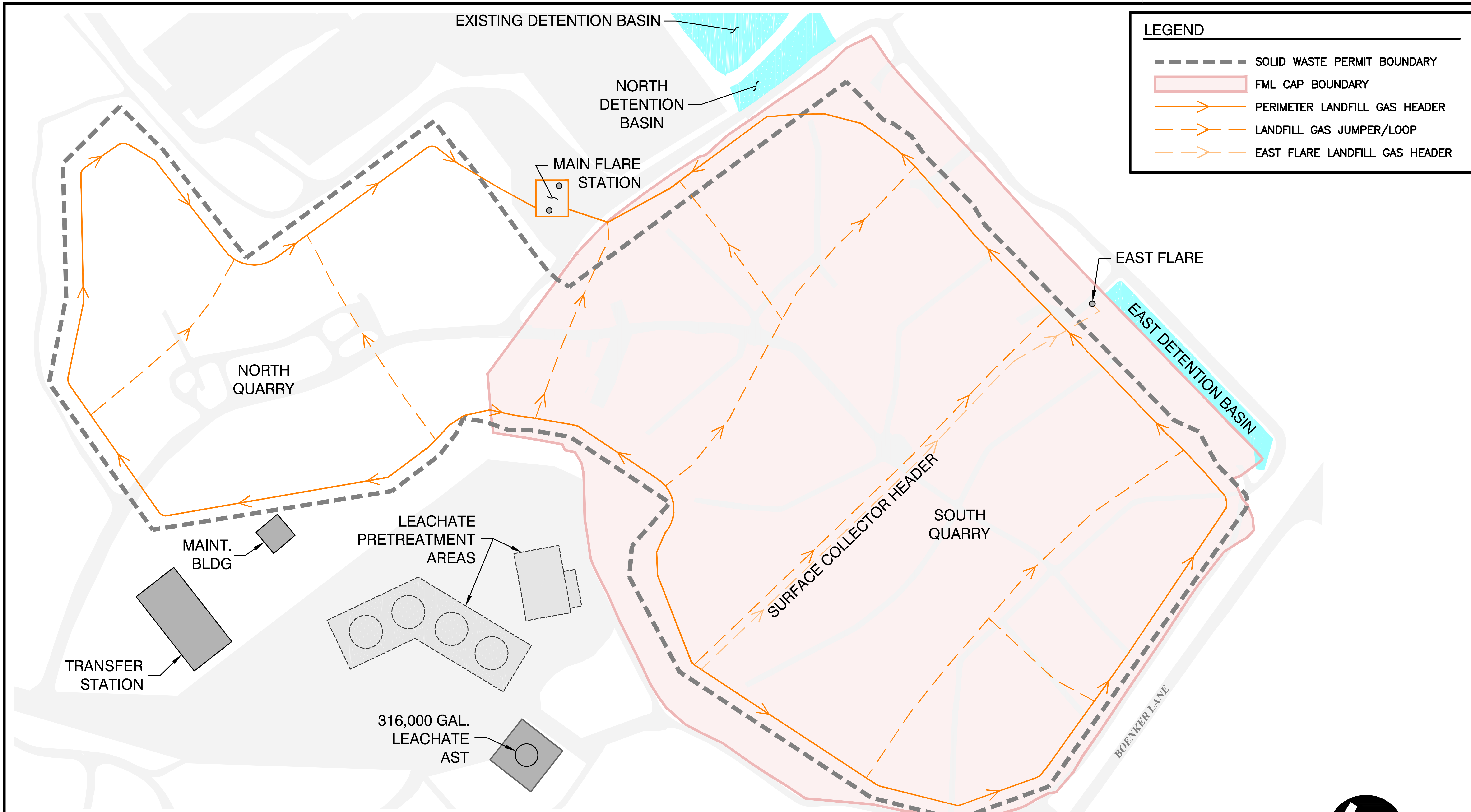
Additional inspection and maintenance procedures for the collection and conveyance piping system are provided in Appendix Q.

TABLES

Table 1 – Inspections and Maintenance for the Gas Collection and Control System

Item or Conditions to Be Inspected	Approximate Inspection Frequency	Inspection and Correction Procedure	Location of Inspection Form or Procedure
Gas Extraction Wellheads	Each monitoring event	Inspect and maintain wellhead components to ensure consistent and reliable operation, including; Joints, Sample ports, Flex hose valves, Well casing and surrounding area.	Appendix L
Gas Extraction Well Pumps	Each monitoring event	Check air supply to pumps, feel for liquid flow, and on the Blackhawk pumps observe a full piston stroke.	Appendix M
Air compressors	Each monitoring event	Inspect oil levels, air filter, and building heat. Follow manufacturer's recommended specs.	Appendix N
Blowers (at Flares)	Each monitoring event	Bearing temperature, proper lubrication, vibration, and drive belts.	Appendix O
Blowers (at Flares)	Quarterly	Ensure proper fail-safe operation during forced system shutdown and inspect flexible and document wear. Follow manufacturer's recommended specs.	Appendix O
Flares	Each monitoring event	Inspect control panel lights, gauges, flame arrestor, thermocouples, valves, flow meter, auto dialer, and pilot system. Follow manufacturer's recommended specs.	Appendix O
Flares	Semi-annually	Check for loose wires in electric controls. Calibrate flow meter. Follow manufacturer's recommended specs.	Appendix O
Flares	Annually	Inspect thermocouples for heat damage. Follow manufacturer's recommended specs.	Appendix O
Condensate Pump Stations	Monthly (pump counts weekly)	Remove and inspect pumps for damage or wear, exercise all valves and record pump counts or hour meter readings. Follow manufacturer's recommended specs.	Appendix P
Knock-Out Pot (KOP)	Monthly	Verify site glass is intact and unobstructed and drain KOP. Maximum differential pressure 1".	Appendix O
KOP Demister Pad (DP)	Annually	Clean or replace annually. Follow manufacturer's recommended specs.	Appendix O
Collection Piping	Quarterly	Air and force main and GCCS piping inspection.	Appendix Q
Collection Piping	Annually	Collection structures (manholes, condensate traps, etc.)	Appendix Q

FIGURES



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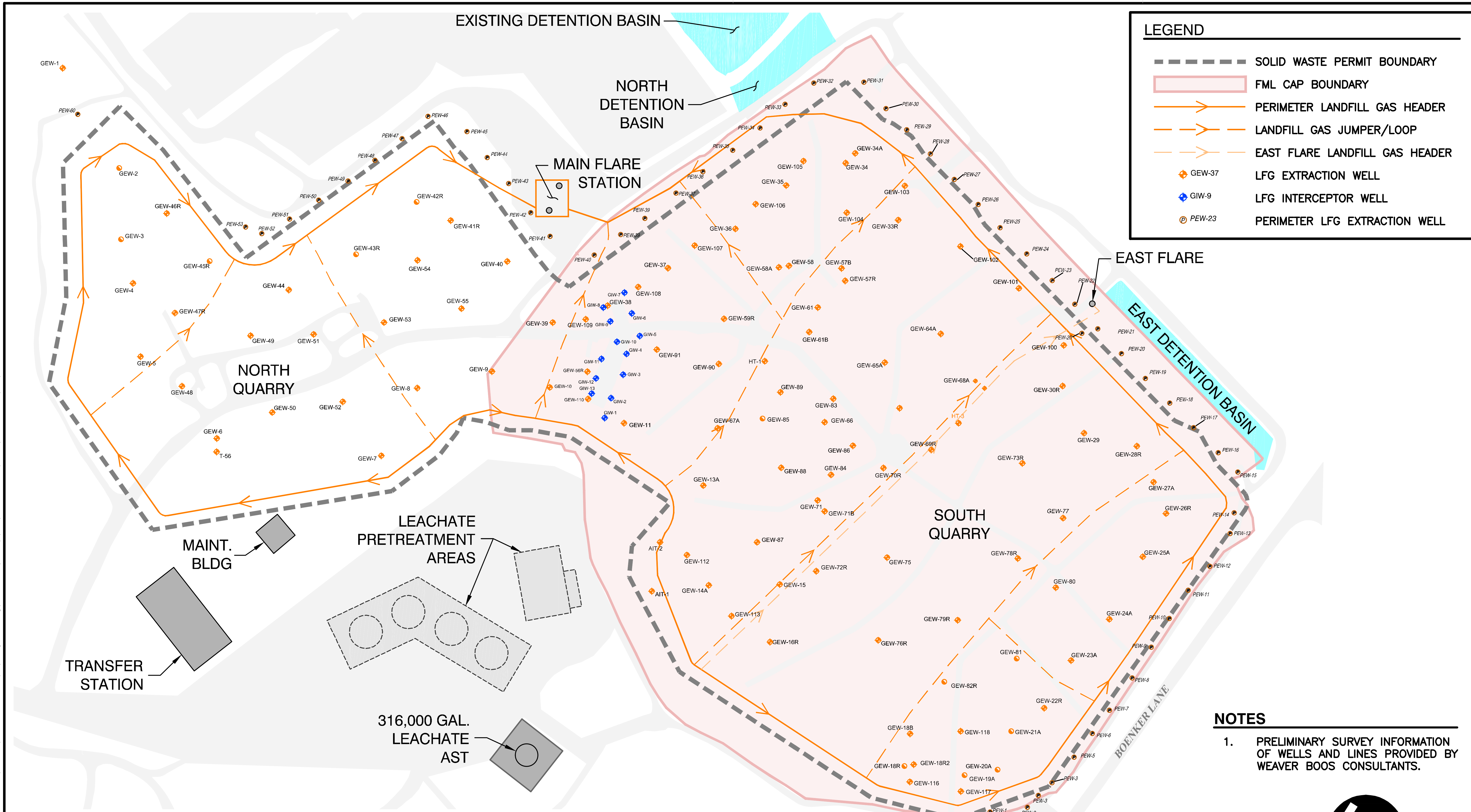
VOLUME 2

