GREENHOUSE GAS PROJECT PLAN FOR QUANTIFICATION OF GREENHOUSE GAS EMISSION REDUCTIONS

SENECA MEADOWS LANDFILL EXPANSION WATERLOO, NY

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EXECUTIVE SUMMARY

Seneca Meadows, Inc. (SMI) owns and operates New York's largest non-hazardous solid waste facility, managing 6,500 tons of waste per day on average. SMI plays a significant role in NYS's solid waste management plan, supporting the State's desire to manage in-state generated waste and reducing environmental impacts associated with it.

SMI is a wholly owned subsidiary of IESI NY Corporation, which, in turn, is a wholly owned subsidiary of IESI Corporation. IESI Corporation is the U.S. subsidiary of BFI Canada, Ltd., a publicly traded company. BFI Canada, Ltd., through its operating subsidiaries, is one of North America's largest full-service waste management companies, providing non-hazardous solid waste collection and disposal services to commercial, industrial, municipal, and residential customers in five Canadian provinces and ten states plus the District of Columbia in the United States. The company provides service to over 1.8 million customers with vertically integrated collection and disposal assets.

The company's Canadian segment operates under the BFI Canada brand serving customers in the provinces of British Columbia, Alberta, Manitoba, Ontario, and Quebec. The initial Canadian assets were acquired in 2000. BFI Canada operates five landfills, four transfer collection stations, seven material recovery facilities (MRFs), and one landfill gas-to-energy facility.

The company's U.S. segment operates under the IESI brand serving customers in Arkansas, District of Columbia, Louisiana, Maryland, Mississippi, Missouri, New Jersey, New York, Oklahoma, Pennsylvania, and Texas. The U.S. business was acquired in 2005. IESI services more than 586,000 residential customers and approximately 66,000 commercial and industrial customers. IESI operates 17 landfills, 29 transfer collection stations, 11 MRFs, and one transportation operation.

The SMI solid waste management facility is located in the Town of Seneca Falls, Seneca County, New York. The current facilities are situated on approximately 2,400 acres of SMI property holdings. These property holdings are located near the intersection of Salcman Road and Route 414, approximately 3.5 miles south of the New York State Thruway (Exit 41) and one mile north of the Route 414 intersection with U.S. Routes 5 and 20. Within these property holdings, the area occupied by solid waste operations totals approximately 600 acres, including the existing and approved landfill expansion areas; stormwater management facilities; the leachate management facility; tire recycling facility; resident drop-off and yard waste areas; and miscellaneous supporting facilities

such as the office, access roads, and scales. The total permitted landfill footprint, including existing and future expansion areas is approximately 400 acres.

The Southeast Landfill (SELF) is located north of Salcman Road and west of Route 414, while the Existing Landfill, also known as the SMI Landfill, is located on the northern portion of the site. West of the site and north of Salcman Road is the tire recycling facility and maintenance garages. On the south side of Salcman Road are the administrative offices and various stormwater retention ponds.

A renewed 6 NYCRR Part 360 permit became effective on October 11, 2007 allowing SMI to begin construction of the 178-acre Expansion. The Expansion involves a horizontal expansion of a portion of the Existing Landfill and the SELF. Approximately 28.6 million tons (MM tons) of additional solid waste disposal capacity will be created over the next 15 years. The Expansion includes new and expanded leachate collection and active landfill gas (LFG) collection. The development of the new landfill cells will occur in a series of sequential phases. For construction purposes, each of these phases will be divided into smaller cells. The Expansion occurs as a lateral expansion into adjoining areas that are not currently used as landfill area. The development areas represent a total of approximately 228 acres, with approximately 50 acres of overfill and 178 acres of new landfill area.

As part of the operations under SMI's approved operating permit, a Gas Collection and Control System (GCCS) Plan has been designed for a multiple-phased construction. Air emissions associated with the landfill operations and management of the LFG that is generated is regulated by SMI's Title V Air Facility Permit (No.: 8-4532-00023/00041). SMI is seeking to generate greenhouse gas (GHG) credits for collecting landfill gas before it is required by this permit or other rules. The GCCS includes many of these provisions.

SMI has constructed a Renewable Resource Recovery Park (RRP), a commercial/business park, located to the east of the Site (just across Route 414 Gas control equipment consists of two enclosed LFG flares (one 2,000 cubic feet per minute [cfm] and one 4,000 cfm flare manufactured by LFG Specialties, Inc.), installed vacuum blowers, and a Landfill Gas Recovery Facility (LGRF) building that provides office space, shop space, and houses the blowers and the automated control system for management of the GCCS. LFG collected from the landfill areas is transmitted across Route 414 via header pipes to the LGRF and then delivered to the gas-to-energy plant (owned by a third party), potentially other future end-users, and to the enclosed flares when excess gas is destructed. The automated system in the LGRF operates a series of valves, piping, and blowers to control the vacuum placed on the GCCS.

The two enclosed flares operated by SMI have routinely undergone performance testing overseen by NYSDEC for destruction efficiency (less than 20 parts per million (PPM) non-methane organic compounds (NMOCs)) in accordance with the MSW NSPS and the facility's Title V permit. Flow and temperature data are recorded continuously and data is maintained in the facility SCADA system. Blowers for the gas collection system are operated by a process logic control (PLC) system that allows for manual or fully automated control. The PLC itself was designed with fully redundant control and battery back-up of the computer system in the event of a loss of electricity. Flow to the flares, and the volume of LFG sold, is measured by thermal mass flow meters.

The LFG that is sold to the gas-to-energy plant is combusted in a series of Caterpillar internal combustion engines. The engines have been tested under direction of the NYSDEC for proper destruction efficiency. The power output from the engines (gen-sets) is the mechanism used to determine the amount of landfill gas used by the energy plant. This data is likewise collected and maintained in electronic format at their facility.

Flow and associated data will be collected from the main header, downstream of each individual cell, from the moment the horizontal gas collectors are connected to the gas extraction system until the first waste in the cell is subject to the MSW NSPS and 6 NYCRR Part 360 requirements. This may or may not require measuring flow from more than one stage at a time, depending on actual fill sequencing.

In order to generate carbon credits, SMI will install collection components as waste is being placed. Since this early collection is voluntary, SMI is seeking buyers for Green House Gas (GHG) credits associated with the early action collection and destruction of this methane collected from the Expansion. There are no permit-related or other regulation requirements for the collection of this gas. Applicable regulations (at 40 CFR 60.753) require that gas collection be installed in waste that has been in place for five or more years in active areas of the landfill or after two years in areas that are closed or at final grade. It has been observed at SMI that the waste begins to generate gas within a few months of placement. The horizontal collectors will be connected to the extraction system within approximately six to nine months of waste placement thereby capturing the gas that would otherwise be released into the atmosphere. According to the USEPA's LandGEM landfill gas generation model, approximately 600-1,800 CFM of LFG is predicted to be available for collection in this manner over the next eight to ten years. While this is a predictive model that can be affected by many variables, tracking of predicted versus collected volumes for several years indicates that these values are

generally reliable. Gas curves from the LandGEM model for each stage of the Expansion are included in Appendix B.

The development of the permitted Expansion is underway. Horizontal collectors and/or extraction wells from each stage of the Expansion will be connected to the GCCS. Flow from each stage will be measured via thermal mass flow meters installed in accordance with manufacturer's requirements. Gas quality concentration will be measured on a daily basis (Monday through Friday during working hours) with a LANDTEC GEM 2000 (GEM) for methane content. Semi-annual verification by laboratory analytical method 3C will also be conducted for methane content. The GEM and flow meter will be calibrated and maintained in accordance with manufacturer's recommendations and records of calibration will be maintained on-site.

Part of these stages will occur as overfills on to an adjacent cell. Although unlikely, the potential does exists for the collectors closest to this interface to influence the adjacent landfill area. Therefore, the volume of landfill gas measured from this subject cell will be reduced by the ratio of the number of the collectors adjacent to the interface compared to the total number of collectors in the entire cell/stage. This will provide a conservative allowance since these collectors will be placed approximately 100 feet from the interface between the two areas. Based on the designed area of influence of the collectors, only a small portion of the flow from these collectors would potentially be from outside of the subject cell. Accordingly, the volume of gas available to generate GHG credits will be slightly less than shown on the attached curves, but is expected to be on the order of 50,000 to 100,000 tons of carbon dioxide equivalents for several years.

Additional details on the design of the landfill, gas collection, control, measurement, and verification procedures are included in this report.

1.0 INTRODUCTION

On behalf of Seneca Meadows, Inc. (SMI), Conestoga-Rovers & Associates, Inc. (CRA) has developed this Greenhouse Gas Project (GGP) Plan for quantifying greenhouse gas (GHG) emission reductions that will result from the early collection and destruction of methane from the SMI Expansion Landfill (Expansion). The collection and destruction of methane from the Expansion prior to the regulatory timetable defined in the New Source Performance Standards (NSPS) regulations or other permit requirements will generate early action GHG credits that will be available for sale on the open market.

Applicable NSPS regulations (at 40 CFR 60.753) require that gas collection be installed in waste that has been in place for five or more years in active areas of the landfill or after two years in areas that are closed or at final grade. In order to generate carbon credits, SMI will install collection components as waste is being placed. It has been observed at SMI that the waste begins to generate gas within a few months of placement. The horizontal collectors will be connected to the extraction system within approximately six to nine months of waste placement. Since this early collection is voluntary, SMI is seeking buyers for GHG credits associated with the early action collection and destruction of this methane collected from the Expansion. There are no permit-related or other regulation requirements for the collection of this gas.

The objectives of this GGP Plan are to:

- Define the monitoring equipment and procedures that will be in place in order to measure the amount of methane that is collected and destructed from the Expansion prior to regulation under the NSPS
- Define the recordkeeping and data collection procedures that will be implemented to quantify the early action carbon credits from the Expansion
- Describe the calculation methodology for early action carbon credits from the Expansion
- Describe the procedures and methods that will be used for quality assurance, maintenance, and repair of all monitoring equipment used to provide data
- Describe the verification process for any early action carbon credits
- Describe the reporting procedures that will be in place for the early action carbon credits

2.0 FACILITY DESCRIPTION

SMI operates a Municipal Solid Waste Landfill (MSWL) regulated under 6 NYCRR Part 360 (Permit No.: 8-4532-00023/00001-0) located at 1786 Salcman Road in Seneca Falls, New York (Facility or Site). The Facility accepts municipal solid waste (MSW) and certain permitted non-hazardous industrial or special wastes primarily from Upstate New York. The landfill operations at the Facility include: waste handling (tipping, covering, compacting), landfill gas (LFG) collection and combustion, composting, landfill cell construction, hauling of construction and cover materials, tire shredding, leachate collection, storage, recirculation, and equipment maintenance operations. As part of operations under SMI's approved operating permit, a landfill gas management system has been designed and constructed. Air emissions associated with the landfill operations and management of the MSWL is regulated by SMI's Title V Air Facility Permit (Permit No.: 8-4532-00023/00041).

There are currently three landfill areas at the Facility: the Existing Landfill with AB Overfill; the Southeast Landfill (SELF); and the Southeast Bumpout (SBO) Landfill. In addition to the landfill areas, there are several other features that are integral to the overall landfill gas management strategy for the Site. The gas collection and control system (GCCS) consists of collectors within the landfill and piping infrastructure to transport the LFG to the Landfill Gas Recovery Facility (LGRF). The LGRF includes a building that houses the blowers responsible for influencing a vacuum on the landfill and delivery of the gas to the flares owned by SMI and the offsite energy plant. The LGRF, flares and energy plant are located across Route 414, to the east of the landfill areas at the Renewable Resource Recovery {Park (RRP). The RRP is a commercial/business park developed by Seneca Meadows not only for the LGRF and the third-party energy plant, but also with the intent of attracting other businesses that could benefit from the landfill gas as a source of renewable energy for their operations.

The following Section provides a description of each landfill area and other features with a more detailed emphasis on the SBO.

2.1 EXISTING LANDFILL

The Existing Landfill began accepting waste in 1974. As a result of the development of 6 NYCRR Part 360 and subsequent revisions, a construction permit was issued on July 13, 1981. The AB Overfill expansion was approved in April 1999 and brought the Existing Landfill from approximately 14,500,000 cubic yards (c.y.) to approximately 19,000,000 c.y.

Landfill gas collectors are tied into two transmission headers running along the east and west perimeter berms of the Existing Landfill that currently lead to the LGRF and then on to the gas-to-energy plant and two enclosed flares.

The perimeter headers are constructed of 18-inch and 12-inch SDR17 and 14-inch SDR26 high-density polyethylene (HDPE) with control valves located throughout the system. Due to depth of waste, settlement, and leachate mounding, the older horizontal collectors have become less reliable and, therefore, vertical wells have been used extensively.

The condensate generated from the GCCS in the Existing Landfill is collected at low points in the gas collection system throughout the landfill and pumped into the leachate force-main. Leachate collection in the Existing Landfill is conducted by a network of piping that draws leachate from the landfill and transfers it to the on-site 501,825-gallon dual-contained aboveground storage tank (AST).

2.2 SELF

The SELF, also approved in April 1999, provided approximately 14 million c.y. of disposal capacity that was filled between 2003 and 2009. The SELF is physically separate from the Existing Landfill, but utilizes a common header to route the collected LFG to the same LGRF located in the RRP.

The GCCS in the SELF consists of a series collectors that tie into a 28-inch SDR17 transmission header constructed of HDPE that runs along the east berm of the landfill to the LGRF and then on to the gas-to-energy plant and enclosed flares as necessary.

There is a valve on the south end of the 28" header that ties into the header for the SBO. The header and associated piping were also sized to accommodate the additional flow. The condensate generated from the GCCS in the SELF is collected at low points in the gas collection system throughout the landfill and pumped into the leachate force-main.

2.3 EXPANSION LANDFILL

In August of 2007, SMI received the approved operating permit allowing SMI to begin the construction of a 178-acre Expansion. The Expansion involves a horizontal expansion of a portion of the Existing Landfill and the SELF. Approximately

28.6 million tons (MM tons) of additional solid waste disposal capacity will be created over the next 12 years. The development of the new landfill cells will occur in a series of sequential phases. For construction purposes, each of these phases will be divided into smaller cells. The Expansion occurs as a lateral expansion into adjoining areas that are not currently used as landfill area. The development areas represent a total of approximately 228 acres, with approximately 50 acres of overfill and 178 acres of new landfill area.

The active gas collection system for the Expansion is designed to prevent the build-up of excess LFG pressure within the landfill, to control subsoil gas migration or surface emissions to the atmosphere, and to collect landfill gas before required by regulation to generate greenhouse gas credits. The design consists of features to ensure compliance with the gas collection standards specified under the MSW NSPS regulations for new MSW landfill sites (including 6 NYCRR Part 208) and to allow for the generation of early action credits.

The design for the leachate collection system for the Expansion areas is similar to the system installed in the SELF. The leachate collection system is divided into four components: a leachate collection system, leachate conveyance system, leachate storage and transfer system, and a leachate recirculation system. Each of these components has been designed in accordance with the design and performance criteria set forth in 6 NYCRR Part 360-2.7(b)(9) and (10), and 2.13(g) and (h).

2.3.1 DECRIPTION OF GCCS

The following presents a detailed description of the GCCS for the Expansion Landfill. Appendix A presents selected GCCS drawings for the Expansion Landfill from the Gas Collection and Control System Design Plan (February 2007 (Revised)).

2.3.1.1 LEACHATE AND CONDENSATE MANAGEMENT SYSTEM

SMI utilizes the following leachate recirculation methods for the Expansion:

- trucking leachate from the AST to the Expansion for direct application ("dosing")
- trucking leachate from the AST to the Expansion for application via horizontal recirculation lines. Runs of horizontal perforated piping will be placed in designed

trenches that allow leachate to be transferred into the piping to gravity drain into the waste layer

- the design allows for leachate to be drawn through a network of piping at the base of the landfill, through leachate side-riser buildings, and back into the landfill via a series of recirculation lines in trenches separate from the gas collection lines placed in waste

- leachate may also be pumped back into the landfill using the network of piping described above

A network of horizontal recirculation lines is installed during waste placement along the same elevations as the gas collectors. The leachate recirculation piping is installed in separate trenches from the gas collectors, and backfilled with stone. Leachate recirculation lines are placed approximately every 150 feet horizontally and every 45-50 feet vertically in an alternating pattern with the GCCS.

A second AST will be constructed to allow for the storage of additional leachate from the Expansion. At this time it is not anticipated that piping will be installed to allow for the recirculation of leachate into the Expansion from the ASTs but this may be reconsidered in the future.

It should be noted that the extent of leachate recirculation shown on the drawings in Appendix A is the maximum amount projected, and represents what is calculated to be significantly more capacity than required to inject all of the leachate. Construction will follow the design of the attached plans; however, depending on the actual amount of leachate injected, and the performance of the system as it is constructed, all of the manifolds and horizontal recirculation lines may not be necessary. The GCCS is intended to be constructed to the extent shown, unless otherwise specified.

Condensate from the portions of the gas header associated with the Expansion are collected in a series of underground tanks and sumps at low points in the system and pumped into the force-main that leads to the leachate AST. In addition, the horizontal collectors and headers are designed to gravity drain back into the landfill double composite liner system rather than being pumped.

2.3.1.2 COVER PROPERTIES

Portions of the landfill that reach interim grades will be covered with a minimum of 1-foot of compacted clayey soil in accordance with SMI's Operating Permit.

The final cover at the Expansion will consist of (from top of refuse to top of cover):

1) 12-inch intermediate cover soil
2) Geocomposite vent layer (similar to drainage layer – used for venting LFG)
3) 60-mil HDPE geomembrane
4) Geocomposite drainage layer
5) 24-inch barrier layer (common fill type soil)
6) 6-inch soil suitable for vegetative cover
7) surface water channels and erosion controls

Intermediate cover consists of a minimum of 12 inches of soil. Alternative cover options, including soil rather synthetic cover, may be investigated in the future.

2.3.1.3 GAS HEADER SYSTEM

The various stages of the expansion will be influenced by perimeter headers that provide vacuum to the horizontal collectors and vertical wells. The amount of vacuum applied to each collector is controlled by a valve at the collector (or "wellhead"). The SBO is influenced by a continuation of the 28-inch header that runs along the east side of the SELF. This header will run around the south and up the west sides of the SBO to deliver vacuum to the GCCS from opposing sides of the landfill. This will result in additional vacuum available to each collector, if it is required. A 28-inch header will also be extended to the east side of the proposed expansion for Stages 3, 4, 5, 6 and 7. This header will support the primary 28-inch extraction header located on the west side of these stages.

Vacuum from the remaining stages will be provided by an expansion of the header that currently exists around the existing landfill and additional header sections on the east, west, and north sides of the new cells. A booster blower may be provided near the current location of the Leachate Storage Building, in order to provide sufficient vacuum to these sides of the landfill, if necessary.

These headers were sized to allow for sufficient capacity to install additional horizontal or vertical collectors if they are required.

Quarterly methane surface monitoring in finished areas and other operational parameters required by the MSW NSPS will be utilized to determine the effectiveness of the system and determine if additional control is warranted.

2.3.1.4 GAS COLLECTION COMPONENTS

In general, the Site has progressed from the use of vertical wells to subsequent horizontal collectors in order to coincide with the fill progression schedule of the landfill. Horizontal collectors can be installed along with placement of waste and they provide a sufficient area of influence to begin reducing odors before vertical wells would be needed. Horizontal collectors are placed within the initial "lifts" of waste, as shown on the attached drawings, to accommodate the extraction of gas before required by applicable regulations. Vertical wells are still an important aspect of the GCCS, primarily to provide localized influence, and at final grade. As refuse filling operations proceed, and portions of the Site reach final or near final grades, additional GCCS components will be installed as shown in the design.

The spacing of the collection system components of approximately 150 feet horizontally and approximately 45-50 feet vertically is based on a combination of engineering calculations and experience with this and similar sites.

The LFG collection elements are designed to prevent excessive air infiltration through the use of solid wall pipe near the ground surface for vertical LFG extraction wells and installation of hydrated bentonite plugs around the vertical well casing where they penetrate the landfill cover. Further, air intrusion control will be accomplished through monitoring of the operational standards for the LFG collection elements in accordance with NSPS requirements. If the GCCS does not meet the operational standards, it will be enhanced or modified in accordance with MSW NSPS requirements. Typical well details are included in Appendix A.

Air infiltration will be additionally minimized by:

1) a minimum depth of bury of 10 feet of waste to allow installation of horizontal collection piping
2) typically a minimum depth of 20 feet of waste above horizontal collection piping to allow commissioning and operation
3) a depth of 40 feet of waste above horizontal collection piping to achieve peak efficiency

4) maximizing the setback of horizontal collection piping from the edge of waste

The existence of base-liner systems for the landfill will also minimize the potential for subsurface gas migration from the landfill and assist with gas collection. Continued review of the quarterly monitoring results will be used to assist in evaluation of the effectiveness of the system.

2.3.1.5 ROUTINE MONITORING

The following is a summary of the routine monitoring activities performed for the GCCS:

- Subsurface gas monitoring is performed quarterly on probes spaced approximately 400 feet apart around the landfill perimeter
- The cover of the landfill is inspected on at least a monthly basis for integrity and to allow for the implementation of repairs as necessary
- Surface monitoring of methane along the entire perimeter of the collection area and along a pattern that traverses the landfill at 30-meter intervals for each collection area is performed on a quarterly basis
- LFG collectors are monitored monthly for pressure, oxygen, and temperature
- The flow rate and temperature of LFG to be burned at the flares is continuously monitored and automatically documented using an electronic data recorder and SCADA system
- Composite sampling of landfill gas condensate is performed semi-annually
- A landfill gas sample is obtained prior to the enclosed flare and analyzed annually

2.3.2 LANDFILL GAS GENERATION

Landfill gas generation estimates for each of the nine permitted stages of the Expansion were obtained by utilizing the United States Environmental Protection Agency (USEPA) Landfill Gas Emissions Model (LandGEM), Version 3.02. A model run was performed for each stage of the Expansion using the projected waste placement shown in Table 1 and parameters referenced from USEPA AP-42 (L_o = 100 m^3/Mg, k = 0.04 yr^{-1}). A collection efficiency (CE) of 75% and a methane concentration of 50% by volume were assumed. Table 2 provides an estimate of total LFG generated and collected for each stage of the Expansion. Appendix B presents the graphs depicting the estimated LFG available for collection during each stage of the Expansion.

2.4 LANDFILL GAS CONTROL SYSTEM

SMI has constructed a Renewable Resource Recovery Park (RRP), a commercial/business park, located to the east of the Site (just across Route 414). The RRP consists of two enclosed LFG flares (one 2,000 cubic feet per minute [cfm] and one 4,000 cfm flare manufactured by LFG Specialties, Inc.), installed vacuum blowers, and a Landfill Gas Recovery Facility (LGRF) building that provides office space, shop space, and houses the blowers and the automated control system for management of the gas collection and control system (GCCS). LFG collected from the landfill areas is transmitted across Route 414 via header pipes to the LGRF and then delivered to the gas-to-energy plant (owned by a third party), potentially other future end-users, and to the enclosed flares when excess gas is destructed. The automated LGRF system operates a series of valves, piping, and blowers to control the vacuum placed on the GCCS.

2.4.1 LANDFILL GAS RECOVERY FACILITY

The machinery, equipment, and materials that are used at the LGRF are described in the following subsections.

2.4.1.1 POWER SUPPLY

Overall supervision and operation of the LFG control system is contained within the main control panel located within the office of the LGRF building. The control panel contains the programmable logic controller (PLC), controllers, relays, signal conditioners, input/output (I/O) to and from the various treatment facility sensors and hardware, etc., and the program to ensure safe operation of the system. The main control panel also houses the operator function switches and system status lights.

2.4.1.2 LFG BLOWERS AND VFDS

The LGRF has been designed with the capacity to manage the rate of LFG production estimated for the landfill. The selected blowers are capable of providing up to 75 inches water column (WC) vacuum at the landfill (100 inches WC at the blowers), and are manufactured by Houston Service Industries, Inc. (HSI). Each blower will be capable of pulling up to 3,500 cfm of LFG. This is almost twice the vacuum typically required to control the landfill.

Flexible connections for both the inlet and outlet of the blowers absorb vibrations during operation and prevent transmission of vibrations to the plant piping. The internal portion of the blowers are also epoxy coated for corrosion protection.

The blowers are spark resistant construction and components coming in contact with the LFG are corrosion resistant. The blowers are equipped with shaft seals to minimize leakage of LFG or air out of or into the blower housing.

Each blower is equipped with a plug valve on the inlet and outlet at the connection to the headers. The inlet valves are manually operated to allow throttling of the blower if necessary (generally fully open). VFDs provide operational flexibility by varying the blower performance characteristics and, as a result, the ability to vary flows. This provides the ability to adjust based on potential variations in LFG production.

A check valve is provided on the inlets of each blower. The check valves will prevent backflow of LFG in the unlikely event that a pressure gradient towards the blowers develops within the plant discharge piping.

2.4.1.3 CONTROLS AND MONITORING

The controls and monitoring for the LGRF building are automated and include the following control features:

- PLC co-ordination and supervision of LGRF building functions
- Automated system start-up
- Logging of various operating parameters
- Automatic recording, warning/alarm notification, or shut-down upon occurrence of fault conditions

In addition to the overall plant controls, the following information is recorded:

- LFG flow rates
- Flare operating temperatures
- Blower operating times

2.4.1.4 PROGRAMMABLE LOGIC CONTROLLER

A PLC located in the control room manages the overall distribution of the LFG throughout the system. The PLC controls the blowers, and is set based on the set point for the vacuum needed at the landfill (determined by SMI). Collected LFG is first delivered to the engines in the gas-to-energy plant. The 2,000 cfm and 4,000 cfm enclosed flares operate only when landfill gas production exceeds the demand of the gas-to-energy plant, or when the plant or individual engines are off-line.

The PLC is programmed to provide for the safe operation of the blowers and the automated shutdown of valves and/or control devices in the event of an upset condition. Also, the PLC is designed for manual or automated control of the system.

2.4.1.5 ENCLOSED FLARES

The LGRF is equipped with two enclosed flares – one 2,000 cfm flare and one 4,000 CFM flare. Additional space for a third flare is being provided at the LGRF for possible future use, if needed. These landfill gas flares are considered the backup combustion devices at the Facility. Both flares have a manufacturer guaranteed destruction efficiency of 99% for methane (refer to Appendix C for manufacturer specifications for the LFG Specialties, Inc. enclosed flares).

Both flares are manufactured by LFG Specialties, Inc., and both are currently permitted by SMI. The flares are designed for fully automatic, unattended operation, and are equipped with alarms that will automatically shut down the flare (based on pre-set high or low temperature points).

Operation and maintenance of the flares during startup, shutdown, and malfunctions (SSM) is covered under the Facility's SSM Plan updated February 2010.

SMI also has two thermal oxidizers that were previously used to combust off-gas from the gas cleaning systems before the engines. These thermal oxidizers are not currently in use; however, SMI maintains these oxidizers on-Site for future use, if needed. They are maintained in the Title V Permit.

2.4.1.6 KNOCKOUT POTS

Each flare is equipped with a knock-out pot and demister that drains to the condensate sump at the LGRF building. Specifications for the knock-out pots are included with the flare specifications. The knock-out pots will drain into the sump at the LGRF building and ultimately to the double-walled pipe that returns to the leachate forcemain.

2.4.2 LANDFILL GAS-TO-ENERGY PLANT

LFG is drawn by vacuum blowers through header piping and delivered to the gas-to-energy plant, which is owned by a third party (separately owned/operated/permitted Facility). The gas-to-energy plant is considered the primary combustion device at the Facility. The gas-to-energy plant houses a total of fourteen Caterpillar 3516 internal combustion (IC) engines and four Caterpillar 3520 IC engines.

A methane destruction efficiency for the Caterpillar IC engines is not specified by the manufacturer. Therefore, SMI will reference a destruction efficiency of 98.34% from information gathered by the Solid Waste Industry for Climate Solutions (SWICS). SWICS is an informal coalition of both public and private solid waste and recycling providers, with the primary goal of ensuring that climate change policy makers are provided with the most accurate and comprehensive information regarding the solid waste and recycling industry and operations that may generate or reduce GHG emissions. The methane destruction efficiency value of 98.34% for engines is based on the results of source tests conducted at a number of facilities between 2003 and 2007.

3.0 PROJECT DESCRIPTION

The development of the nine permitted stages of the Expansion is underway as depicted on Figure 1. Horizontal collectors and/or extraction wells from each stage will be connected to a primary gas header. Flow from each stage will be measured via thermal mass flow meter(s) installed and maintained in accordance with manufacturer's requirements. Gas quality concentration will be measured on a daily basis (Monday through Friday during working hours) with a LANDTEC GEM 2000 (GEM) for methane content. Semi-annual verification by laboratory analytical method 3C will also be conducted for methane content. The GEM and flow meter will be calibrated and maintained in accordance with manufacturer's recommendations and records of calibration will be maintained on-site.