GAS COLLECTION AND FLARING SCHEMATIC

DRAWN BY: MSP	CHECKED BY: MRB	APPROVED BY: IAC	FIGURE NO.: 1
DATE: AUG. 2013	DWG SCALE: 1"=200'	PROJECT NO: 131-178	

P:\2013\130-484\-CADD\Dwg\SolidWaste\OM&M\131178-OM&M(V2)_Figures.dwg{FIGURE 1} LS:(9/10/2013 - mpeake) - LP: 9/10/2013 3:17 PM



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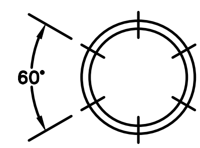
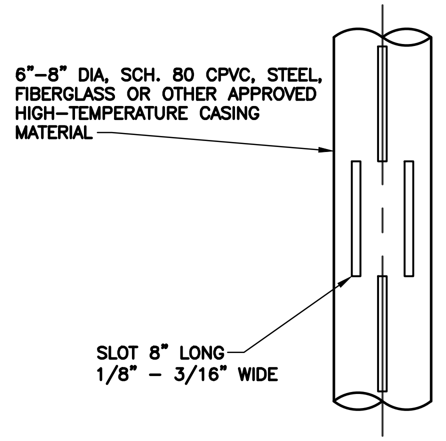
VERTICAL GAS COLLECTION WELLS SCHEMATIC

DRAWN BY: MSP	CHECKED BY: MRB	APPROVED BY: IAC	FIGURE NO.:			
DATE: AUG. 2013	DWG SCALE: 1"=200'	PROJECT NO: 131-178	2			

APPENDIX A

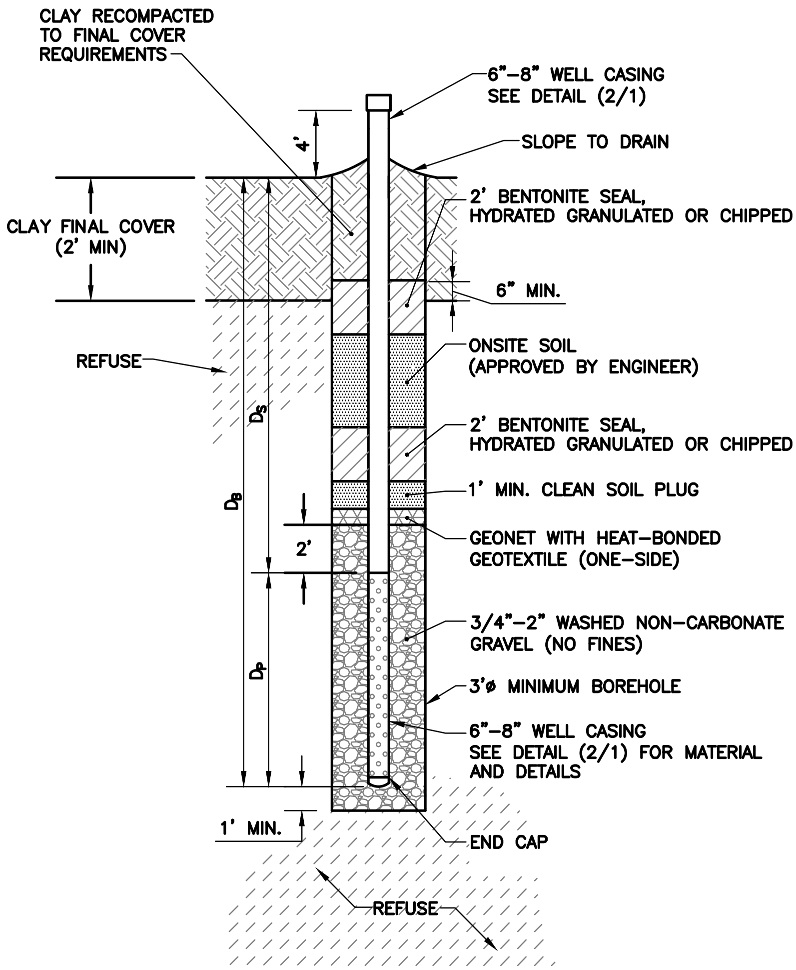
TYPICAL GCCS DETAIL DRAWINGS





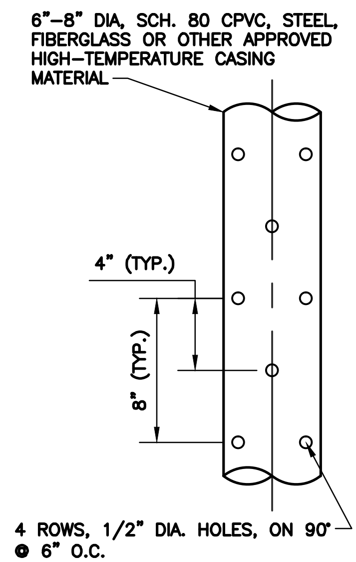
2A/1 SLOTTED WELL CASING

N.T.S.



NOTES:

1. D_B = DEPTH OF BORING
   D_S = DEPTH OF SOLID PIPE (BELOW GRADE) –20 FT. MINIMUM
   D_P = LENGTH OF PERFORATED PIPE



1/1 VERTICAL LFG WELL

N.T.S.

2B/1 PERFORATED WELL CASING

N.T.S.

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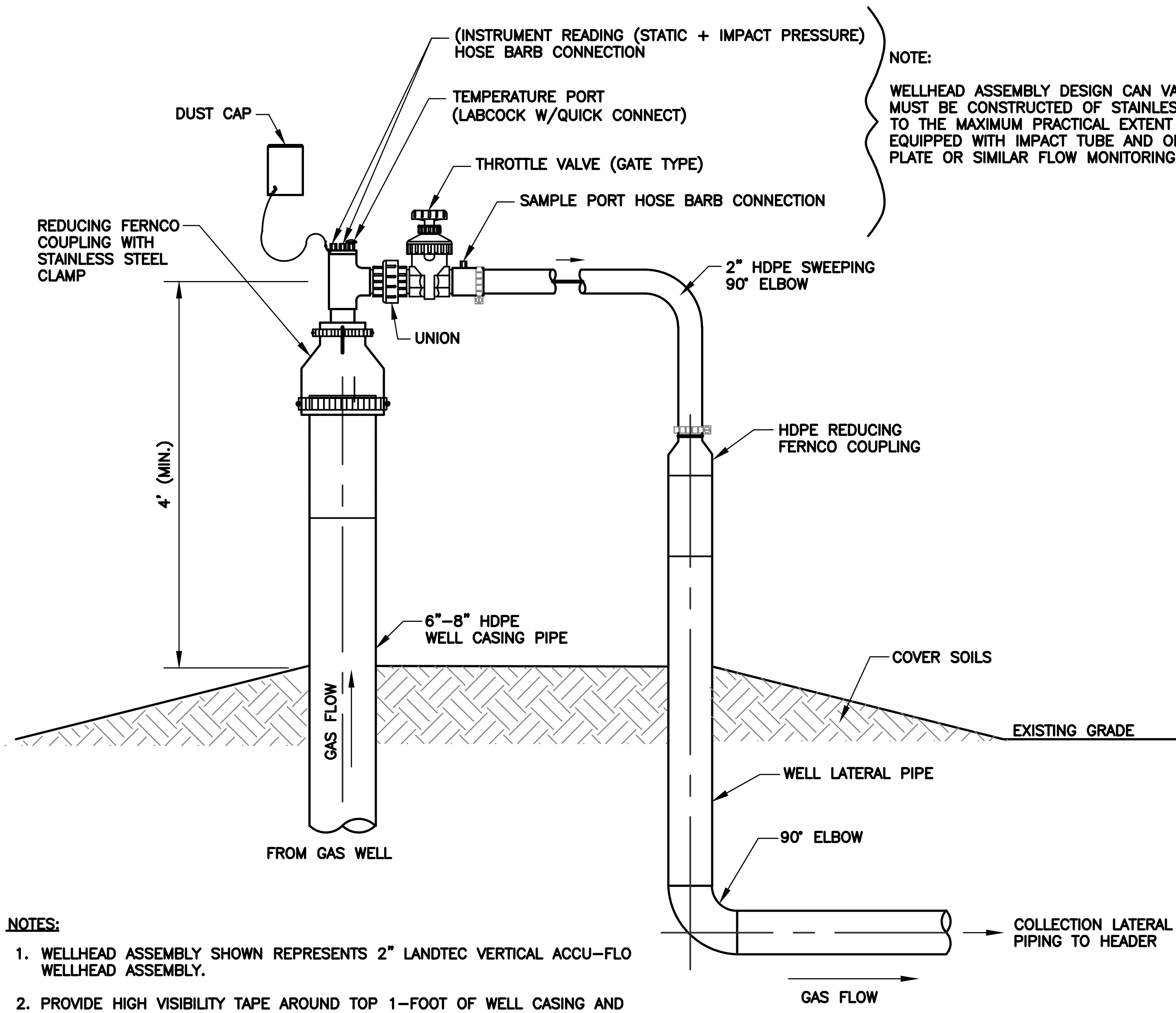
TYPICAL GAS WELL INSTALLATION DETAIL

DRAWN BY: JM	CHECKED BY: MB		APPROVED BY: MB		FIGURE NO.:	
DATE: SEPT. 2013	DWG SCALE: NTS		PROJECT NO: 131-178		1	



NOTE:

WELLHEAD ASSEMBLY DESIGN CAN VARY BUT MUST BE CONSTRUCTED OF STAINLESS STEEL TO THE MAXIMUM PRACTICAL EXTENT AND BE EQUIPPED WITH IMPACT TUBE AND ORIFICE PLATE OR SIMILAR FLOW MONITORING

NOTES:

1. WELLHEAD ASSEMBLY SHOWN REPRESENTS 2" LANDTEC VERTICAL ACCU–FLO WELLHEAD ASSEMBLY.
2. PROVIDE HIGH VISIBILITY TAPE AROUND TOP 1–FOOT OF WELL CASING AND LATERAL PIPE.

1/2 WELLHEAD
N.T.S.

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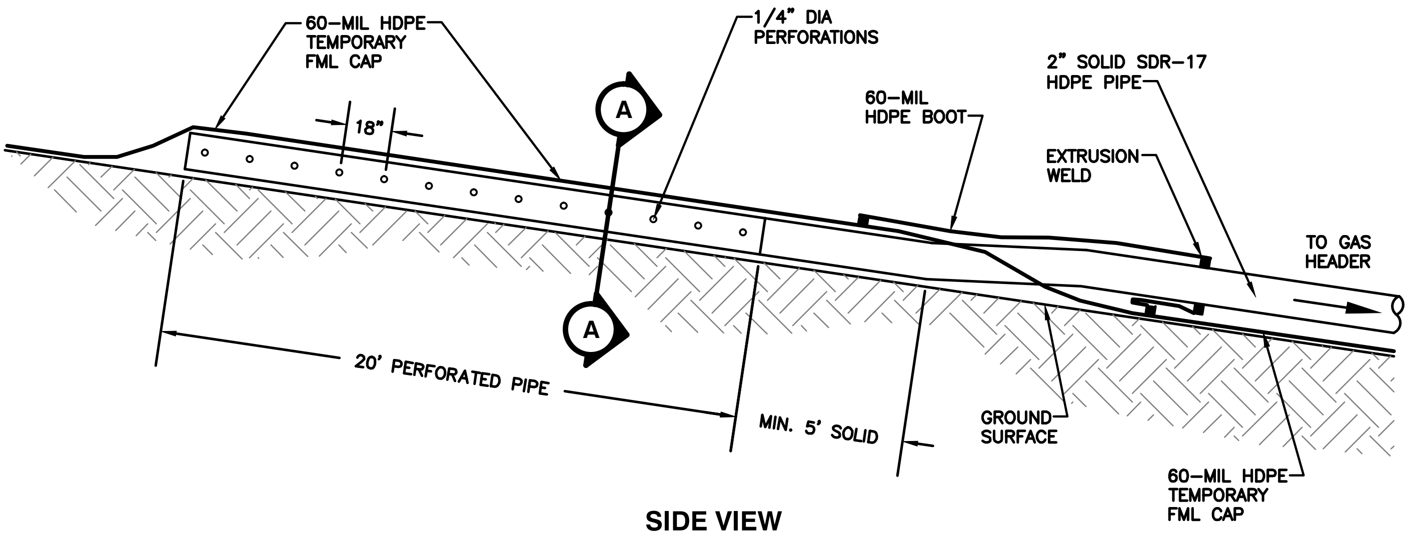
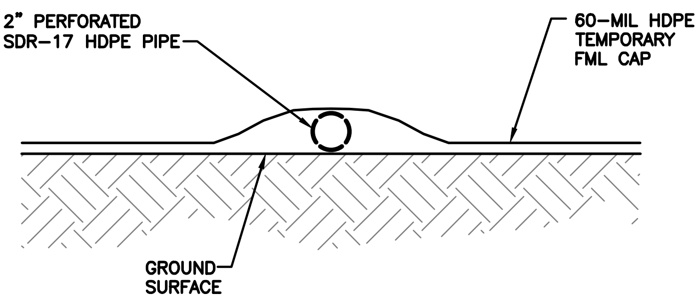
TYPICAL HARD PIPED WELLHEAD

DRAWN BY: JM	CHECKED BY: MB	APPROVED BY: MB	FIGURE NO.: 2
DATE: SEPT. 2013	DWG SCALE: NTS	PROJECT NO: 131-178	



SIDE VIEW



SECTION A

1/3 **SUB-CAP FML GAS "BUBBLESUCKER" DETAIL**

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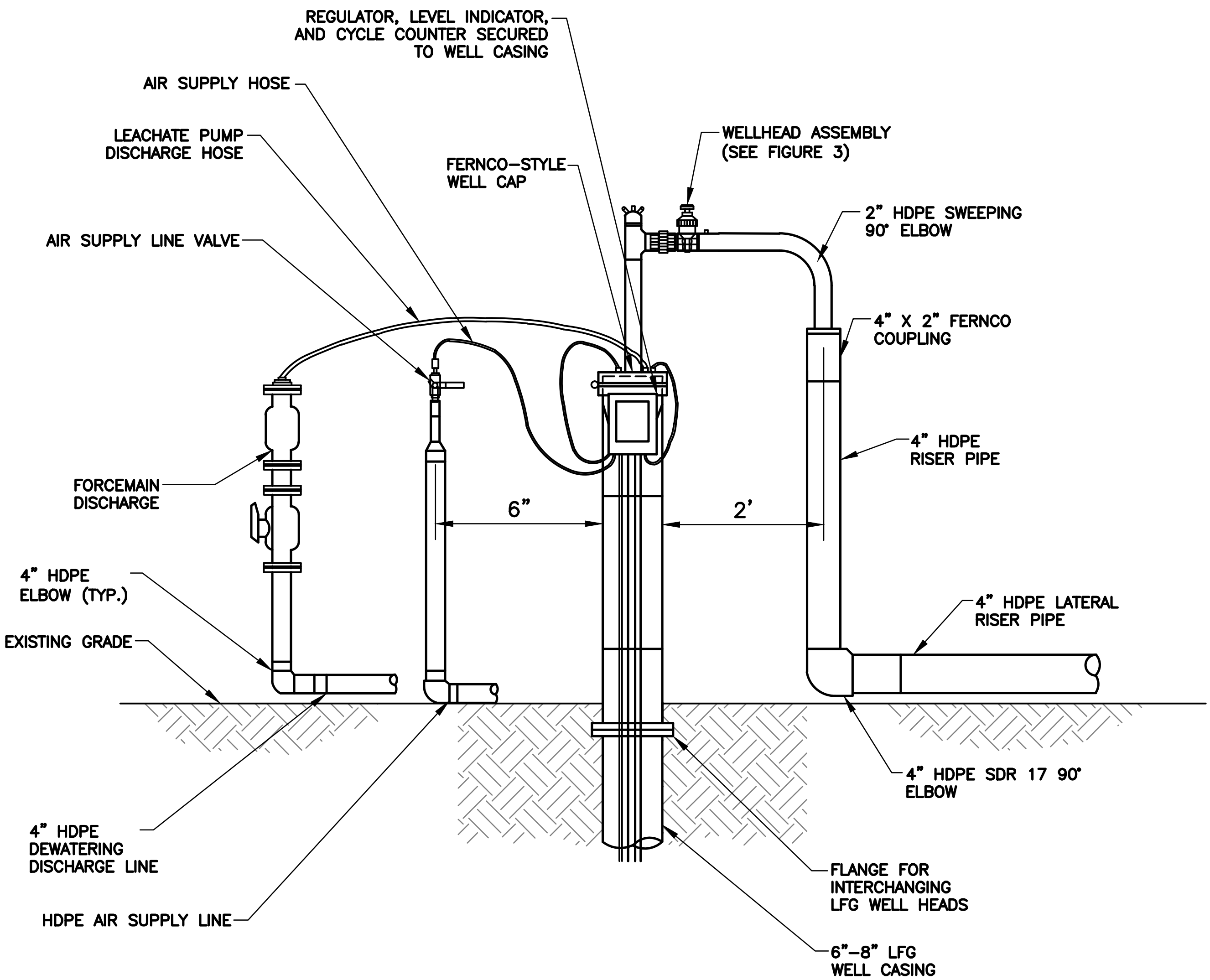
TYPICAL SUB-CAP FML GAS
"BUBBLESUCKER" DETAIL

DRAWN BY: JM	CHECKED BY:	MB	APPROVED BY:	MB	FIGURE NO.:	
DATE: SEPT. 2013	DWG SCALE:	NTS	PROJECT NO:	131-178	3	

P:\2013\131-178\-CADD\Dwg\131178_Details.dwg{DETAIL 3} LS:(8/26/2013 - jmccutcheon) - LP: 9/11/2013 3:11 PM



1/4 **DUAL-PHASE EXTRACTION WELL**

N.T.S.

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405 Duke Drive, Suite 270 - Franklin, TN 37067

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BRIDGETON LANDFILL
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TYPICAL DUAL-PHASE EXTRACTION WELL DETAIL

DRAWN BY: JM	CHECKED BY: MB	APPROVED BY: MB	FIGURE NO.:
DATE: SEPT. 2013	DWG SCALE: NTS	PROJECT NO: 131-178	4

APPENDIX B

WELLHEAD MEASUREMENT AND ADJUSTMENT PROCEDURES

APPENDIX B

Landfill Gas Extraction
Wellhead Measurement and Adjustment Procedures

Wellfield Available Vacuum

A. Excessive Vacuum Variation

- In the event vacuum is excessively inconsistent, trouble shoot the available vacuum surge prior to well field tuning

B. Prime Mover Shutdown

- If the prime mover(s) is down, the prime mover technician will restart the system and notify the Environmental Specialist,
- Start primary or back-up device (if present) and adjust vacuum to set-point, and
- Continue to monitor the wellfield once vacuum has stabilized from the back-up device.

C. Malfunction

- Postpone monitoring and adjustments until the malfunction is resolved.
- Notify Environmental Specialist of the delay in monitoring and/or adjustments.
- Perform postponed monitoring and adjustment as soon as practical after the resolution of the malfunction, but in no circumstance shall the postponement result in an exceedance of the applicable monitoring or adjustment standard timeline.

D. Design or Equipment Limitation

- The Environmental Specialist may initiate an investigation into system design or equipment limitations that may be preventing the application of a consistent vacuum,
- Investigation must include at a minimum: analysis of cause of inconsistent vacuum and evaluation of existing equipment,
- Analysis of cause of inconsistent vacuum,
- Evaluation of existing equipment,
- Pricing to repair existing equipment or purchase new equipment,
- Feasibility of achieving consistent vacuum, in a cost effective manner, using best industry practices,
- If design or equipment modifications are not possible, the operator of the prime mover shall make periodic adjustments of the vacuum to maintain the set-point, and
- Adjustments should be made as necessary.