Part of these stages will occur as overfills on to an adjacent cell. Although unlikely, the potential does exist for the collectors closest to this interface to influence the adjacent landfill area. Therefore, the volume of landfill gas measured from this subject cell will be reduced by the ratio of the number of the collectors adjacent to the interface compared to the total number of collectors in the entire cell/stage. This will provide a conservative allowance since these collectors will be placed approximately 100 feet from the interface between the two areas. Based on the designed area of influence of the collectors, only a small portion of the flow from these collectors would potentially be from outside of the subject cell. Accordingly, the volume of gas available to generate GHG credits will be slightly less than shown on the curves presented in Appendix B, but is expected to be on the order of 50,000 to 100,000 tons of carbon dioxide equivalents for several years.

3.1 PROJECT START DATE

SMI will begin collecting data in the 2nd quarter of 2010. On or about April 1, 2010, SMI will begin monitoring the amount of LFG collected from the Stage 1 and 2 Expansion area (Stage 1/2 Area), as well as the methane concentration of the collected LFG. Refer to Section 4.0 for further discussion of the monitoring activities that will commence on April 1, 2010.

3.2 PROJECT SEQUENCE

NSPS regulations require that gas collection be installed in waste that has been in place for five or more years in active areas of the landfill or after two years in areas that are

closed or at final grade. Waste placement began in the Stage 1/2 Area in December 2008. Therefore, monitoring of collected LFG and methane concentration from the Stage 1/2 Area will occur until approximately December 2013, unless closure or final grade of the Stage 1/2 Area is obtained prior to December 2011, in which case monitoring would occur until two years after closure/final grade is obtained.

Next, the flow meter will be installed in the Stage 3 area to monitor collected LFG and methane concentration from the Stage 3 area. This monitoring would commence immediately after installation of the initial horizontal collectors in the Stage 3 Area is completed. The duration of monitoring for this area (and adjoining stages) would occur until 5 years after initial waste placement, unless closure or final grade is completed within 3 years of initial waste placement. This sequence would continue until the final stage of the Expansion becomes applicable to NSPS regulations.

3.3 ADDITIONALITY

The three-prong test for determining additionally, as described in the American Carbon Registry (ACR), is demonstrated in the following subsections.

3.3.1 REGULATORY SURPLUS

There are no existing laws, regulations, statutes, legal rulings, or other regulatory frameworks in effect as of now or the project start date that mandate the collection and combustion of LFG from areas of the Expansion where waste has been in place for less than five years for active areas and less than two years for areas that are closed or at final grade. Landfill gas is being collected, measured and monitored before required by NSPS primarily for the purpose of generating carbon credits. Therefore, this project passes the regulatory surplus test of additionality.

3.3.2 COMMON PRACTICE

Only a minority of landfills in the United States install active collection systems solely for the purpose of generating carbon credits. Therefore, the early collection and combustion of LFG prior to regulation under the NSPS can be considered "beyond business as usual" and additional. Therefore, this project passes the common practice test of additionality.

3.3.3 FINANCIAL IMPLEMENTATION BARRIER

The purpose of the project is primarily to generate carbon credits for sale to the open market. Since carbon funding is what provides incentive to complete the project, the project passes the financial implementation barrier test of additionality.

3.4 ELIGIBILITY REQUIREMENTS

This Section discusses the project eligibility according to the American Carbon Registry Standard (version 2.0):

- **Project Document**: This document represents the GHG Project Plan for the project and has been prepared in accordance with the American Carbon Registry Standard (version 2.0)
- **Start Date**: The start date for each expansion stage is the date on which construction of that stage is completed and LFG capture and combustion begins. The following table presents the approximate start date for each expansion stage based on current projections of waste placement:

Stage	*Year Waste Placement Begins*	*Year LFG Capture & Combustion Begins*	*Start Date*
1	2009	2010	2010
2	2009	2010	2010
3	2012	2013	2013
4	2013	2014	2014
5	2014	2015	2015
6	2017	2018	2018
7	2018	2019	2019
8	2021	2022	2022
9	2022	2023	2023

- In the event that construction moves more quickly or slowly than planned, SMI will update the start dates as part of the Annual Attestation, monitoring and verification process. No emission reduction tons (ERTs) will be issued for GHG reductions that have not already occurred and been verified
- **Minimum Term**: Since the project is not a forestry project or a Carbon Capture & Storage project, there is no minimum term required for this project

- **Crediting Period**: The crediting period for each expansion stage will begin on the start date and end 5 years after waste is first placed, or 2 years after a new stage is closed or at final grade, whichever occurs sooner. Crediting will cease when NSPS regulations would have mandated LFG collection, whether or not LFG capture and combustion begins on schedule. The following table summarizes the approximate crediting periods for each expansion stage based on current projections of waste placement:

Stage	*Year Waste Placement Begins*	*Start Date*	*Crediting Period Start*	*Crediting Period End*
1	2009	2010	2010	2013
2	2009	2010	2010	2013
3	2012	2013	2013	2016
4	2013	2014	2014	2017
5	2014	2015	2015	2018
6	2017	2018	2018	2021
7	2018	2019	2019	2022
8	2021	2022	2022	2025
9	2022	2023	2023	2026

- **Real**: The quantified GHG reductions will represent actual emission reductions that have already occurred since carbon credits will be reported and verified for each reporting period after the conclusion of the respective quarterly/annual period
- **Direct Emissions**: SMI will own and control the Expansion and the GCCS system from which the emission reductions originate over the life of the project
- **Additional**: The project passes the three-prong test for additionality as shown in Section 3.3
- **Offset Title**: SMI will own all generated carbon credits from the project. SMI will not relinquish the rights to any carbon credits generated from gas combusted at the gas-to-energy plant
- **Land Title**: SMI has the necessary documentation and attestation of clear, unique, and uncontested land title to all project lands
- **Project Baseline**: The project baseline is considered zero since LFG would not be collected and combusted from the Expansion until required to by the NSPS if the project is not implemented
- **Permanence**: The GHG reductions are permanent after the combustion of collected LFG from the Expansion prior to regulation occurs since combusted LFG cannot naturally convert back to a form of GHG

- **Net of Leakage**: There is no leakage of emissions outside of the project boundary anticipated with this project (verified by quarterly surface scans); however, if it is determined that leakage is occurring, these emissions will be quantified using the equation in Section 6.3 and included in the calculation of reductions
- **Independent Verification**: A third-party verifier approved by ACR will annually verify emission reductions as described in Section 8.0 (in addition to a separate verification of 2010 2nd Quarter emission reductions)
- **Community & Environmental Impacts**: See Mitigation Plan Below

3.5 MITIGATION PLAN

While no negative community or environmental impacts have been identified associated with this early action credit project, Seneca Meadows has existing procedures for tracking any community complaints so they may be reviewed and addressed on a timely basis (refer to Appendix I for Complaint Management Standard Operating Procedure included in SMI's Operations, Maintenance and Monitoring Plan). Both Seneca Meadows and NYSDEC maintain toll free telephone numbers where residents can register complaints. If these complaints are determined to be significant they are acted upon immediately, however, all complaints are reviewed and followed-up. Complaint records are also sent to the local Town and the New York State Department of Environmental Conservation (NYSDEC).

A list of any complaints will be reviewed on an annual basis. If any negative community or environmental impact, or claim of any community or environmental impact, associated with this early action carbon credit project is identified, an action plan will be prepared to address the issue along with a schedule for implementation of the action plan. Seneca Meadows will disclose any negative impact associated with this project in their annual attestation and make available copies of any action plans. In addition, a summary of complaints and negative impacts are discussed in the annual regulatory report required by the Site's permit.

3.6 PROJECT BOUNDARIES

The physical boundary of the project, presented in Figure 2, includes the following components of landfill operation:

- Expansion Landfill: areas where waste has been in place for less than five years for active areas and less than two years for areas that are closed or at final grade

- Vertical gas wells, horizontal collectors and gas collection piping
- Blowers
- Enclosed Flares

All project-related construction activities are also included within the physical boundary.

The GHG accounting boundary for the collection and combustion of LFG includes emissions of methane generated at the landfill (including the portion that is microbially oxidized to carbon dioxide). Avoided emissions from fuel displacement with LFG at the gas-to-energy plant are not included in the project boundary. Any emissions of methane, carbon dioxide, and nitrous oxide that result from the combustion of fuel used for the blower and any fuel combusted during the operation of equipment used during construction of the gas collection system are included in the GHG assessment boundary and will be calculated using the formula presented in Section 6.2. Any GHG emissions from fuel used to assist and maintain flare operation are also included.

Carbon dioxide emitted from the landfill or from onsite combustion of the landfill gas is not included in the GHG accounting boundary because the carbon dioxide produced at the Expansion Landfill is primarily from biogenic sources and, therefore, these emissions do not increase concentrations of carbon dioxide in the atmosphere.

Methane emissions that escape the cap, or from leaking valves or seals do not need to be included within the project boundary because these methane emissions would have occurred in the absence of the project.

3.7 REGULATORY ELIGIBILITY

This Section discusses the regulatory applicability of the Expansion to federal, state, and local regulations.

3.7.1 FEDERAL REGULATIONS

The following EPA regulations for MSW Landfills have a bearing on the eligibility of methane collection and combustion projects as GHG offset projects:

- New Source Performance Standards (NSPS) for Municipal Solid Waste Landfills, codified in 40 CFR 60, Subpart WWW – Targets landfills that commenced construction or made modifications after 1991
- Emission Guidelines (EG) for Municipal Solid Waste Landfills, codified in 40 CFR 60, Subpart CC – Targets existing landfills that commenced construction before May 30, 1991, but accepted waste after November 8, 1987
- The National Emission Standards for Hazardous Air Pollutants (NESHAP), codified in 40 CFR 63, Subpart AAAA – Regulates new and existing landfills

The SMI Existing/AB Overfill Landfill and SELF Landfill are currently subject to NSPS Operational Standards and NESHAP since uncontrolled NMOC emissions are greater than 50 million megagrams per year, the landfill has a design capacity greater than 2.5 million megagrams, and waste has been in place for a period exceeding five years. However, areas of the Expansion Landfill that has waste in place less than five years for active areas and less than two years for areas that are closed or at final grade are not subject to NSPS or NESHAP regulations. Therefore, the generation of carbon credits will be exclusive to these areas.

The EG Guidelines for MSW Landfills are not applicable for the Expansion since construction commenced after May 30, 1991.

3.7.2 STATE AND LOCAL REGULATIONS

There are currently no state or local regulations that mandate the collection and combustion of LFG in landfill areas with waste in place less than five years for active areas and less than two years for areas that are closed or at final grade.

3.8 METHODOLOGY FOR DISCOUNTING POTENTIAL LFG FROM NSPS APPLICABLE LANDFILL AREAS

The following methodology will be implemented for each Stage of the Expansion in order to discount any potential collected LFG from areas that are subject to NSPS regulations:

1. SMI will evaluate as-built GCCS drawings in order to determine placement of horizontal collectors and vertical gas wells located adjacent to areas subject to NSPS regulations.

2. SMI will perform Radius of Influence (ROI) calculations (based on Darcy's Law) for each horizontal collector and vertical gas well using the following equation:

$$r = \left[\frac{2 g_c K T_s (h_s / h_T)}{P_s (dG/dt) \rho \mu T} (P_1^2 - P_o^2) \right]^{1/2}$$

where,

r = radius of influence for vertical gas well or horizontal collector
g_c = gravitational acceleration constant
K = permeability of refuse
T_s = standard temperature
T = temperature of landfill gas
h_s = slotted length of perforated pipe
h_T = total length of pipe
P_s = standard pressure
dG/dt = landfill gas generation rate
ρ = density of refuse
μ = landfill gas viscosity
P_1 = Atmospheric pressure
P_o = Vacuum applied at wellhead or pipe

3. SMI will identify all horizontal collectors and vertical gas wells that have a ROI that extends into an area subject to NSPS regulations based on the calculated ROI.
4. The total perforated length of piping for all horizontal collectors and vertical gas wells for the Expansion stage will be determined.
5. The total perforated length of piping for horizontal collectors and vertical gas wells that have a ROI that extend into an NSPS applicable region will be determined.
6. The calculated LFG that qualifies for early action credits will be determined by the following equation:

$$LFG_{cred} = LFG_{meas} * \left(\frac{L_{total} - \frac{L_{ROI}}{2}}{L_{total}} \right)$$

where,
LFG_{cred} = Collected LFG from Expansion that qualifies for early action credits (SCFM)

LFG_{meas} = Collected LFG from Expansion measured with thermal mass flow meter (SCFM)
L_{total} = Total length of perforated pipe for all horizontal collectors and vertical wells within Expansion stage (feet)
L_{ROI} = Total length of perforated pipe of horizontal collectors and vertical wells that have a ROI extending into an NSPS applicable area (feet)

SMI will present the results of this calculation methodology in the annual report.

3.9 EX ANTE ESTIMATED GHG EMISSIONS REDUCTIONS

Greenhouse gas emissions reductions were estimated for each stage of the Expansion, and are provided in Appendix J. The following assumptions were utilized in the analysis:

- Waste placement numbers are based on the projected design capacity of each stage of the Expansion;
- Putrescible waste is assumed to comprise 78.85% of total waste (based on an analysis of waste types accepted at the Facility);
- Landfill gas is assumed to be composed of 50% methane by volume;
- The density of methane at 60°F and 1 atm equals 0.0423 pounds per cubic foot; and
- Methane has a global warming potential of 21 times that of carbon dioxide

The lower boundary limit of GHG credits generated (in metric tons of carbon dioxide equivalents) was estimated based on landfill gas generation rates utilizing the USEPA LandGEM model with AP-42 parameters (L_o = 100 m^3/Mg, k = 0.04 yr^{-1}) and a 75% collection efficiency. The upper boundary limit of GHG credits generated (in metric tons of carbon dioxide equivalents) was estimated based on landfill gas generation rates utilizing the USEPA LandGEM model with the modeling parameters L_o = 170 m^3/Mg and k = 0.1 yr^{-1} with a 90% collection efficiency.

The following table presents the estimated ex ante projection of GHG emission reductions for the Project:

Stage	*Approximate Range of GHG Emission Reductions (metric tons CO_2 equivalents)*
1	178,130 – 812,682
2	263,198 – 1,245,740
3	302,743 – 1,395,370
4	157,787 – 734,072
5	302,136 – 1,427227
6	263,395 – 1,215,711
7	342,842 – 1,622,307
8	202,582 – 941,703
9	246,605 – 1,166,615
Totals	***2,259,419 – 10,561,427***

3.10 IDENTIFICATION OF PROJECT RISKS

The generation of landfill gas from municipal solid waste (MSW) disposal and the subsequent collection and control is a proven technology. Therefore, no significant risks are identified with this process. The greatest potential risk with the project is a change in regulation that would affect credit eligibility.