Operating manuals for the flares are located at the facility.

APPENDIX B

Wellheads

A. Make no wellhead adjustments during the initial reading.

B. Acquire valid wellhead measurements.

- Select appropriate well ID on meter,
- With the sample train and pressure sensor hoses disconnected, activate the meter's internal sample pump so that the entire sample train is purged and the results are indicative of ambient air (approximately 20% to 21% oxygen and 79% to 80% balance gas).
- Perform transducer zero function to ambient air conditions. Be sure to minimize wind effects during the procedure by shielding the hose ends,
- Do not block hoses ends,
- Check wellhead sample fittings for cracks, bad o-rings and blockage by liquid, ice, spider webs or other substances, and
- Record temperature by inserting Fluke temperature probe or dial thermometer into wellhead temperature sample port.
  - Insertion thermometers must be long enough to reach gas stream inside wellhead.
  - Check accuracy of removable and permanently installed thermometers at least once a year. This is accomplished by comparing the permanently installed thermometer with a new thermometer.
  - Replace damaged or inaccurate thermometers before the next monitoring event.

C. Connect all applicable sample train hoses.

- Verify that all connections are snug and air tight, and
- Verify sample train hoses are not pinched or kinked.

D. Acquire gas concentrations and differential pressure.

- Activate sample pump,
- Allow gas measurements to stabilize, and

  Allow meter to stabilize for a minimum of 60 seconds with pump activated. Note: stabilization may take longer than this.

- Verify that measurements are acceptable.

E. A compete data set is critically important to Bridgeton. Incomplete datasets, corrupted data, missing data are unacceptable.

The following are examples of measurements that are not acceptable.

- Gas concentrations totaling more than 100% by volume,
- Methane concentrations higher than 70% by volume,
- Oxygen concentrations greater than 21% by volume,

- Balance gas concentrations greater than 81% by volume, and
- Balance gas to oxygen ratios less than 4:1.

If measurements exhibit any of the examples above, recalibrate monitoring instrument before continuing monitoring event.

Verify the following when monitoring wellhead pressures.

- The static well vacuum has stabilized.

F. Differential pressure (for gas wells that are not in the SSE-affected area)

Positive values – acceptable.

Negative differential pressures – Troubleshoot.

- Look for reason for an error in measurement, and
- Well ID is not set-up properly in the meter.

If a negative differential pressure is read, take the following steps:

- Check sample train for kinked hoses,
- Check sample train filters and hoses for water,
- Recalibrate (zero) pressure sensors in the field,
- Reconnect and observe pressures,
- If issue persists, pull and clean pitot tube or orifice plate within wellhead or send meter back to manufacturer for recalibration, and
- <<<or>>> symbols for differential pressure are questionable, usually an indication that the sensor is out of its measuring range.

G. Verify flow is properly displayed (for gas wells that are not in the SSE-affected area)

If flow range is higher than normal at the monitoring point, this is usually a result of high differential pressures.

- Make sure both hoses that measure differential pressure are connected to the meter and the wellhead,
- Check sample train for kinked hoses,
- Check sample train filters and hoses for water,
- Verify sample ports on wellhead are not plugged with debris, water or ice,
- Verify ID setup is correct for the monitoring device,
- Recalibrate (zero) pressure sensors, and
- Reconnect and observe pressures.

H. Flow measurements with error symbols (i.e. <<<, >>> or blank) may be an indication that:

- Temperature of the gas has not been entered into the monitoring unit or the unit is missing required pressures for calculation, or
- Meter may be out of range.

I. Verify temperature is stored correctly.

- Temperature is to be stored in degrees Fahrenheit.

J. Ensure well ID is properly set up in the meter.

K. Select correct comment.

- Ensure each reading has a stored comment (except temperature probe reading if taken).

L. Utilize only site approved comments. Store measurements.

- ***Make no adjustment during the initial reading*** and store the initial reading with no comment,
- Utilize only site approved comments, and
- Ensure each reading has a stored comment (except temperature probe reading if taken).

M. Store the measurements.

N. Determine if adjusted wellhead readings are necessary.

If an adjustment to the extraction well is required:

- Turn wellhead control valve to new setting.
- Once the adjustment has stabilized, store reading with one of the allowable comments listed below.

Allowable Comments for Valve Adjustments

Create the following standard list of operation comments to use in the meter if a valve adjustment is made. Note: Environmental Manager reserves the right to modify the comment lists as needed.

- No change,
- Opened Valve ½ turn or less,
- Opened Valve ½ to 1 turn,
- Opened Valve > 1 turn,
- Valve 100% open,
- Closed Valve ½ turn or less,
- Closed Valve ½ to 1 turn,
- Closed Valve > 1 turn, and
- Valve 100% closed.

APPENDIX B

Allowable comments for Operation Issues

Create a standard list of operation comments to utilize in the meter if an operation issue is observed. Suggested comments are as follows, but are not limited to:

- Surging in header,
- Bad sample sorts,
- Valve needs replacement,
- Pump not operation,
- Flex hose needs replacement,
- Header vacuum loss,
- Repair well bore seal,
- Well needs to be extended / lowered.
- Static pressure surging,
- Available pressure surging, valve damaged, and
- User defined – See field notes.

Make well adjustments only after initial measurements have been stored to the meter.

Measure same parameters as recorded for initial routine event.

Document corrective action or well adjustments.

Store a comment in the meter to document type of adjustment made. If no change was made, store the reading with the comment "NO CHANGE."

APPENDIX C

FIELD DATA RECORDING PROCEDURES

APPENDIX C

Field Data Recording Procedures

Upon downloading data from the meter, use the following procedures to manage the electronic and written field information. This procedure has been written so that it can be implemented by a third-party technician if desired.

1.1.1 Electronic Data

A. Do not alter the raw data file.

B. When naming the raw data file (meter download file), uses the site name, date of the event, and technician's initials (e.g., BL tuned on July 21, 2007 by John Tech BL072107JT.cvs).

C. Download the electronic data and e-mail to the specified data manager, **within 24 hours** of completing the monitoring event.

D. Retain copies of unaltered data files.

E. All data files are property of Bridgeton Landfill. Submit all copies of data to upon request.

F. If data from certain wells is corrupted, lost, or unusable, immediately re-monitor those wells.

1.1.2 Written Log Book Data

In an effort to record conditions that cannot be stored electronically within the monitoring instruments, field technicians are required to keep a site-specific logbook. This log book is the property of Bridgeton Landfill, and will be relinquished to the site upon request.

A. Logbook requirements:

- Rite in the Rain brand field book, Model 310 or equivalent, and
- Record entries in log book using waterproof ink, if available.

B. Requirements for recording data in log book:

- Do not remove pages or portion of pages,
- Date each page in the top right hand corner,
- If a correction is made, cross out the mistake with a single line. Do not black out the mistake,
- Technician recording data shall initial each cross-out,
- Cross out blank lines on a page when the page is completed, and
- Do not go back to previous pages and insert comments or additional measurements. Always use a new page for each event.

APPENDIX C

7. Record the following, at a minimum:

    - If maintenance if performed, write a description of maintenance performed.
    - Record non-tuning efforts. Examples include: tighten flex hose, replace sample port, call contractor to regrade header, increase flare vacuum to field, etc.,
    - Date, time-on and time-off site,
    - Unusual conditions,
    - Erosion areas,
    - Surface depressions,
    - Document damage to wellheads and/or surrounding surface area discovered during monitoring event or repairs completed during event, describe damage,
    - Well liquid levels, if measured,
    - Pump counters, if equipped, and
    - Hand drawings that identify specific locations or distances from wellfield components.

8. When the book is full, submit it to The Bridgeton Landfill Environmental Specialist and start a new log book.

APPENDIX D

GEM EQUIPMENT CALIBRATION PROCEDURES

APPENDIX D

GEM Equipment Calibration Procedures

The technician will be responsible for assuring that the instrument is functioning properly at the end of each day or shift. At the start of the next day or shift, the technician shall verify that the monitoring unit is still functioning properly, use the following procedure for field calibration.

A. Inspect in-line filters for moisture and fine particles – replace if necessary.

B. Inspect the integrity of the sample train.

- Sample tubing should seal tight onto the hose barbs,
- Note condition of the tubing,
- Note sample fitting O-ring(s) condition, and
- If using a carbon filter – replace filter daily.

C. Perform field calibrations per manufacturer's specifications.

D. Field calibrate meter a minimum of 3 times per day.

- Prior to beginning monitoring for the day,
- Midway through the daily monitoring event, and
- Prior to final inlet sample.

E. Perform additional field calibrations if the following circumstances occur:

- Extreme ambient air temperature changes (plus or minus 20 degrees F),
- Significant increase or decrease in atmospheric pressures,
- Unable to stabilize gas quality,
- Gas qualities totaling more than 100% volume,
- Methane concentrations higher than 70% by volume,
- O^2 concentrations in ambient air less than 19% or greater than 21% by volume, and
- Balance gas concentrations in ambient air greater than 81% by volume.

F. Log Data and upload to SCS Dataservices:

- Complete all entries – if the line does not apply, write "NA",
- Calibration shall fall within acceptable range – if not, utilize another meter,
- Ensure meter date and times are accurate before starting the monitoring event,
- Uses the appropriate calibration gas for the monitoring event: (2 lines below are indented on his copy)
- 50% CH^4 / 35% CO^2 / 4% O^2 for monitoring the landfill gas collection system, and
- 15% CH_4 / 15% CO^2 / 4% O_2 for migration probe monitoring, unless otherwise specified, in state, federal or sit-specific regulation.

G. Zero the meter pressure sensors (transducers) during each calibration event.

H. Minimize the impact of wind by cupping hoses in the palm of the hand.

I. Do not block hose ends.

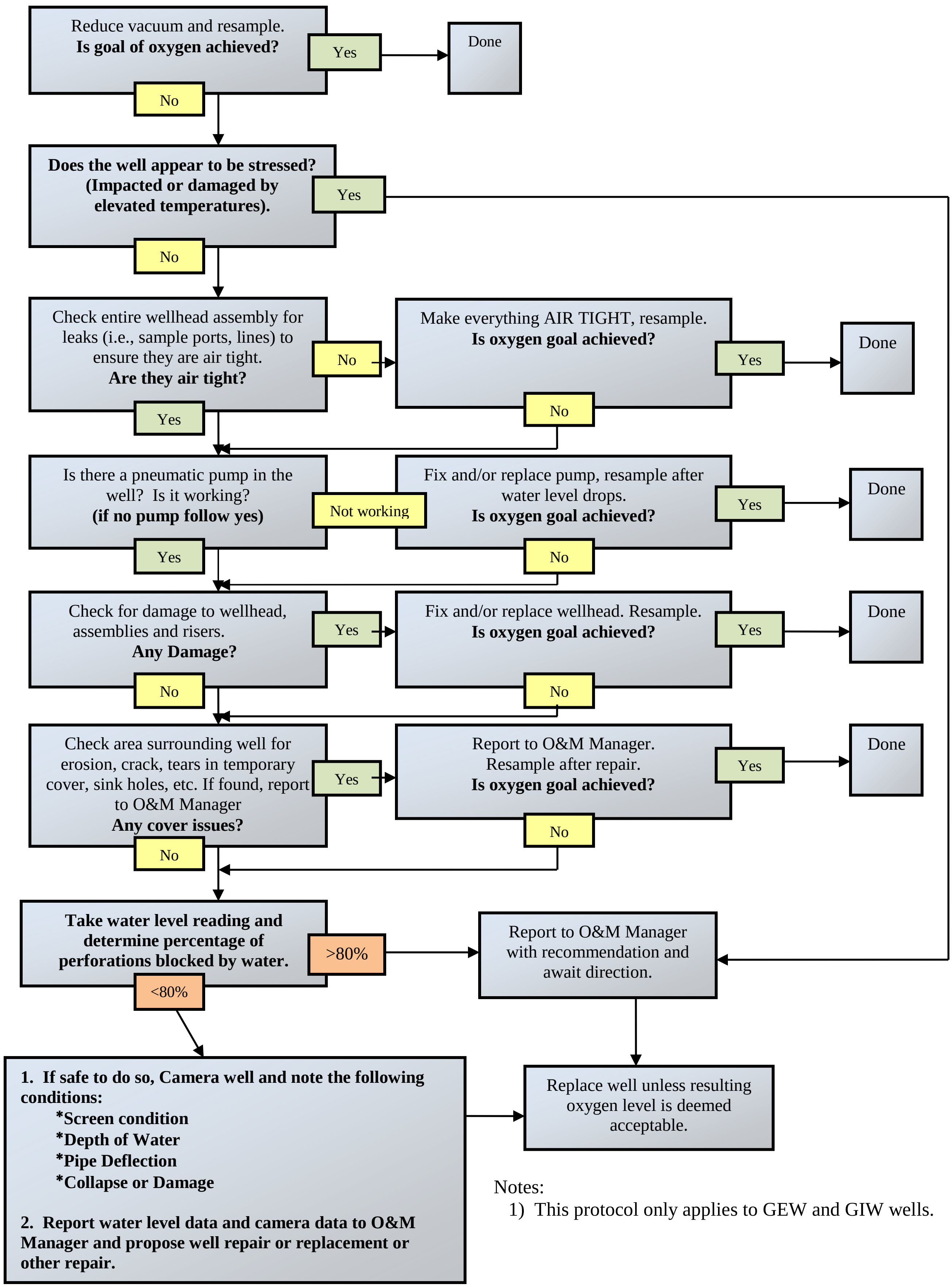
J. Calibrate pressure sensors. Also, zero transducers before each wellhead reading if sensors read anything other than 0.00 when disconnected from the wellhead.

APPENDIX E

GAS WELL ASSESSMENT PROTOCOL – OXYGEN >2%

Appendix E

Gas Well Assessment Protocol-Oxygen[1]



Notes:

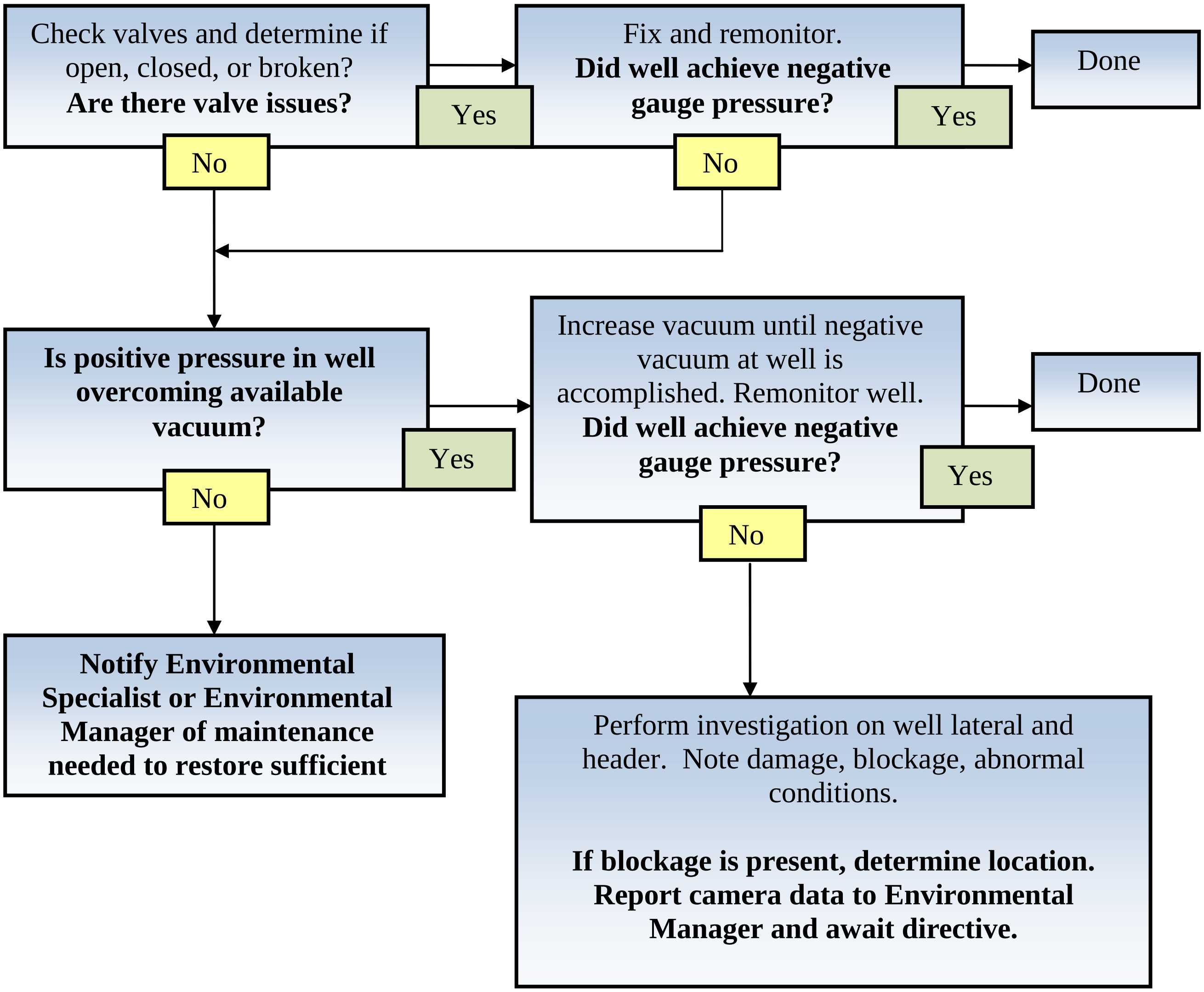
1) This protocol only applies to GEW and GIW wells.

APPENDIX F

GAS WELL ASSESSMENT PROTOCOL – POSITIVE PRESSURE

APPENDIX F

Landfill Gas Extraction Well Assessment Protocol
Positive Pressure



APPENDIX G

GAS WELL ASSESSMENT PROTOCOL – NON TYPICAL TEMPERATURES

APPENDIX G

Landfill Gas Extraction Well Assessment Protocol
Non-Typical Temperatures (North Quarry Only)

During routine gas wellfield monitoring, field technicians have opportunity to observe the conditions and note the parameters of each gas well. Immediately following a monitoring event day, and prior to leaving the site, well field data shall be reviewed by the Site Technician for temperature of >145° F at a gas extraction wellhead which has not previously exhibited such an elevated temperature. If the Site Technician is unable for any reason to review data immediately following the collection event, the technician must notify the Environmental Specialist so alternative review arrangements can be made.

In addition to routine field monitoring, technicians will be required to look for changed conditions or integrity issues at wellheads around the landfill, even between monitoring events. These integrity issues are potentially recognized as:

- An obstructed well casing or damaged pump (detected during fluid level measurements or pump maintenance).
- A technician's observations that above-grade well or pipe materials are melted, deformed, discolored, or somehow else affected.
- Observations made by any site personnel and contractors (odor, steam).

<u>RESPONSE PROTOCOL</u>

Upon identification of a validated exceedances of the aforementioned temperature values, the following will be performed:

- The onsite technician will provide notification to the Environmental Manager or his designee.
- The technician and Environmental Specialist will make immediate assessment of the issue and provide guidance to assure that safe and appropriate actions are taken.
- Monthly CO laboratory testing and weekly field Draeger tube testing will be performed on that gas well.
- A combination of wellhead temperature greater than 180° F and CO greater than 1,500 ppm, at any GEW gas well in the North Quarry will initiate a verification and further investigation process as indicated below:
- Carbon monoxide shall be resampled and sent to a laboratory for expedited testing and results within one week of receipt of the initial Draeger tube or laboratory CO data that indicated over 1,500 ppm;
- Daily wellhead temperature readings will be made at the GEW to confirm the initial reading over 180° F and observe trends;
- Procedures to address the possibility of a common, localized subsurface oxidation (SSO) event will be implemented as set forth in the "Standard Operating Procedure for Management of a Local Subsurface Oxidation Event" which is included in Appendix H of this Plan.
- If the above steps confirm sustained readings above 180° F and CO greater than 1,500 ppm at the GEW well, and suggest that the readings are not the result of a localized SSO

that can be managed and controlled to that specific location, then Bridgeton Landfill will notify the MDNR SWMP Engineering Section Chief within one business day. The MDNR may wish to observe confirmatory testing or perform independent testing to confirm the trigger reading

- If the trigger temperature is exceeded and/or if the operational issue is determined by the Environmental Specialist to indicate a potential thermal event, then the procedures indicated in Appendix H shall be undertaken and the actions outline in the “North Quarry Contingency Plan” will be employed..