3.11 ROLES, RESPONSIBILITIES AND CONTACT INFORMATION

The primary contact for all information related to this project is the Environmental, Engineering and Compliance (EEC) Manager for Seneca Meadows, Inc. The EEC Manager or designee will coordinate the services of the Environmental Specialist, LFG Control System Specialist, Environmental Engineer, outside consultants or other parties, as needed, to gather information and respond to any questions or other information. There are no other entities that hold title to the Seneca Meadows Landfill property. The New York State Department of Environmental Conservation (NYSDEC) is the regulatory agency responsible for issuing permits associated with landfill gas generation and collection. NYSDEC also has delegated authority for most applicable Federal rules.

A copy of a contact list with names and phone numbers has been included in Appendix K.

3.12 RELEVANT OUTCOMES FROM STAKEHOLDER CONSULTATIONS

There have been no relevant stake holder conversations to date. As detailed above, any communications would be handled by the Environmental, Engineering and Compliance Manager and communicated to relevant parties as needed.

3.13 OTHER GHG EMISSIONS TRADING SYSTEMS

To date, the Project has not applied for GHG emission reductions or removal credits through any GHG emissions trading system.

4.0 MONITORING PROCEDURES

This Section provides a description of the monitoring procedures that will be in place at the Facility beginning on or about April 1, 2010 in order to measure and record the amount of methane voluntarily collected from the Expansion prior to regulation under the NSPS. Specifically, this Section discusses the monitoring of:

- Collected landfill gas from Expansion
- Methane concentration of collected landfill gas
- Flare Combustion Temperature
- Engine Kilowatt Output
- Temperature of Landfill Gas
- Applied Vacuum in Horizontal Collectors and Vertical Gas Wells

Refer to Table 3 for a summary of these monitoring parameters.

4.1 COLLECTED LANDFILL GAS FLOW

The flow of collected LFG from the Expansion will be measured by a Thermatel Model TA2 mass flow meter manufactured by Magnetrol International, Inc (Magnetrol). The Thermatel Model TA2 mass flow transmitter measures mass flow by detecting heat dissipation from a heated surface. The sensor contains two mass balanced elements with precision matched resistance temperature detectors (RTDs). The reference sensor measures the process temperature (up to +400° F [+200° C]); the second RTD measures the temperature of the heated sensor. The power to the heater is varied to maintain a constant temperature difference above the reference temperature.

There is an inherent non-linear relationship between power and mass flow. The microprocessor in the TA2 compares the power against the calibration curve and converts the power requirements to the mass flow rate. Temperature is also measured to provide temperature compensation of the mass flow over the operating range of the instrument. Refer to Appendix D for the Magnetrol Thermatel Model TA2 flow meter manufacturer specifications.

Flow measurements will be recorded continuously every 15 minutes or less (considered continuous by USEPA standards) by a supervisory control and data acquisition (SCADA) system located on Site. The SCADA system takes the readings from various monitoring equipment on Site, and compiles them into one reportable electronic file.

Refer to Section 5.0 for further discussion of the data recording system utilized at the Facility.

The Facility has two Magnetrol Thermatel Model TA2 flow meters available for this project (one in operation at the Expansion, one for backup purposes). One of the units provides flow measurements adjusted to a standard temperature of 60 degrees Fahrenheit (^{0}F) and a standard pressure of 1 atmosphere (atm), while the other corrects to 80 ^{0}F and a standard pressure of 1 atm. Since the new USEPA GHG regulation (under 40 CFR Part 98, Subpart HH) defines standard conditions as 60 ^{0}F and 1 atmosphere, a temperature correction of (520 degrees Rankine (^{0}R) / 540 ^{0}R) will be applied to the gas flow measurements recorded from the Magnetrol Thermatel Model TA2 flow meter that corrects to 80 ^{0}F and 1 atm.

Figure 3 provides the approximate location of the flow meter at the gas header on the northeast corner of the Stage 1/2 area.

4.2 METHANE COMPOSITION OF COLLECTED LANDFILL GAS

The Facility will collect measurements of methane concentration at the location of the flow meter once every business day (Monday through Friday). A technician will perform the methane concentration measurements using a LANDTEC Gas Analyzer and Extraction Monitor (GEM), Model 2000 (LANDTEC GEM 2000) or an Envision gas analyzer. The GEM and Envision gas analyzer instruments utilize infrared technology that is capable of providing measurements of methane as a percent of total volume. In addition, the gas sample is not dried or adjusted for gas humidity during measurement and therefore is on a wet basis. Technical specifications for the GEM and Envision gas analyzer are presented in Appendix E.

Measurements of methane concentration will be collected by connecting ¼" tubing from the GEM or Envision gas analyzer to a sample port installed within the gas header at the gas flow meter location. The sample port will have a ¼" quick-connect fitting available for hookup.

After a measurement of methane concentration is taken with the GEM or Envision gas analyzer, the technician will log the reading into one of several hand-held field PCs using software developed for the site (known as eDAT). The field PC identifies the measurement location by scanning a specific bar code placed at the flow meter. At the end of each day, the wellfield technician downloads the collected data onto a server installed specifically to manage this database. A supervisor accepts or rejects the data

and it is automatically saved into the database. The data is secure and backed-up regularly. The network is managed by an on-Site technology specialist.

The arithmetic average of all daily measurements within a given week will be used to obtain the weekly methane concentration.

4.2.1 SEMI-ANNUAL VERIFICATION OF METHANE CONCENTRATION

A LFG sample will be collected at the location of the flow meter on a semi-annual basis using a SUMMA canister. The sample will be shipped to a laboratory and analyzed under USEPA Reference Method (RM) 3C for % methane (% of total volume).

Before the sample is collected, a reading of methane concentration will be taken using a GEM in order to provide a comparison between the instrument reading and the analytical results.

4.3 FLARE COMBUSTION TEMPERATURE

Since there are no dedicated control devices that are exclusive to the Expansion Landfill, all of the LFG that is collected from the Expansion is "co-mingled" with LFG collected from the rest of the Site (Existing/AB Overfill & SELF). In order to ensure that proper destruction of the LFG is occurring according to manufacturer requirements, SMI will continuously monitor the combustion temperature of the enclosed flares.

A performance test for the 2,000 cfm enclosed flare and the 4,000 cfm enclosed flare was conducted on February 26, 2009. The testing provided the following results:

Control Device	*Average Combustion Temperature (^oF)*	*Outlet NMOC (ppmv)*
2,000 cfm Enclosed Flare	1,549	< 1.8
4,000 cfm Enclosed Flare	1,502	< 1.9

According to NSPS requirements, proper destruction of LFG is occurring if the combustion temperature within the enclosed flare is within 28 ^oC of the average combustion temperature demonstrated during the most recent performance test that demonstrates proper destruction of NMOC (98% DE or < 20 ppmv NMOC as hexane

corrected to 3% oxygen). Therefore, the combustion temperature will be continuously monitored to ensure that the temperature does not fall below the following limits:

Control Device	*Minimum Allowable Combustion Temperature (°F)*
2,000 cfm Enclosed Flare	1,499
4,000 cfm Enclosed Flare	1,452

If the combustion temperature approaches these limits, the enclosed flare will send an alarm and shut down.

Combustion temperatures at the enclosed flares are recorded by the Citect SCADA system described in Section 5.0. In addition, the enclosed flares have a backup Yokogawa system that continuously records temperature electronically. These records are maintained at the Site and available for review.

4.4 ENGINE KILOWATT OUTPUT

In order to demonstrate that the LFG routed to the gas-to-energy plant is being properly destructed, they will monitor and record the kilowatt output of the engine plant (since this relies on combustion of LFG in the engines). The amount of LFG collected at the engine plant will also be monitored using the Magnetrol Thermatel Model TA2 flow meter that is located at the inlet to the plant. This flow meter is similar to the one described in Section 4.1 and uses the same recording system described in Section 5.0.

4.5 TEMPERATURE OF LANDFILL GAS

SMI will monitor each horizontal collector and vertical gas well placed in an area of the Expansion with waste in place less than five years for active areas and less than two years for areas that are closed or at final grade. Temperature measurements will be made monthly at each horizontal collector and vertical gas well using a GEM or Envision gas analyzer. Temperature measurements will be collected by connecting ¼" tubing from the GEM or Envision gas analyzer to a sample port installed within the horizontal collector or vertical gas well. The sample port will have a ¼" quick-connect fitting available for hookup.

After a measurement of pressure is taken with the GEM or Envision gas analyzer, the technician will log the reading into one of several hand-held field PCs using software

developed for the site (known as eDAT). The field PC identifies the measurement location by scanning a specific bar code placed at the horizontal collector or vertical gas well. At the end of each day, the wellfield technician downloads the collected data onto a server installed specifically to manage this database. A supervisor accepts or rejects the data and it is automatically saved into the database. The data is secure and backed-up regularly. The network is managed by an on-Site technology specialist.

The arithmetic average of all monthly measurements within a given year will be used to obtain the average annual temperature. The average annual temperature for each horizontal collector and vertical gas well will be used in the Darcy's Radius of Influence equation described in Section 3.7.

4.6 APPLIED VACUUM IN HORIZONTAL COLLECTORS & VERTICAL GAS WELLS

SMI will monitor each horizontal collector and vertical gas well placed in an area of the Expansion with waste in place, less than five years for active areas and less than two years for areas that are closed, or at final grade. Pressure measurements will be made monthly at each horizontal collector and vertical gas well using a GEM or Envision gas analyzer. Pressure measurements will be collected by connecting ¼" tubing from the GEM or Envision gas analyzer to a sample port installed within the horizontal collector or vertical gas well. The sample port will have a ¼" quick-connect fitting available for hookup.

Vacuum measurements will be stored in eDAT as described in Section 4.5 above.

The arithmetic average of all monthly measurements within a given year will be used to obtain the average annual vacuum applied. The average annual applied vacuum for each horizontal collector and vertical gas well will be used in the Darcy's Radius of Influence equation described in Section 3.7.

4.7 ELECTRICITY USAGE IN LANDFILL GAS RECOVERY FACILITY

The Facility will record the amount of electricity consumption in the LGRF. A meter reading will be taken monthly and documented on a form maintained at the Facility. The amount of electricity usage at the LGRF will be used to calculate project energy emissions as described in Section 6.2.

4.8 FUEL USAGE IN CONSTRUCTION RELATED ACTIVITIES

The Facility will record the amount of diesel fuel, gasoline, or any other type of fuel used in the construction of the GCCS. The amount of fuel used will be documented daily on a form maintained at the Facility. The amount of fuel usage in the construction of the GCCS will be used to calculate project energy emissions as described in Section 6.2.

4.9 FUEL USAGE FOR FLARE ASSISTANCE

The Facility will record the amount of propane or any other type of fuel used to assist the operation of the enclosed flare(s). The amount of propane used will be documented per occurrence (filling of propane tank(s)) on a form maintained at the Facility based on purchase records. The amount of propane usage for the assistance of flare operation will be used to calculate project energy emissions as described in Section 6.2.

4.10 CHANGES TO REGULATORY REQUIREMENTS

The Facility routinely monitors changes to regulations that may affect the eligibility of the Project. The following sources of information will be checked at least semi-annually for any changes to federal, state, or local regulations that may impact the Project:

- The *Federal Register*, located at http://www.gpoaccess.gov/fr/
- The United States Environmental Protection Agency (USEPA) website, located at http://www.epa.gov/
- The New York State Department of Environmental Conservation (NYSDEC) *Environmental Notice Bulletin*, located at http://www.dec.ny.gov/enb/enb.html
- The NYSDEC website, located at http://www.dec.ny.gov/
- The Town of Seneca Falls website, located at http://www.senecafalls.com/

A summary of any regulatory changes that impact the Project will be presented in the annual report described in Section 9.0.

5.0 DATA ACQUISITION AND STORAGE

LFG flow readings from the flow meter at the Expansion will be recorded by a Citect SCADA system, which collects and records data from the various monitoring equipment on Site, and compiles it into one reportable electronic file. A fiber optic cable is used to transmit the information from the location of the flow meter to the hard drive located at the Leachate Storage Building. In addition, there is a backup SCADA system available in case a malfunction or shutdown occurs on the main hard drive. The Facility uses Citect Historian software to archive all of the collected LFG flow data.

The Facility can query and download gas flow measurements for any time period needed. The Facility will use this data to obtain the weekly amount of LFG collected from the Expansion.

5.1 MISSING DATA

In the event that a quality-assured data value's become unavailable, due to meter malfunctions as an example, substitute data value for the missing parameter shall be used in the calculations.

Typically these values will be assessed on an annual basis at the time of issuing the annual report for third-party verification. The values for these points with respect to methane concentration and landfill gas flow will constitute the arithmetic average of the data points that fall directly before and after the missing data. This methodology was referenced from the USEPA Greenhouse Gas Reporting Rule under 40 CFR Part 98 since a methodology for estimating missing data is not provided under the ACR Standard (Version 2.0, February 2010).

For flow measurements with the Magnetrol flow meter, the data set will be required to be complete to a level of 90%. Since flow measurements are taken each minute, the total amount of missing data points on an annual basis shall not exceed 52,560 (52,704 data points for leap years). The data substitution procedures discussed above can be utilized as long as the data set is 90% complete. If the data set is less than 90% complete, then these missing time periods must be excluded from the calculations.

For methane concentration measurements from the Landtec GEM or the Envision gas analyzer, the data set must also be 90% complete on an annual basis. Since methane concentration measurements are taken each business day, the total amount of missing data points on an annual basis shall not exceed 26. The data substitution procedures

discussed above can be utilized as long as the data set is 90% complete. If the data set is less than 90% complete, then these missing time periods must be excluded from the calculations.

5.2 ASSESSMENT OF UNCERTAINTY

Uncertainty has been considered throughout the selection of monitoring equipment, frequency, calculation and reporting methodologies. Methane measuring devices selected have a measurement accuracy of + or - 3%, and flow meters are accurate + or - 1%, plus 3% of the calibrated flow scale. In addition, data is collected more frequently than required; methane concentrations are measured each business day as opposed to monthly and flow is measured and recorded each minute as opposed to every 15 minutes. Section 5.1 above was also included in order to provide data accuracy and calculation transparency should there be any missing data. Further, all equipment is maintained and calibrated in accordance with manufacturer's requirements (at a minimum). Therefore, no additional statistical analysis is proposed, nor is any reduction of calculated emissions reduction/removal proposed, providing equipment is operated and maintained within the requirements specified in this GGP Plan.

Should required maintenance or calibration fail to occur, if technical issues arise that call into question the accuracy of the data collected, or if the quantity of missing data is outside of the parameters listed in Section 5.1, additional statistical analysis will be conducted. If the emissions reductions are then determined to be more than + or - 10% of the mean at 90% confidence, then the reportable amount of GHG reductions will be the mean minus the lower bound of the 90% confidence interval.

6.0 CALCULATION METHODOLOGY

This Section discusses how the monitoring data collected at the Site will be used to calculate methane emission reductions.

6.1 CALCULATING METHANE COMBUSTION FROM EXPANSION

For landfills with active landfill gas collection systems in place, the amount of methane recovered and combusted by the collection and control system can be calculated using the following equation:

$$R = \sum_{n=1}^{N} \left\{ V_n * [1 - (f_{H2O})_n] * \left(\frac{C_n}{100\%} \right) * \rho * \left(\frac{520^0 R}{T_n} \right) * \left(\frac{P_n}{1atm} \right) * \Delta t * \left(\frac{0.454}{1{,}000} \right) * DE \right\}$$

where,

R = Annual quantity of CH_4 combusted (metric tons CH_4)
N = total measurement periods in year (for daily measurements: N = 365, for weekly measurements: N=52)
n = index for measurement period (daily or weekly)
V_n = Average volumetric flowrate of LFG recovered over period n (cfm)
$(f_{H2O})_n$ = Average moisture content of LFG over period n (cubic feet H_2O / cubic feet LFG)
C_n = Average CH_4 concentration of LFG for period n
ρ = 0.0423 pounds per cubic foot (density of CH_4 at 60°F and 1 atm)
T_n = Temperature at which flow is measured for period n (°R)
P_n = Pressure at which flow is measured for period n (atm)
Δt = number of minutes for period n (T = 1,440 for daily measurements and T = 10,080 for weekly measurements)
0.454 / 1,000 = conversion factor (metric tons / pound)
DE = destruction efficiency of control devices (98.34%)

Since the Facility will be operating a thermal mass flow meter that corrects flow measurements to 60°F and 1 atm, and methane concentration measurements are on a wet basis, the above equation can be simplified to the following form:

$$R = \sum_{n=1}^{N} \left\{ V_n * \left(\frac{C_n}{100\%} \right) * \rho * \Delta t * \left(\frac{0.454}{1{,}000} \right) * DE \right\}$$

where,

R = Annual quantity of CH_4 combusted (metric tons CH_4)
N = total measurement periods in year (for weekly measurements: N=52)
n = index for measurement period (weekly)
V_n = Average weekly volumetric flowrate of LFG recovered (scfm)
C_n = Average weekly CH_4 concentration of LFG
ρ = 0.0423 pounds per cubic foot (density of CH_4 at 60°F and 1 atm)
Δt = number of minutes for period n (T = 10,080 for weekly measurements)
0.454 / 1,000 = conversion factor (metric tons / pound)
DE = destruction efficiency of control devices (98.34%)

This simplified equation will be used to calculate annual methane combustion (in metric tons) from the Expansion Landfill.

Since the LFG collected is destructed in either the engines or the enclosed flares, SMI will use the lower destruction efficiency of 98.34% (for the Caterpillar IC engines) when determining methane emission reductions.

In addition, the Facility has a backup thermal mass flow meter that corrects flow measurements to 80°F and 1 atm. When this unit is in operation, the following equation will be utilized to calculate the amount of methane combusted from the Expansion:

$$R = \sum_{n=1}^{N} \left\{ V_n * \left(\frac{C_n}{100\%} \right) * \rho * \left(\frac{520^0 R}{540^0 R} \right) * \Delta t * \left(\frac{0.454}{1{,}000} \right) * DE \right\}$$

where,

R = Annual quantity of CH_4 combusted (metric tons CH_4)
N = total measurement periods in year (for weekly measurements: N=52)
n = index for measurement period (weekly)
V_n = Average weekly volumetric flowrate of LFG recovered (scfm)
C_n = Average weekly CH_4 concentration of LFG
ρ = 0.0423 pounds per cubic foot (density of CH_4 at 60°F and 1 atm)
Δt = number of minutes for period n (T = 10,080 for weekly measurements)
0.454 / 1,000 = conversion factor (metric tons / pound)
DE = destruction efficiency of control devices (98.34%)

It is important to note that the blowers at the LGRF automatically shut down if the gas-to-energy plant and both enclosed flares are all down simultaneously. Therefore, collected LFG is not vented directly to the atmosphere.

6.2 CALCULATION OF PROJECT ENERGY EMISSIONS

The project energy emissions will be calculated using the following equation:

$$E = \sum_i \left\{ \frac{FE_i * EF_i}{1000 kg / ton} \right\}$$

where,

E = project energy emissions (metric tons)
FE_i = Quantity of each specific fuel, or electricity, used for construction-related activities and operation of collection and combustion equipment, and transportation (MMBtu or MWh)
EF_i = factor for CO_2, CH_4, and N_2O emitted from any fuel consumption or electricity use (kg CO_2e/MMBtu or MWh); referenced from Appendix III of 'Climate Leaders Greenhouse Gas Inventory Protocol Offset Project Methodology for Project Type: Landfill Methane Collection and Combustion,' dated August 2008

6.3 CALCULATION OF PROJECT LEAKAGE EMISSIONS

The project leakage emissions will be calculated using the following equation:

$$L = \sum_i \left\{ \frac{FL_i * EF_i}{1000 kg / ton} \right\}$$

where,

L = project leakage emissions (metric tons)
FL_i = Quantity of each specific fuel, or electricity, used for activities outside of the project boundary (MMBtu or MWh)
EF_i = factor for CO_2, CH_4, and N_2O emitted from any fuel consumption or electricity use (kg CO_2e/MMBtu or MWh); referenced from Appendix III of 'Climate Leaders Greenhouse Gas Inventory Protocol Offset Project Methodology for Project Type: Landfill Methane Collection and Combustion,' dated August 2008

6.4 CALCULATION OF TOTAL PROJECT EMISSION REDUCTIONS

The total project emission reductions will be calculated using the following equation:

$$TCO_2eq = (R * GWP_{CH4} * OX) - E - L$$

where,

TCO_2 eq = total project emission reductions (metric tons)
R = Annual quantity of CH_4 combusted (metric tons CH_4)
GWP_{CH4} = global warming potential of methane (21)
OX = factor to account for oxidation of LFG through landfill cover (0.90)
E = project energy emissions (metric tons)
L = project leakage emissions (metric tons)

7.0 QA/QC REQUIREMENTS

This Section discusses the measurement accuracy, calibration schedule, and calibration procedures for all of the monitoring equipment used to collect data for the calculation of GHG emissions.

Refer to Table 4 for a summary of the calibration procedures that will be in place at the Facility for monitoring equipment used to measure early action carbon credits from the Expansion.

7.1 MAGNETROL THERMATEL MODEL TA2 FLOW METER

According to manufacturer specifications, the Magnetrol Thermatel Model TA2 mass flow meter has a measurement accuracy of +/- 1.0% + 0.5% of the calibrated full scale and a temperature measurement accuracy of +/- 2 ^{o}F. Since the manufacturer does not specify a periodic calibration schedule for the Magnetrol Thermatel Model TA2 mass flow meter, the unit will be calibrated biannually (every 2 years) as specified in 40 CFR Part 98.344 (c).

When an internal calibration is required, SMI will install the backup unit and ship the Magnetrol Thermatel Model TA2 flow meter back to the manufacturer. During each servicing, the instrument will be inspected, tested, and calibrated according to manufacturer procedures. Calibration certificates will be maintained at the Facility to ensure that each unit is in compliance with the calibration schedule.

The Facility utilizes a total of two Magnetrol Thermatel Model TA2 flow meters (one in operation at the Expansion, one for backup purposes). The following table lists the calibration information for each unit:

Serial Number	*Date of Last Internal Calibration*
10829 - 01 - 001	January 12, 2010
10829 - 01 - 002	January 12, 2010

The most recent calibration certificates for each Magnetrol Thermatel Model TA2 flow meter are presented in Appendix F.

7.1.1 MAINTENANCE AND INSPECTION SCHEDULE

A semi-annual inspection of the Magnetrol Thermatel Model TA2 flow meter will be performed. The unit will be visually checked and cleaned of any excess dirt or soot. In addition, the unit will be inspected for signs of erosion and corrosion. These semi-annual inspections will be documented on a form and maintained at the Facility.

7.2 METHANE COMPOSITION MONITORS

7.2.1 LANDTEC GEM 2000

The following table displays the manufacturer specified measurement accuracy of the LANDTEC GEM 2000 for different concentration ranges:

CH_4 Concentration (% of total volume)	*Measurement Accuracy*
0 – 5 %	+/- 0.3 %
5 – 15 %	+/- 1 %
15 % - Full Scale	+/- 3 %

The manufacturer recommends an internal calibration once every six months. SMI will ship each unit used as part of this program to a LANDTEC approved facility for an internal calibration at a frequency of every six months. During each servicing, the instrument will be inspected, tested, and calibrated according to manufacturer procedures. Calibration certificates will be maintained at the Facility to ensure that each unit is in compliance with the manufacturer recommended calibration schedule.

The Facility utilizes several GEM units. The following table lists the calibration information for the units that will be used for this project:

Serial Number	*Date of Last Internal Calibration*
07616	10/12/2010
07908	1/25/2010
07990	9/09/2010

The most recent calibration certificates for the GEM units are presented in Appendix G.

A field calibration of the GEM will also be performed before every use. The instrument will be "zeroed" by flowing compressed air through the unit for a minimum of two minutes. The instrument will also be field calibrated by flowing methane gas at a span concentration of 50% by volume through the unit for a minimum of two minutes. After each field calibration, a calibration check will be performed by measuring the difference between the calibration gas span value and the actual methane reading. The % error can be calculated using the following equation:

$$\%Error = \frac{\left|50\% - [CH_4\ \mathrm{Re}\,ading(\%)]\right|}{50\%}$$

Three separate calibration check runs will be performed after calibrating the unit. If the total error of a unit exceeds 10% during the calibration check, the unit will be immediately sent to a LANDTEC approved facility for an internal calibration.

Each field calibration will be documented on a form and maintained at the Site for review.

7.2.2 ENVISION GAS ANALYZER

The following table displays the manufacturer specified measurement accuracy of the Envision gas analzyer for different concentration ranges:

CH_4 Concentration (% of total volume)	***Measurement Accuracy***
0 – 5 %	+/- 0.3 %
5 – 30 %	+/- 1 %
30 - 100%	+/- 2 %

The manufacturer recommends an internal calibration once every year. SMI will ship the unit to an approved facility for an internal calibration at a frequency of every twelve months. During each servicing, the instrument will be inspected, tested, and calibrated according to manufacturer procedures. Calibration certificates will be maintained at the

Facility to ensure that each unit is in compliance with the manufacturer recommended calibration schedule.

The Facility utilizes two Envision gas analyzers. The following table lists the calibration information for the units that will be used for this project:

Serial Number	*Date of Last Internal Calibration*
1007001	September 17, 2010
1007009	September 17, 2010

The most recent calibration certificates for the Envision gas analzyer are presented in Appendix H.

A field calibration of the Envision gas analyzer is also performed before every use. The instrument will be "zeroed" by flowing compressed air through the unit for a minimum of two minutes. The instrument will also be field calibrated by flowing methane gas at a span concentration of 50% by volume through the unit for a minimum of two minutes. After each field calibration, a calibration check will be performed by measuring the difference between the calibration gas span value and the actual methane reading. The % error can be calculated using the following equation:

$$\%Error = \frac{\left|50\% - [CH_4\ \mathrm{Re}\,ading(\%)]\right|}{50\%}$$

Three separate calibration check runs will be performed after calibrating the unit. If the total error of a unit exceeds 10% during the calibration check, the unit will be immediately sent to an approved facility for an internal calibration.

Each field calibration will be documented on a form and maintained at the Site for review.

8.0 GHG CREDIT VERIFICATION

Any carbon credits that are generated during the proposed project will be independently verified by a third party organization that is certified by the American National Standards Institute (ANSI). The 3rd party verifier will be chosen from the list of American Carbon Registry (ACR) approved verifiers or verifiers that are approved under the following:

- Designated Operational Entities approved under Clean Development Mechanism (CDM); and
- Accredited Independent Entities approved under Joint Implementation (JI).

During periodic audits, the verifier will be allowed to observe monitoring and recordkeeping operations at the Facility. The verifier will also be given access to all monitoring data, calibration records, and any other records to be maintained at the Facility.

Desk-based audits of the data and programs will be performed by the verifier at least annually. In addition to the periodic audits, it is anticipated that the verifier will conduct a field verification at least every five years or at the completion of each Crediting Period for each stage of the landfill (approximately every 2 years).

9.0 REPORTING

SMI will compile an initial report after completion of the 2nd quarter of 2010 that summarizes the early action carbon credits generated from the Expansion. This initial report will serve to ensure that the proper monitoring, record-keeping, and QA/QC procedures are in place at the Facility. This report will be submitted to a third-party verifier that meets the qualifications described in Section 8.0. SMI will also re-visit this Protocol and determine if any changes or revisions are necessary.

An annual report will also be prepared every calendar year that summarizes the early action carbon credits generated from the Expansion. This report will be submitted to a third party organization for verification by March 31 of each year.