APPENDIX H

SUBSURFACE OXIDATION (SSO) PROCEDURE

Appendix H

Local Subsurface Oxidation (SSO – Potential Landfill Fires)

Subsurface Oxidation Events (SSO) are common events that occur at many landfills that have active gas collection systems. These are local subsurface fires that are caused by a combination of subsurface conditions and well management. Unlike large subsurface reactions (which are extremely rare, do not require oxygen to propagate, and are quite different in nature), SSOs usually only involve a small area and a minimal number of gas wells.

In the North Quarry of the Bridgeton Landfill, it is important to distinguish between an isolated, readily-contained and easily-extinguished SSO from the advancement or initiation of a large subsurface reaction.

Typical Symptoms

- Dramatic localized landfill settlement.
- Charred or cracked surface cover.
- Stressed or dead vegetation in an area that is otherwise properly vegetated.
- Smoke or smoky odor emanating from the landfill surface or wellhead.
- Drastic or unusual increase in flowing gas temperature.
- Abnormal discoloration of wellhead/riser assembly.
- Abnormally high CO concentration in LFG.
- Deformed riser pipes.

Initial Notification and Investigation

Notify Environmental Manager immediately after visually identifying any potential SSO. An initial investigation shall be started within 12 hours after visual identification of a potential SSO.

1) Do not change the condition of the well during the initial investigation.

2) Health and Safety Considerations

   - Consult HASP for procedures related to landfill fires.
   - Under no circumstances shall an initial investigation be conducted without first consulting the HASP and implementing appropriate controls and procedures.
   - Do not breathe landfill gas or smoke. Stand upwind of emissions.
   - Wear appropriate PPE. Burns may be caused by hot PVC / HDPE / steel.
   - Do not drive heavy equipment / vehicles near well or depression until ground stability has been verified. *The burned waste mass may give way and equipment/personnel may fall into sinkhole.*

3) Conduct physical inspection

   a) Inspect the nearest extraction well to the potential SSO location.
   b) Inspect all wells within 500 feet of nearest extraction well to the potential SSO location.
   c) Inspect the landfill surface within 500 feet of nearest extraction well to the potential SSO location.

d) Visibly inspect for large localized settlement, cracks, holes, collapse, missing components, and areas that could be sources of air intrusion into the waste mass including:

- Monitoring ports
- Well casing
- Hoses
- Erosion ruts
- Dry soil cracks
- Manways
- Lift stations
- Sumps
- Leachate cleanout risers

4) Measure gas quality, pressure and temperature, at all wells within 500 feet of nearest extraction well to the potential SSO location. *Special precautions may be necessary to address high gas temperatures.*

5) Measure CO concentrations with colorimetric tubes (Draeger tubes) at all wells within 500 feet of nearest extraction well to the potential fire location, and obtain summa canister samples for laboratory CO analyses at all wells that indicate CO detections >500 ppm by colorimetric tube. *Gas temperature and other interference gasses can affect the accuracy of the measurement; therefore, the results of any CO field monitoring should be expressed qualitatively only.*

6) Infrared Thermometer Survey

- Use an IR laser thermometer to measure the temperature of the ground surface in the area of the suspected SSO. *Shallow fires or fires that have consumed large amounts of refuse will produce elevated surface temperatures. Extreme caution must be taken in these areas due to the possibility of the ground giving way.*

SSOs are often caused by “overpulling” a gas well or wells in a certain area. Oxygen is drawn into the waste mass which can generate heat and provide the necessary oxygen for combustion. Since oxygen readings are collected as part of normal Title V, New Source Performance Standards (NSPS) monitoring, a review of the collected historical data from surrounding wells should be made. The data review should trend oxygen readings in from the wells in the general area of the SSO to determine if there was an overpull situation. Temperature should also be historically trended as heat; along with CO data (see below) is a good indicator of an SSO in the area.

Gas quality in wells adjacent to the SSO *may* be affected. In particular, carbon monoxide levels could elevate based on wellfield operation issues and preferred pathways within the waste mass. It is important to determine if the SSO is constrained to a single gas well and / or a single isolated area. Therefore, laboratory CO analyses will be expedited with results received within seven days of detection by colorimetric tube.

Appendix H

If the above investigation suggests that more than one gas well may be actively involved in an SSO area, then the investigation shall be expanded to include the wells within 500 feet of the SSO area.

Formal Notifications

The Environmental Manager shall notify the MDNR (SWMP Engineering Section Chief or Program Director at (573) 751-5401) within one business day of determination. The notification will include the gas well identification, date of initial detection, approximate area of the SSO, and results of initial investigation. The MDNR may observe or conduct confirmatory sampling.

Data Analysis

Determine the state of the SSO

- Analyze temperature gradient between monitored wells.
- Analyze oxygen gradient between monitored wells.
- Analyze nitrogen to oxygen ratio gradient between monitored wells. *If nitrogen is not measured directly, assume balance gas of nitrogen.*
- Analyze pressure gradient between monitored wells.
- Analyze methane to CO_2 ratio gradient between monitored wells.

Removing the Oxygen from the Fire

The key to stopping a SSO once it has begun is to completely restrict oxygen from entering the smoldering waste mass (snuff out the fire). Once the initial investigation has been performed and a general sense of the extent of the SSO has been determined, safely begin to restrict further oxygen intrusion using the following method:

1) Shutdown well(s) that is believed to have been the cause of the SSO.

2) Shutdown all wells in surrounding area (within the approximately 300 feet of suspect well(s)).

3) Cap or repair any item identified during the physical inspection that may be contributing to oxygen intrusion.

4) Carefully add additional cover to areas that show cap integrity issues if necessary. Work slowly and pay special attention to the ground surface as material placement commences.

    - During cover placement activities, there should be a minimum of two people available; the equipment operator, and a line-of-sight person on the ground that is responsible for watching the ground surface as the equipment operator places the soil.
    - Use a low ground pressure (LGP) machine, if available. If LGP machine is not available, use the lightest machine with the widest tracks available. Do not use rubber tired machine to place cover material.
    - Slowly push soil into the area and compact with the bucket or tracks of the equipment.

Appendix H

Note: Closing wellhead valves to minimize vacuum in the area of concern may cause vacuum levels to increase within the main header. This will redistribute the overall vacuum applied to the wellfield and may cause higher vacuums to other wells in the GCCS. Carefully watch for redistribution of vacuum, and adjust prime mover vacuum set-point accordingly. If greater than 10 percent of the total wells in the wellfield are closed to remediate the SSO, a complete retune of the wellfield may be warranted.

Things to Avoid

- *Flushing the well with water* – Flushing the well with water can potentially clog the well.
- *Excavating soil in the SSO area* – Do not excavate in the SSO area. Excavation will allow additional oxygen to enter the already smoldering waste mass and can potentially auto-ignite.
- Venting – Do not remove the wellhead to vent the well. Wellfields are typically under negative pressure. Residual vacuum exists in the waste mass for a period of time when wells are closed. If the wellhead is removed to vent, it is highly possible that the residual vacuum in the area will pull ambient air into the waste mass adding oxygen to the SSO.
- *Introduction of water into open cap fissures* – Applying water to open fissures in the cap where an SSO exists can create a plume of highly odorous stream. It is also dangerous to bring a heavy, rubber tired water truck to the area to apply water. The steam created can be dangerous to workers in the immediate area. If an open cap fissure exists in an SSO area, is shall be safely filled with soil. Removing the pathway for oxygen intrusion is the most effective way to put out the SSO.

Continued Monitoring

Monitor the wells closest to the suspected SSO area and adjacent wells at least once a day for at least two weeks.

- Monitor for gas quality, temperature, and CO. *As the SSO subsides, residual CO will remain in the waste mass for weeks and possibly months. Elevated CO levels are not a reliable indicator that an SSO is still in progress. However, CO levels should generally decline with time if the fire has been extinguished.*
- Once SSO indicators are no longer noted, monitor the well and adjacent wells once a week for at least 4 months before returning to normal monitoring schedule.

It is important that during these monitoring events the valve on the wellhead is opened for a prescribed time at a prescribed vacuum. This must be performed consistently form event to event to pull stagnant LFG form the well and fill the casing with fresh LFG form the Landfill formation. Analysis of this fresh LFG will provide the most realistic picture of the status of the SSO. Once readings are collected, the well must be returned to its closed position.

Appendix H

Repairs

Repairs should be made to the SSO area, as necessary

- Visual Inspection
- O&M Provider shall visually inspect the following:
  - Wellheads and lateral piping,
  - Cover soil and geosynthetics, and
  - Other items within SSO area.
- Provide findings to, and generate repair options for OM&M Manager.
- OM&M Manager shall facilitate repairs, as required.

Timeline for Local SSO Resolution

It is important that a structured SSO monitoring plan and diligent adherence to the plan be carried out to return the wellfield to normal operation as soon as possible. However, it is advisable to take time and slowly ensure the SSO is fully extinguished and that the bacteria population in the area has recovered and is consistently producing gas.

The severity of the SSO, the age of the waste, moisture content, and a number of other variables will all determine how long it takes the wellfield to regain compliance with NSPS. Experience has shown that the timeline form the point when the SSO is identified and extinguished to the point when the wellfield resumes normal operation can vary from 2 to 3 weeks up to (in some serious SSO situations) 1 year or more.