FIGURES

figure 1
SITE PLAN
EXPANSION STAGES 1-9
GREENHOUSE GAS PROJECT PLAN
SENECA MEADOWS LANDFILL
Seneca Falls, New York

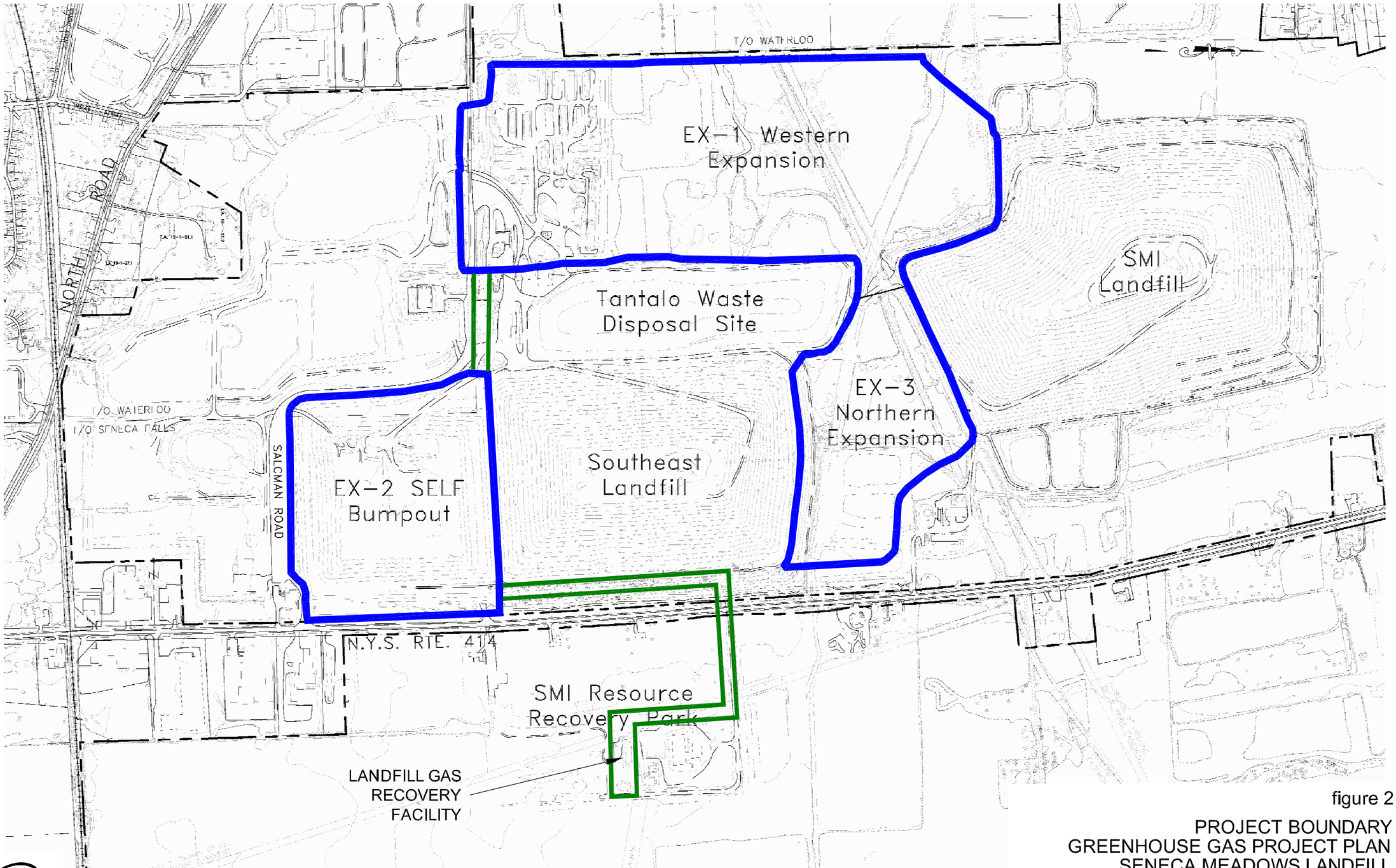


figure 2

PROJECT BOUNDARY
GREENHOUSE GAS PROJECT PLAN
SENECA MEADOWS LANDFILL
Seneca Falls, New York

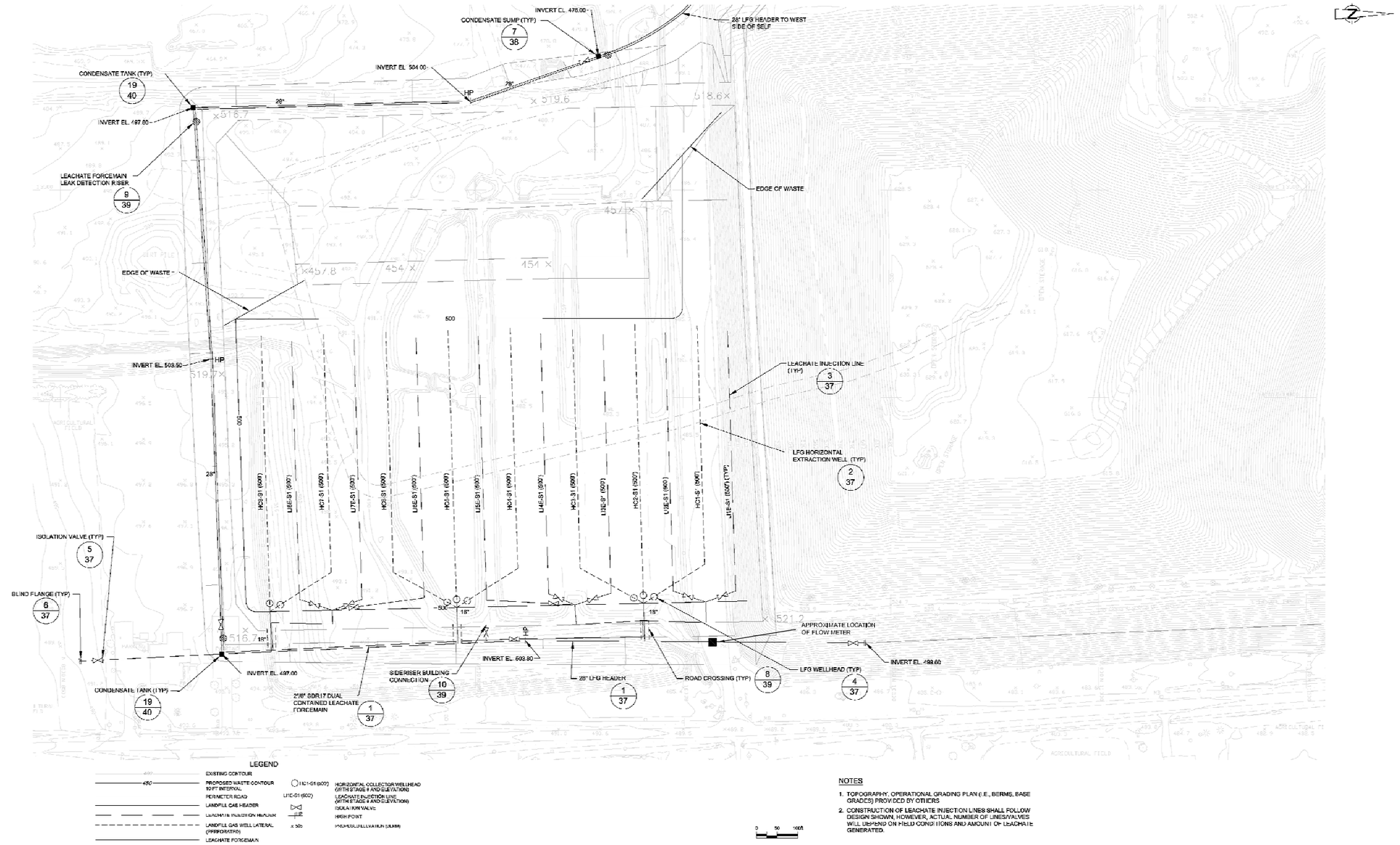


figure 3

PROPOSED LOCATION OF FLOWMETER STAGE 1/2 AREA
GREENHOUSE GAS PROJECT PLAN
SENECA MEADOWS LANDFILL
Seneca Falls, New York

TABLES

TABLE 1

PROJECTED WASTE PLACEMENT - EXPANSION LANDFILL
GREENHOUSE GAS PROJECT PLAN
SENECA MEADOWS, INC.

	Stage 1 Expansion		Stage 2 Expansion		Stage 3 Expansion		Stage 4 Expansion		Stage 5 Expansion	
Year	Total Waste (metric tons)	Putrescible Waste (metric tons)	Total Waste (metric tons)	Putrescible Waste (metric tons)	Total Waste (metric tons)	Putrescible Waste (metric tons)	Total Waste (metric tons)	Putrescible Waste (metric tons)	Total Waste (metric tons)	Putrescible Waste (metric tons)
2009	1,905,088	1,502,162	171,458	135,195						
2010			2,057,495	1,622,335						
2011			2,057,495	1,622,335						
2012					2,049,292	1,615,866				
2013					1,554,046	1,225,365	496,351	391,373		
2014							1,557,515	1,228,101	494,382	389,820
2015									2,045,717	1,613,048
2016									2,045,717	1,613,048
2017									409,143	322,610
2018										
2019										
2020										
2021										
2022										
2023										
2024										
Totals	**1,905,088**	**1,502,162**	**4,286,448**	**3,379,864**	**3,603,338**	**2,841,232**	**2,053,866**	**1,619,473**	**4,994,959**	**3,938,525**

TABLE 1

PROJECTED WASTE PLACEMENT - EXPANSION LANDFILL
GREENHOUSE GAS PROJECT PLAN
SENECA MEADOWS, INC.

	Stage 6 Expansion		Stage 7 Expansion		Stage 8 Expansion		Stage 9 Expansion		Total Expansion	
Year	Total Waste (metric tons)	Putrescible Waste (metric tons)	Total Waste (metric tons)	Putrescible Waste (metric tons)	Total Waste (metric tons)	Putrescible Waste (metric tons)	Total Waste (metric tons)	Putrescible Waste (metric tons)	Total Waste (metric tons)	Putrescible Waste (metric tons)
2009									2,076,546	1,637,356
2010									2,057,495	1,622,335
2011									2,057,495	1,622,335
2012									2,049,292	1,615,866
2013									2,050,397	1,616,738
2014									2,051,897	1,617,921
2015									2,045,717	1,613,048
2016									2,045,717	1,613,048
2017	1,640,658	1,293,659							2,049,802	1,616,269
2018	1,538,117	1,212,805	681,778	537,582					2,219,895	1,750,388
2019			2,045,335	1,612,747					2,045,335	1,612,747
2020			2,045,335	1,612,747					2,045,335	1,612,747
2021			1,346,512	1,061,725	701,349	553,013			2,047,861	1,614,738
2022					1,915,879	1,510,671	136,677	107,770	2,052,557	1,618,441
2023							2,050,160	1,616,551	2,050,160	1,616,551
2024							1,793,890	1,414,482	1,793,890	1,414,482
Totals	**3,178,775**	**2,506,464**	**6,118,961**	**4,824,801**	**2,617,228**	**2,063,684**	**3,980,726**	**3,138,803**	**32,739,389**	**25,815,008**

TABLE 2

PROJECTED LFG AVAILABLE FOR COLLECTION - EXPANSION LANDFILL
GREENHOUSE GAS PROJECT PLAN
SENECA MEADOWS, INC.

	Stage 1 Expansion		Stage 2 Expansion		Stage 3 Expansion		Stage 4 Expansion		Stage 5 Expansion	
Year	Total LFG Generated (CFM)	Total LFG Collected (CFM)	Total LFG Generated (CFM)	Total LFG Collected (CFM)	Total LFG Generated (CFM)	Total LFG Collected (CFM)	Total LFG Generated (CFM)	Total LFG Collected (CFM)	Total LFG Generated (CFM)	Total LFG Collected (CFM)
2009	0	0	0	0						
2010	793	595	71	54						
2011	762	571	925	694						
2012	732	549	1,745	1,309	0	0				
2013	703	528	1,677	1,258	853	640	0	0		
2014					1,467	1,100	207	155	0	0
2015					1,409	1,057	847	635	206	154
2016					1,354	1,015	814	610	1,049	787
2017							782	586	1,860	1,395
2018									1,957	1,468
2019										
2020										
2021										
2022										
2023										
2024										
2025										
2026										

TABLE 2

PROJECTED LFG AVAILABLE FOR COLLECTION - EXPANSION LANDFILL
GREENHOUSE GAS PROJECT PLAN
SENECA MEADOWS, INC.

	Stage 6 Expansion		Stage 7 Expansion		Stage 8 Expansion		Stage 9 Expansion		Total Expansion	
Year	Total LFG Generated (CFM)	Total LFG Collected (CFM)	Total LFG Generated (CFM)	Total LFG Collected (CFM)	Total LFG Generated (CFM)	Total LFG Collected (CFM)	Total LFG Generated (CFM)	Total LFG Collected (CFM)	Total LFG Generated (CFM)	Total LFG Collected (CFM)
2009									0	0
2010									864	648
2011									1,687	1,265
2012									2,477	1,858
2013									3,233	2,425
2014									1,673	1,255
2015									2,462	1,846
2016									3,217	2,413
2017	0	0							2,642	1,981
2018	683	512	0	0					2,640	1,980
2019	1,297	972	284	213					1,580	1,185
2020	1,246	934	1,124	843					2,370	1,777
2021	1,197	898	1,932	1,449	0	0			3,128	2,346
2022			2,416	1,812	292	219	0	0	2,708	2,031
2023					1,078	809	57	43	1,135	851
2024					1,036	777	908	681	1,944	1,458
2025					995	746	1,619	1,215	2,615	1,961
2026							1,556	1,167	1,556	1,167

TABLE 3

DESCRIPTION OF MONITORING PARAMETERS
GREENHOUSE GAS PROJECT PLAN
SENECA MEADOWS, INC.