Classification of the Event

The Environmental Manager and the MDNR will actively collaborate to verify and classify the SSO event. Such determination will be made within four weeks of the Initial Notification.

The event will be classified as a local SSO if monitoring indicates that combustion is constrained to one gas well and that there is no evidence that the SSO is enlarging.

If the event is not classified as a local SSO and may, instead, be considered a triggerable action per the North Quarry Contingency Plan, then Bridgeton Landfill and the MDNR will discuss and reach agreement on the appropriate action which may include further monitoring or entering into the path of actions provided in Table 1 of the North Quarry Contingency Plan – Part 1.

APPENDIX I

WELL LIQUID MEASUREMENT PROCEDURES

APPENDIX I

Well Liquid Measurement Procedures

Equipment Specifications

A. Conductance probe meter – electronic liquid level indicator tape.

- Uses a probe attached to a permanently marked tape, fitted on a reel.
- The probe incorporates an insulating gap between electrodes. When contact is made with liquid, the circuit is complete, activating a loud buzzer and a light. The water level is then determined by taking a reading directly from the tape.
- To maintain measurement consistency, measure liquid levels from the same point of the well every time (i.e. probe sample port on wellhead, north side of casing with wellhead removed, etc.)
- Accurate records of well field modifications shall be updated in the depth to liquid and depth to bottom summary.

B. Examples of this instrument are the Solinist Model 101, Heron Skinny Dipper or equivalent.

C. Restrictions

- Instrument is to be dedicated to leachate and/or gas extraction well monitoring, and
- Never use the instrument on groundwater due to cross contamination concerns.

Liquid Measurement Procedure

A. Preparation

- Obtain well drill logs or a table that summarizes the anticipated well depths and screen intervals for field reference. This information is currently summarized on a monthly basis, and
- Record data in log book

B. Obtaining Liquid Levels

- Measure applied vacuum (static pressure) of well using landfill gas meter,
- Remove wellhead or open access port,
- Obtain liquid level measurement:
    - Measure from the top of well casing (TOC) or access port,
    - Measure TOC to ground surface,
    - Determine depth to liquid (DTW) using liquid level indicator,
    - Subtract height of well casing above ground elevation, and
    - The result is the liquid level below ground level (BGL).

APPENDIX I

Problems that may be encountered:

- Well leaning too far to allow indicator probe to progress down well casing.
  - Record in log book “Well learning past measurement point”.
- Well is deflected underground and causes probe to hang on welds or couplers,
  - Record in log book “Probe gets hung up in well, liquid level will have to be verified using other method” (down well camera, chalk tape, water indicating paste, etc.).

Record observed depth to liquid levels in log book.

- Obtain depth to bottom of well (DTB) measurement.

Measurements are to be measured from top of well casing (TOC) or access port.

- Find level at which indicator probe will not progress,
- Subtract height of well casing above ground elevation, and
- The result is the depth to bottom, or total depth of the well.

Problems that may be encountered:

Well has soft bottom due to silt or other material,

- Record in field book “soft or silty bottom, depth cannot be verified and is estimated”,
- A down well camera can be used to attempt to verify well bottom.
- Note: Temperature may become an issue with operation of the down hole camera. Refer to manufacturer’s recommendations for range of operation in high temperature conditions.

Probe may not extend to anticipated well casing depth.

- Well may be deflected underground so much that indicator probe cannot reach bottom of well casing.
- Well may be pinched.
- Probe may be hung-up on weld or couple.
- Probe may be snagged on a pump component.
- A down well camera can be used to identify what is holding up the indicator probe.

If removed, reinstall wellhead and record stabilized static well vacuum in log book.

APPENDIX I

C. Liquid Level Data Management

Maintain historical information in a liquid level log electronic spreadsheet. Include the following:

- Well ID,
- Date of well installation,
- Well's GPS coordinates (northing and easting), if available,
- Original ground elevation when well was drilled,
- Length of constructed solid pipe including distance from ground surface to point on well pipe where liquid level measurement is taken,
- Length of original screen, and
- Original depth to bottom.

Update the following information after a liquid level is obtained:

- The current well elevation (msl) either from recent survey or field handheld GPS unit,
- Date of activity,
- Measured depth to liquid,
- Measured depth to bottom,
- Calculation of percentage of screen available, and
- Calculation of loss in well depth.

Update the liquid level log spreadsheet when new liquid levels are obtained.

APPENDIX J

GAS WELL DECOMMISSIONING PROCEDURES

APPENDIX J

Landfill Gas Extraction Well Decommissioning Procedures

1. All work must be performed in accordance with the Health and Safety Plan specific to activities in the potential thermal event area.
2. Remove wellhead and appurtenant piping and features.
3. Using tremie technique, backfill well casing to top of casing with lean cement-bentonite grout (5 gallons per sack concrete with 2% by weight bentonite).
4. Allow grout to settle at least 24 hours.
5. Re-fill to top of casing using bentonite chips placed and hydrated in 1-foot thick layers.
6. Using high-vis orange paint mark casing with "Decomm. Gas Well _____, Date:_____.
7. To prevent the casing from becoming a trip hazard or possibly pushing up through future temporary FML cap, do not cut the casing down.

APPENDIX K

GAS WELL INSTALLATION PROCEDURES

APPENDIX K

Landfill Gas Extraction Well Replacement/Drilling Procedure

These procedures are specific to gas extraction wells which are being installed in areas which are affected by the potential thermal event, or may reasonably be expected to be affected by the thermal event.

1. All work must be performed in accordance with the Health and Safety Plan specific to activities in the potential thermal event area.
2. Dimension, depth, and perforation interval will be approved by and provided to drilling contractor only by the Environmental Manager.
3. Maintain 5 CY stockpile of clean soil near borehole in case the hole needs to be smothered.
4. For well casing material use only CPVC, fiberglass, steel, or other approved high-temperature material.
5. For backfill around well perforations, use only rounded non-calcareous material.
6. Turn off vacuum at all immediately adjacent (within 150 feet) gas extraction wells, horizontal collectors, or other extraction points at least 4 hours prior to drilling to minimize air intrusion. Vacuum at the adjacent wells should be resumed upon completion of the backfill for new gas extraction well. Additionally, an odor neutralizing devices should be placed near the drilling activity to reduce migrant odors.
7. Equip well with wellhead and vacuum source within 24 hours of gas well completion (do not cap well for extended period).

APPENDIX L

WELLHEAD INSPECTION AND MAINTENANCE PROCEDURES

APPENDIX L

Wellhead Inspection and Maintenance Procedures

Inspect and Maintain

Inspect and maintain wellhead components to ensure consistent and reliable operation.

Document and Repair

Document major damage and schedule repairs. If typical wear and tear is noted by the inspector, repair components to function as intended.

Inspection Frequency

Inspect as part of each monitoring events. Minor repairs to GCCS components shall be completed within 48 hours.

Joints

A. Inspect mechanical joints (flexible coupler, flange, electrofusion collar, etc.) on the wellhead and casing for leaks during each monitoring event.

B. Immediately document and repair indications of vacuum leak. Potential leak indication includes, but are not limited to:

- Hissing sound coming from a joint,
- Staining or accumulation of liquid on well casing or wellhead, or
- 4:1 balance to oxygen ratio.

C. Inspect all clamps and mechanical fasteners. Ensure they are tight and operating properly.

D. The application of electrical tape and/or silicone to malfunctioning joints is considered a short term (15 days or less) “quick fix” and is not an acceptable long-term repair option. Once a joint malfunction is identified, install a permanent replacement as soon as practicable.

E. Fix broken valve components immediately.

Sample Ports

- Inspect sample port(s) and o-rings for cracks and damage and replace as necessary, Check for tightness and tighten as necessary,
- Ensure sample ports are free of debris and clean as necessary, and
- Inspect sample port caps for damage or deterioration. Replace if damaged or deteriorated.

- It is important that caps are in place on sample ports to prevent deterioration of port and dirt accumulation.

Flex Hose

A. Inspect for:

- Cracks, brittleness and deterioration,
- Kinks and constrictions,
- Appropriate length to promote condensate drainage,
- Adequate length. Hose is not to be in tension and should be long enough to accommodate slight differential movement of well pipe and lateral riser, and
- Replace is house does not pass inspection.

Well Casing

A. Visually inspect above grade well casings and surrounding areas for sign of damage, deterioration, or potential problems.

B. Use below grade inspection techniques when GCCS monitoring data warrants Geosynthetic cap penetrations.

C. Inspect geosynthetic boots during each monitoring event or as GCCS monitoring data warrants.

- Verify that seal between boot and well casing, valve extension, sump, etc. is intact.
- Verify that the integrity of the geosynthetic material is intact, and has not torn, stretched, or otherwise failed.

Surrounding Area

A. Visually inspect the surrounding cover surface integrity.

- Pay special attention to the cover located directly around each well casing, noting signs that the soil is desiccating or pulling away from the well casing,
- Note surface water erosion, ponding, leachate breakouts or staining.

Report Findings

A. Report findings immediately following the event to the Environmental Specialist so that the appropriate repairs can be performed.

B. Provide an accurate description and location of the repair needed.

C. Make note of the repairs needed.

APPENDIX M

PUMP INSPECTION AND MAINTENANCE PROCEDURES

APPENDIX M

Pump Inspection and Maintenance Procedures

Seven types of pneumatic pumps are currently utilized at Bridgeton QED and Blackhawk Vector 101 and low drawdown series pumps. Blackhawk pumps are utilized in hard piped wells where temperatures may exceed 160˚ F. Pump inspections will be performed on a weekly basis while well field tuning is being conducted at each well. Descriptions of a complete preventative maintenance plan on both pump designs are defined by the pump manufacturers Operations and Maintenance Manuals which are available on site.

A. For wells in which a QED pump has been installed the following inspection procedure will be used:

- Determine if the liquid is being pumped. Check the pump stroke counter, if so equipped and compare the value to the previous stroke counter reading. The site technician may either hear the liquid being pumped, or may touch the discharge line to detect hear, which would indicate the pump is discharging fluid,
- Check for sufficient air pressure supply to the pump,
- Drain the air supply line to be sure it is free of liquid,
- Check for leakage in and around the pump discharge line,
- Inspect the air line, regulator, and all connections, look for ice or blockage, and
- Note pump inspection in the site technician log book.

B. For hard piped wellheads where a Blackhawk pump has been installed, the following inspection will be conducted:

- Check for proper operation of the pump motor to include a full piston stroke as well as sufficient air pressure supply to the pump,
- Drain the air supply line to be sure it is free of liquid,
- Determine if liquid is being pumped. The site technician may either hear the liquid being pumped, or may touch the discharge line to detect hear, which would indicate the pump is discharging fluid,
- Check for leaks on the discharge line piping and around the pump motor stuffing box seals,
- Inspect air line, regulator, and all connections, look for ice or blockage, and
- Note pump inspection in the site technician log book.

If it is determined that the pump requires maintenance, the site technician will follow the manufacturer's manual troubleshooting and maintenance procedures. If the pump cannot be made operational in a timely manner, the pump will be replaced. Bridgeton maintains a full spare part inventory for each pump type. In addition, spare and/or rebuilt pumps are maintained in order to facilitate a complete pump change out if necessary. Unclogging or thawing or removal of ice can be accomplished by the technician as necessary.

APPENDIX N

PERMANENT AIR COMPRESSOR INSPECTION AND MAINTENANCE PROCEDURES

APPENDIX N

Compressor Inspection Sheet
Bridgeton Landfill

Technician: ________________
Date of Monitoring: ________________

	Each Wellfield Monitoring Event		**Monthly Check**
Operational (Y/N)		Bleed liquid from system	
System Alarms?		Inspect Air Dryer	
Oil Level		Inspect and Adjust Belts	
Air Filter (Cleaned/Changed)		General Housekeeping	
Building Air Temp		Parts Inventory	
Tank Pressure			
Outlet Pressure			
Hour Meter			
Visible/Audible Leaks			

Additional Comments:

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APPENDIX O

BLOWER AND FLARE OPERATION AND MAINTENANCE PROCEDURES

APPENDIX O

Blower and Flare Operation and Maintenance Procedures

Flare and Blower Operation Procedures

Prestart-up

Prestart up checks consist of:

1. Check the condensate drain valve at the base of the KOP. Inspect the KOP sight gauge for any liquids present and drain if necessary.
2. Verify air pressure on the fail close valve regulator setting is 90 psi. Verify that compressed gas is supplied to the pneumatic valve.
3. Check propane tank valve is open, propane line valve is open, and propane tanks are not empty.
4. Verify that the flow control or vacuum control set point is set to the desired position.
5. Verify the selected blower inlet and outlet manual values are open.
6. Ensure the selected blower housing drain is empty.

Start-up Procedure

Normal flare system start-up is summarized below. For the detailed Start-up Procedures please consult the manufacture's user manual.

1. Check all circuit breakers to ensure that they are in the "on" position.
2. Turn the operation mode switch in the flame controller to "Auto" and press the reset button. The controller will then automatically start the system and proceed through the start-up sequence. See the manufacturer's user manual for the start-up sequence steps.

Start-up and Operation after Failure Shutdown

If the flare system was automatically shut down for an unknown reason, the entire system should be inspected before repeating the start-up procedure to determine the reason for the shutdown.

APPENDIX O

1. Inspect the flare station equipment and piping for any obvious physical failure (i.e., leaks, pipeline breaks, low pilot fuel).
2. Check the flare controls Human-Machine Interface (HMI) screen for information about the operating status of the flare, of LFG delivery, and user operation (Check the manufacturer's manual for general HMI screen descriptions). Typical information the alarm screen provides is:
   a) System status;
   b) Faults;
   c) Warnings;
   d) User Logon / Logoff;
   e) Alarm history and reasons;
   f) Page navigation; and
   g) Set point adjustment(s).
3. Inspect the blower housing and shaft for binding or excessive looseness.
4. Investigate the possibility of power interruption, if no other cause is indicated.
5. Consult the troubleshooting guidance in manufacture's manual.

APPENDIX O

To prevent repeated failure alarms, repair any deficient conditions before attempting to restart system. If none of the above appears to have caused the shutdown, contact the LFGS representative for troubleshooting and service.

Blower Maintenance Procedures

System Operation

Ensure proper fail-safe operation during forced system shutdown.

- Perform forced shutdown quarterly, and
- Observe all fail-safe components, document and repair components that do not perform as designed.

Blower Bearing Temperature

During each monitoring event, inspect for excessive bearing temperature (relative to design or manufacturer's suggested operating temperature).

- During every GCCS monitoring event, collect a temperature reading using an infrared laser thermometer at a consistent location on the bearing cap, and
- Record the temperature and plot temperature trends to identify wear or potential bearing failure.

Blower / Motor

- Inspect for proper operation,
- Ensure all moving parts are properly lubricated, per manufacturer's recommendations,
- Inspect for excessive vibrations in blower / motor relative to normal operating conditions,
- Inspect during every GCCS monitoring event,
- Inspect and adjust drive belts,
- Bridgeton maintains a spare blower for each operating flare. The technician will operationally rotate, and
- Inspect flexible couplers quarterly, document wear and replace as necessary.

Flare Maintenance Procedures

System Operation

Ensure proper fail-safe operation during forced system shutdown.

- Observe all fail-safe components, document and repair components that do not perform as intended.

Control Panel

- Verify all indicator lights, gauges, and other components are operational during weekly monitoring,

- Check for loose wires – semi-annually, and
- Check for and remove debris, rodents, and insects that may have entered the panel.

Flame Arrestor

- Check differential pressure monthly, and
- Remove and clean flame arrester monthly, or when DP is above manufacturer's specification.

Thermocouples

- Inspect for indication of thermocouple failure monthly,
- Check for heat damage annually, and
- Replace as necessary.

Valves

- Exercise all valves monthly, and during each forced shutdown, and
- Exercise valves across the complete operational range of the valve.

Pilot System

- Verify supply of pilot gas during each monitoring event, and
- Verify operation of pilot system during each forced shutdown.

Flow Meter Maintenance Procedures

Flow meters are maintenance items that need to be serviced and calibrated on regular frequencies. Flow meters provide data so Bridgeton can properly, document compliant flow for regulatory agencies, and provide accurate data for wellfield evaluation. Without proper maintenance, flow measurement accuracy begins to decline over time.

Calibrate instrumentation

- Per manufacturer's recommendations, semi-annually at a minimum,
- Calibration requires removal of the flow measuring device from the header line,
- The unit will be shipped back to the manufacturer for calibration and maintenance, and
- A spare or loaner flow device will be inserted into the header pipe while the primary device is being serviced.

Insertion Type Meters (heat probe)

- Pull and clean probe as needed, monthly at a minimum,
- Verify proper position and orientation prior to removal and following replacement, and
- Verify meter is property zeroed by forcing shutdown and observing the recorded flow. Flow should be zero during a forced shutdown.

APPENDIX O

Chart Recording Device (Paper / Digital)

- Digital Recorder – download digital recorders during each monitoring event,
- Convert digital data to a graphical representation, where possible,
- If conversion into graphical representation is not possible, print data, and
- File graphical representation or printed date in site operating record if equipped; ensure battery back-up functions as designed.

Auto-Dialer

- Inspect auto-dialer operation daily and during all shutdowns and forced shutdowns for proper operation,
- Verify phone service exists and is operational to auto-dialer monthly,
- Inspect auto-dialer to determine proper programming, quarterly, and
- Record in the log book the personnel and phone numbers contained in the device, and ensure they match the call-out tree.

APPENDIX P

CONDENSATE MANAGEMENT SYSTEM INSPECTION AND MAINTENANCE PROCEDURES

APPENDIX P

CONDENSATE MANAGEMENT SUMP INSPECTION ITEM TRACKING FORM

Date of Inspection: _______________

Name of Inspector: ____

Inspection Item	Item Tracking Number(s)
Monthly	
Fittings	
Joints	
Corrosion	
Riser Vertically	
Absence of Flow	
Flow Meter Performance	

Note: See attached Condensate Management Sump Inspection Item Tracking Form (one per item indicated on the above form).

Inspection Items		
Sump I.D.	Date	Time

BRIDGETON LANDFILL

CONDENSATE MANAGEMENT SUMP INSPECTION ITEM TRACKING FORM

Tracking No.________________ (e.g. MMDDYY-____)

Inspector's Name: ____

Inspection Item Noted:

Description: ____

Location: ____

Other: ____

Follow-up Technician's Name: ____

Incident Resolution Description: ____

____

____

Date of Resolution: _____________________

____

Follow-Up Technician's Signature

APPENDIX Q

GAS COLLECTION PIPE INSPECTION AND MAINTENANCE PROCEDURES

APPENDIX Q

Transmission Piping Visual Inspection
Bridgeton Landfill

Technician(s): _______________
Date of Monitoring: _______________

Weekly

During routine monitoring events and inspections, the following items should be inspected as part of the GCCS piping integrity program. Completion of this form will indicate that the systems were inspected according to the below:

Quarterly

Air and Force Main – Walk the length of each line Quarterly. Observe and document evidence of leakage and excessive strain.

GCCS Piping – Quarterly, exercise valves through their full range of motion to ensure operation, monitoring vacuum at both sides of valve. Inspect sample ports, check for sagging or breaks.

Annually

Inspect all GCCS piping access points (manholes, access risers, sumps, etc.) for integrity (gaskets, flanges, piping).

Inspect all leachate access points (cleanout risers, manholes, tanks, etc.) for gas leaks, or air intrusion. Check integrity of gaskets, flanges, piping, etc.

For this monitoring period, the following areas exhibited a deficiency, as noted below and shown on the attached map.

Piping	***Date Discovered***	***Deficiency***	***Date Corrected***	***Tech***