Parameter Monitored	*Monitoring Device*	*Units of Measurement*	*Monitoring Frequency*	*Data Recording Device*	*Notes*
Flow of Landfill Gas	Magnetrol Thermatel Model TA2 Flow Meter	SCFM	Continuous	SCADA System	Correction factor of (520°R / 540°R) applied to flow measurements for applicable flow meter
Methane Concentration of Landfill Gas	LANDTEC GEM 2000; Envision Gas Analyzer	% of total volume, wet basis	Each Business Day (M-F)	PC / eDat software	Measurement taken at flow meter location
Methane Concentration of Landfill Gas	Analysis of LFG sample for CH_4 using USEPA RM 3C	% of total volume, wet basis	Semi-annual	Laboratory Report	Measurement taken at flow meter location
Combustion Temperature of Enclosed Flares	Thermocouple	°F	Continuous	SCADA System	---
Kilowatt Output of Engines	Meter	KW	Continuous	Monthly Operating Reports	---
Temperature of Landfill Gas at Well / Collector	LANDTEC GEM 2000; Envision Gas Analyzer	°F	Monthly	PC / eDat software	Measurement taken at each horizontal collector / well
Applied Vacuum on Well / Collector	LANDTEC GEM 2000; Envision Gas Analyzer	" H_2O (inches water column)	Monthly	PC / eDat software	Measurement taken at each horizontal collector / well
Electricity Consumption of LGRF	Meter	KW	Continuous	Manual reading logged on form	Meter reading taken at the end of each month
Fuel Consumption - GCCS Construction Activities	None	gallons	Daily	Fuel usage amount logged on form	Amount of fuel usage logged on form daily
Fuel Consumption - Flare Operation Assistance	None	gallons	Daily	Fuel usage amount logged on form	Amount of fuel usage logged on form daily
Regulatory Changes Affecting Project	None	NA	Semi-annually	NA	The Facility will check information sources for possible changes to regulations affecting the Project

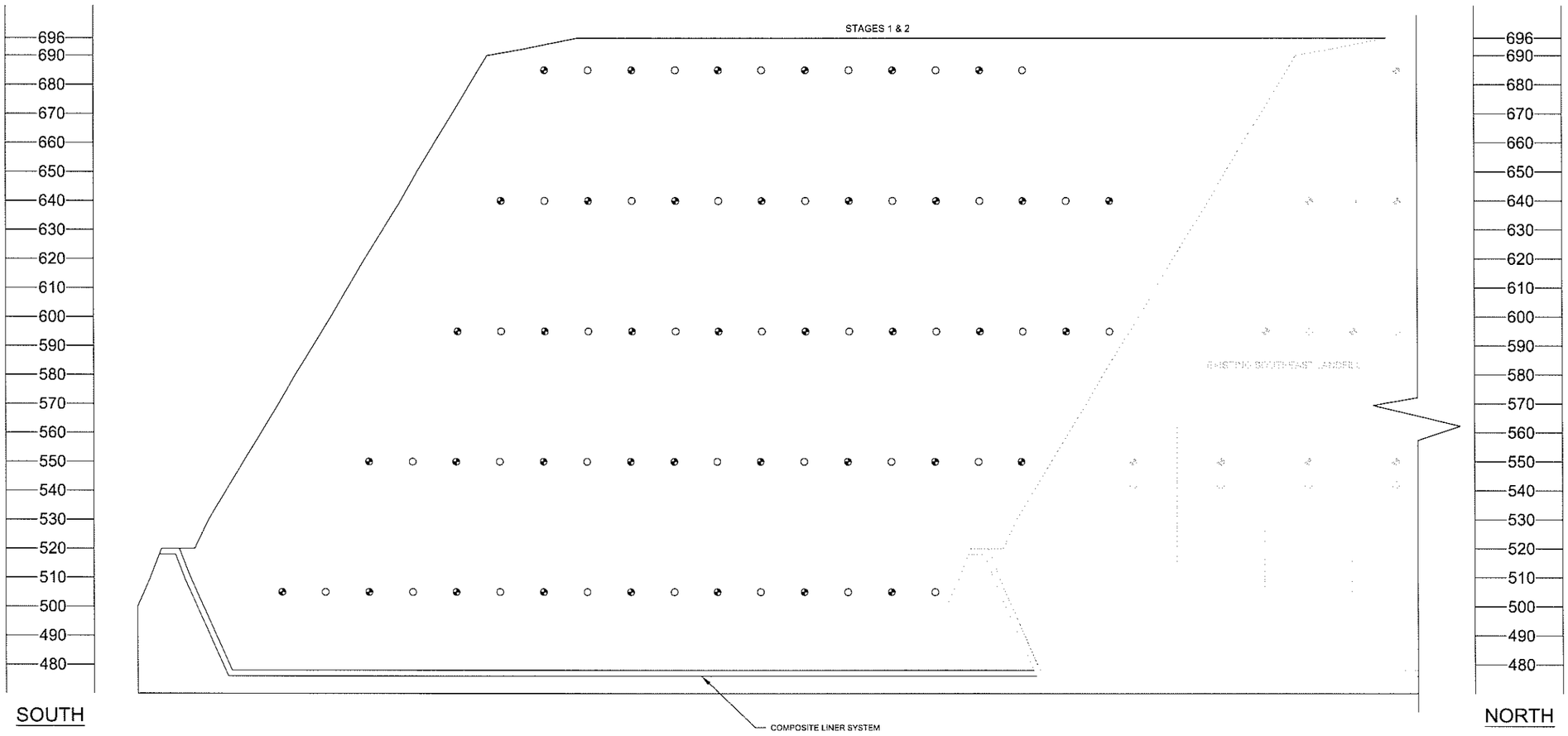
TABLE 4

DESCRIPTION OF CALIBRATION PROCEDURES
GREENHOUSE GAS PROJECT PLAN
SENECA MEADOWS, INC.

Monitoring Device	*Field Calibration Frequency*	*Internal Calibration Frequency*	*Notes*
Magnetrol Thermatel Model TA2 Flow Meters	Quarterly	Every 2 Years	Field calibration performed using pitot tubes; internal calibration performed according to manufacturer specifications
LANDTEC GEM 2000	Every Business Day (M-F)	Every 6 Months	Field calibration performed using calibration gases; internal calibration performed according to manufacturer specifications
Envision Gas Analyzer	Every Business Day (M-F)	Every 12 Months	Field calibration performed using calibration gases; internal calibration performed according to manufacturer specifications

APPENDIX A

EXPANSION LANDFILL GCCS DRAWINGS



LEGEND

- LEACHATE INJECTION LINE
- LFG HORIZONTAL EXTRACTION WELL

NOTES

1. CONSTRUCTION OF LEACHATE INJECTION LINES SHALL FOLLOW DESIGN SHOWN, HOWEVER, ACTUAL NUMBER OF LINES/VALVES WILL DEPEND ON FIELD CONDITIONS AND AMOUNT OF LEACHATE GENERATED.

2. CONSTRUCTION OF LANDFILL GAS EXTRACTION LINES SHALL FOLLOW PATTERN SHOWN AND BE PLACED AS SHOWN ON PLAN VIEWS PER RESPECTIVE STAGE. THE ACTUAL LOCATIONS WILL BE BASED ON WASTE PLACEMENT AND FIELD CONDITIONS TO MAXIMIZE EXTRACTION COVERAGE.

REV. NO.	DESCRIPTION OF REVISION	APPROVAL	DATE	REV. NO.	DESCRIPTION OF REVISION	APPROVAL	DATE
△				△			
△				△			
△				△			
△				△			
△				△			
△				△			
△				△			

STATE OF NEW YORK
Douglas Mitchell Gatrell
083375
DATE OF SEAL

Douglas M. Gatrell, P.E.
NY P.E. LICENSE NO. 083375-1

Douglas M. Gatrell EXP. 11/30/08

DATE: DECEMBER 2006
SCALE: 1" = 100'
CAD FILE NO: 42746-00(004)CI-DE031
DESIGNED BY: D. GATRELL
DRAWN BY: D. GILLESPIE
CHECKED BY: S. WILSEY

CRA Infrastructure & Engineering, Inc.
CONESTOGA-ROVERS & ASSOCIATES
NIAGARA FALLS, NY

SENECA MEADOWS SOLID WASTE MANAGEMENT FACILITY
SENECA FALLS, NEW YORK
6 NYCRR PART 360 APPLICATION
LANDFILL EXPANSION DESIGN

GCCS DESIGN PLAN

N-S CROSS SECTION (STAGES 1 & 2)

PROJECT NO. 42746-00

DRAWING NO. LFG-31

I:\DRAWINGS\42000S\42746 42746-REPORT\42746-00(001) 42746-00(004)CI 42746-00(004)CI-DE031.DWG 12/01/2006 LAYOUT: LFG-31

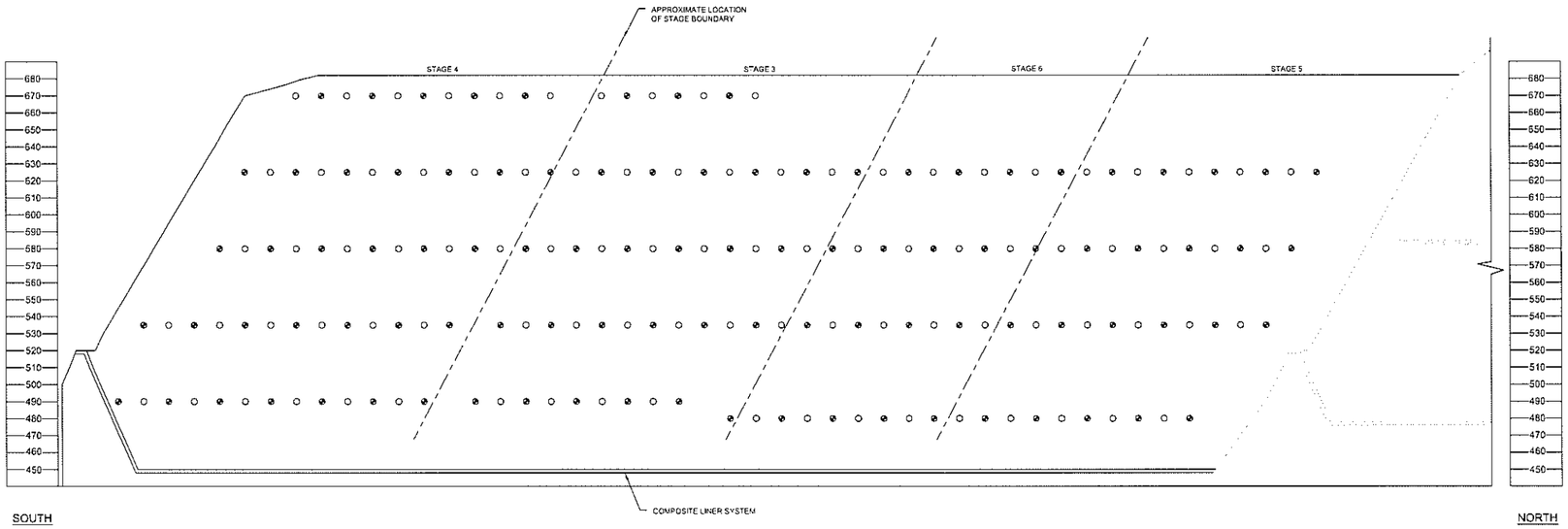
NOTES

1. CONSTRUCTION OF LEACHATE INJECTION LINES SHALL FOLLOW DESIGN SHOWN, HOWEVER, ACTUAL NUMBER OF LINES/VALVES WILL DEPEND ON FIELD CONDITIONS AND AMOUNT OF LEACHATE GENERATED.

2. CONSTRUCTION OF LANDFILL GAS EXTRACTION LINES SHALL FOLLOW PATTERN SHOWN AND BE PLACED AS SHOWN ON PLAN VIEWS PER RESPECTIVE STAGE. THE ACTUAL LOCATIONS WILL BE BASED ON WASTE PLACEMENT AND FIELD CONDITIONS TO MAXIMIZE EXTRACTION COVERAGE.

LEGEND

- LEACHATE INJECTION LINE
- LFG HORIZONTAL EXTRACTION WELL



STATE OF NEW YORK
Douglas Mitchell Gatrell
083375
LICENSED PROFESSIONAL ENGINEER

Douglas M. Gatrell, P.E.
NY P.E. LICENSE NO. 083375-1

EXP. 11/30/08

WARNING	REV. NO.	DESCRIPTION OF REVISION	APPROVAL	DATE	REV. NO.	DESCRIPTION OF REVISION	APPROVAL	DATE
IT IS A VIOLATION OF SECTION 7209, SUBDIVISION 2, OF THE NEW YORK STATE EDUCATION LAW FOR ANY PERSON, OTHER THAN WHOSE SEAL APPEARS ON THIS DRAWING, TO ALTER IN ANY WAY AN ITEM ON THIS DRAWING. IF AN ITEM IS ALTERED, THE ALTERING ENGINEER SHALL AFFIX TO THE ITEM HIS SEAL AND THE NOTATION "ALTERED BY" FOLLOWED BY HIS SIGNATURE AND THE DATE OF SUCH ALTERATION, AND A SPECIFIC DESCRIPTION OF THE ALTERATION.	△				△			
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	△				△			
	△				△			

DATE: DECEMBER 2006
SCALE: 1" = 200'
CAD FILE NO.: 42746-00(004)CI-DE032
DESIGNED BY: D. GATRELL
DRAWN BY: D. GILLESPIE
CHECKED BY: S. WILSEY

CRA Infrastructure & Engineering, Inc.
CONESTOGA-ROVERS & ASSOCIATES
NIAGARA FALLS, NY

SENECA MEADOWS SOLID WASTE MANAGEMENT FACILITY
SENECA FALLS, NEW YORK
6 NYCRR PART 360 APPLICATION
LANDFILL EXPANSION DESIGN

GCCS DESIGN PLAN

N-S CROSS SECTION (STAGES 3 THROUGH 6)

PROJECT NO. 42746-00

DRAWING NO. LFG-32

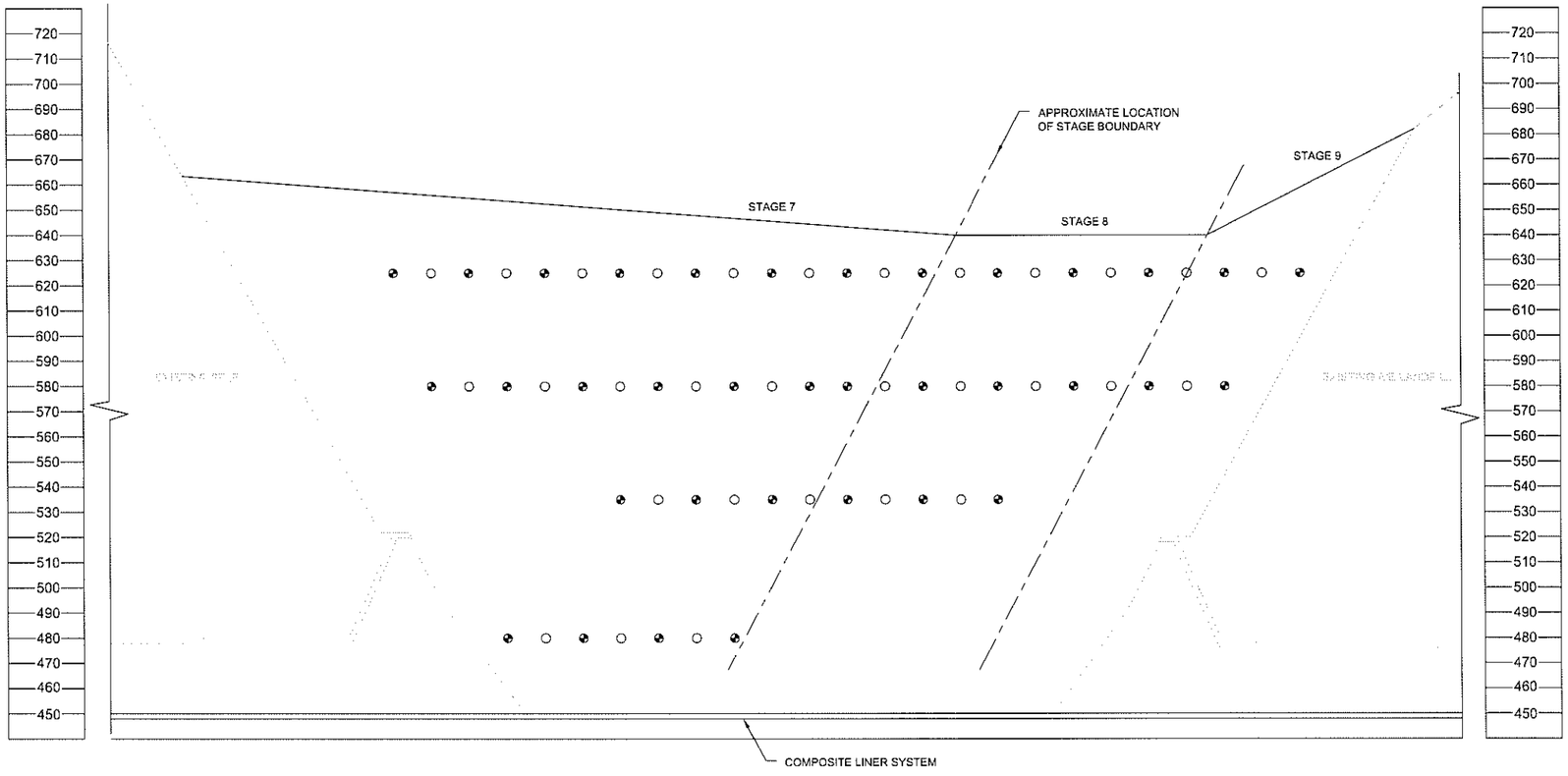
DRAWINGS-42000 42746 42746-REPORT 42746-00(003) 42746-00(004)SI 42746-00(004)SI-DE032.DWG 12/01/2006 LAYOUT: LFG-32

NOTES
1. CONSTRUCTION OF LEACHATE INJECTION LINES SHALL FOLLOW DESIGN SHOWN, HOWEVER, ACTUAL NUMBER OF LINES/VALVES WILL DEPEND ON FIELD CONDITIONS AND AMOUNT OF LEACHATE GENERATED.

2. CONSTRUCTION OF LANDFILL GAS EXTRACTION LINES SHALL FOLLOW PATTERN SHOWN AND BE PLACED AS SHOWN ON PLAN VIEWS PER RESPECTIVE STAGE. THE ACTUAL LOCATIONS WILL BE BASED ON WASTE PLACEMENT AND FIELD CONDITIONS TO MAXIMIZE EXTRACTION COVERAGE.

LEGEND

- LEACHATE INJECTION LINE
- LFG HORIZONTAL EXTRACTION WELL



SOUTH NORTH

STATE OF NEW YORK
Douglas Mitchell Gatrell
083375
Douglas M. Gatrell
EXP. 11/30/08
Douglas M. Gatrell, P.E.
NY P.E. LICENSE NO. 083375-1

WARNING	REV. NO.	DESCRIPTION OF REVISION	APPROVAL	DATE	REV. NO.	DESCRIPTION OF REVISION	APPROVAL	DATE
IT IS A VIOLATION OF SECTION 7209, SUBDIVISION 2, OF THE NEW YORK STATE EDUCATION LAW FOR ANY PERSON, OTHER THAN WHOSE SEAL APPEARS ON THIS DRAWING, TO ALTER IN ANY WAY AN ITEM ON THIS DRAWING. IF AN ITEM IS ALTERED, THE ALTERING ENGINEER SHALL AFFIX TO THE ITEM HIS SEAL AND THE NOTATION "ALTERED BY" FOLLOWED BY HIS SIGNATURE AND THE DATE OF SUCH ALTERATION, AND A SPECIFIC DESCRIPTION OF THE ALTERATION.	△				△			
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DATE: DECEMBER 2006
SCALE: 1" = 200'
CAD FILE NO.: 42746-00(004)CI-DET33
DESIGNED BY: D. GATRELL
DRAWN BY: D. GILLESPIE
CHECKED BY: S. WILSEY

CRA Infrastructure & Engineering, Inc.
CONESTOGA-ROVERS & ASSOCIATES
NIAGARA FALLS, NY

SENECA MEADOWS SOLID WASTE MANAGEMENT FACILITY
SENECA FALLS, NEW YORK
6 NYCRR PART 360 APPLICATION
LANDFILL EXPANSION DESIGN

GCCS DESIGN PLAN

N-S CROSS SECTION (STAGES 7, 8 & 9)

PROJECT NO. 42746-00
DRAWING NO. LFG-33

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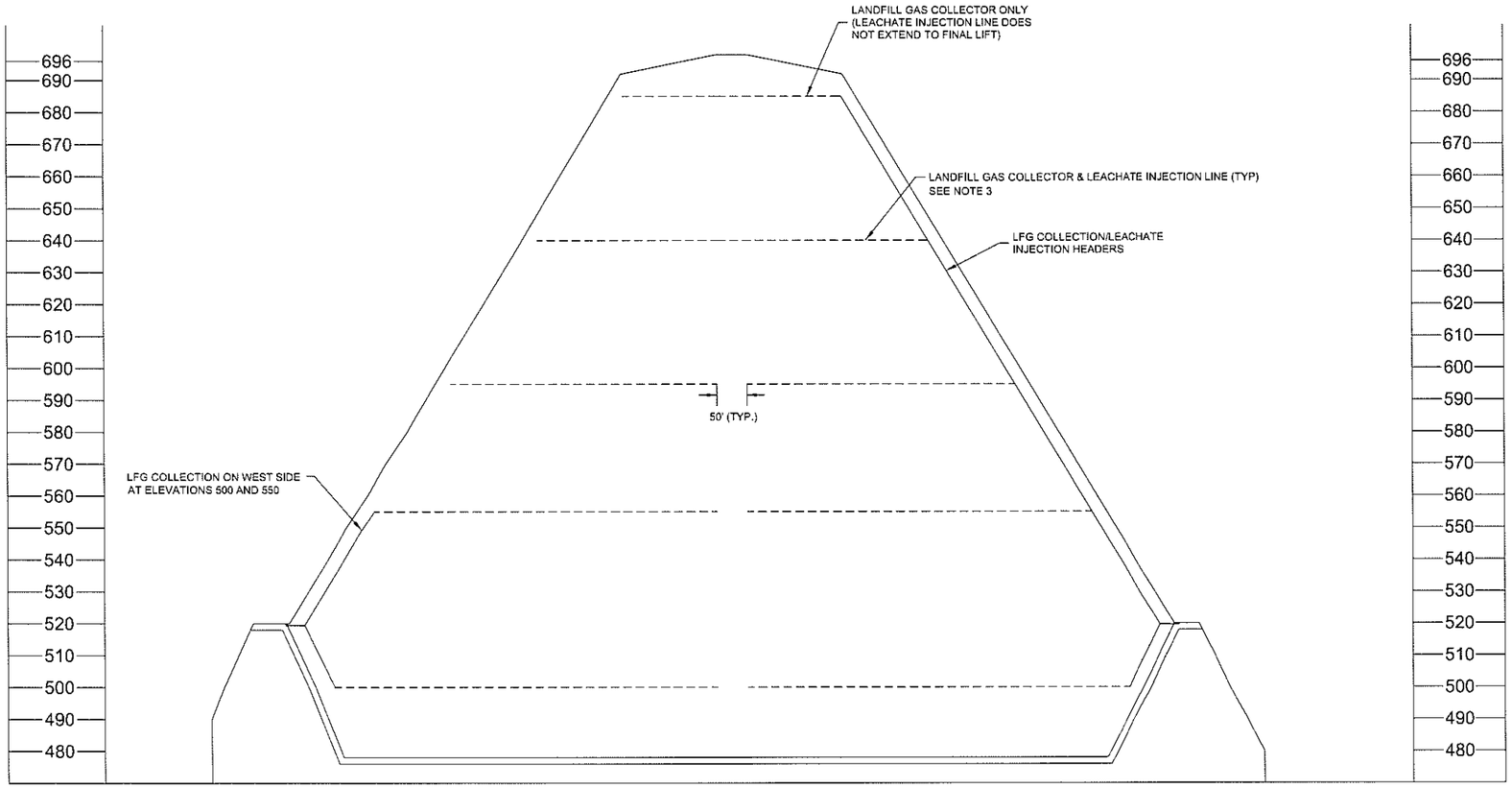

WEST

TYPICAL CROSS SECTION

EAST

LEGEND

LFG HORIZONTAL EXTRACTION WELL

NOTES

1. CONSTRUCTION OF LEACHATE INJECTION LINES SHALL FOLLOW DESIGN SHOWN. HOWEVER, ACTUAL NUMBER OF LINES/VALVES WILL DEPEND ON FIELD CONDITIONS AND AMOUNT OF LEACHATE GENERATED.
2. SOLID LFG PIPING TO BE 100 FEET FROM PERIMETER OF LANDFILL TO PERFORATED PIPING.
3. LFG HORIZONTAL EXTRACTION WELLS SEPARATED BY 50 FEET EXCEPT AT ELEVATION 640 AND ABOVE. LEACHATE INJECTION LINES ARE CONTINUOUS ACROSS WASTE (NOT SHOWN ON DRAWING).

STATE OF NEW YORK
Douglas Mitchell
Gatrell
083375
LICENSED PROFESSIONAL ENGINEER

Douglas M. Gatrell EXP. 11/30/08

Douglas M. Gatrell
NY P.E. LICENSE NO. 083375-1

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DATE: DECEMBER 2006
SCALE: 1" = 100'
CAD FILE NO: 42746-00(004)CI-DE034
DESIGNED BY: D. GATRELL
DRAWN BY: D. GILLESPIE
CHECKED BY: S. WILSEY

CRA Infrastructure & Engineering, Inc.
CONESTOGA-ROVERS & ASSOCIATES
NIAGARA FALLS, NY

SENECA MEADOWS SOLID WASTE MANAGEMENT FACILITY
SENECA FALLS, NEW YORK
6 NYCRR PART 360 APPLICATION
LANDFILL EXPANSION DESIGN

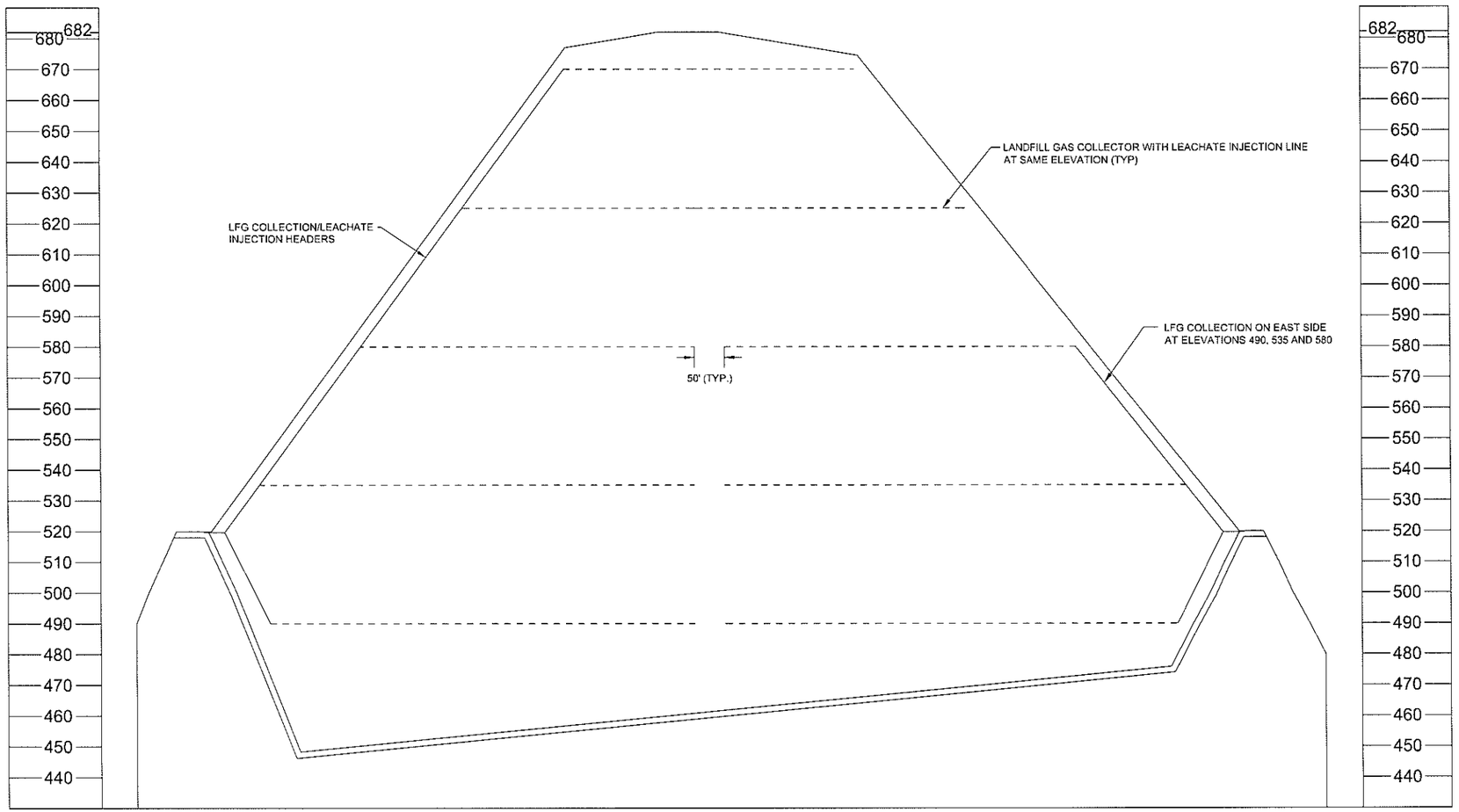
GCCS DESIGN PLAN

E-W CROSS SECTION (STAGES 1 & 2)

PROJECT NO. 42746-00

DRAWING NO. LFG-34

I:\DRAWINGS\42000S\42746\42746-REPORT\42746-00(001)\42746-00(004)\3\42746-00(004)-DE034.DWG 12/01/2006 LAYOUT: LFG-34



WEST

TYPICAL CROSS SECTION

EAST

LEGEND

LFG HORIZONTAL EXTRACTION WELL

NOTES

1. CONSTRUCTION OF LEACHATE INJECTION LINES SHALL FOLLOW DESIGN SHOWN, HOWEVER, ACTUAL NUMBER OF LINES/VALVES WILL DEPEND ON FIELD CONDITIONS AND AMOUNT OF LEACHATE GENERATED.
2. SOLID LFG PIPING TO BE 100 FEET FROM PERIMETER OF LANDFILL TO PERFORATED PIPING.
3. LFG HORIZONTAL EXTRACTION WELLS SEPARATED BY 50 FEET EXCEPT AT ELEVATION 625 AND ABOVE. LEACHATE INJECTION LINES ARE CONTINUOUS ACROSS WASTE (NOT SHOWN ON DRAWING).

STATE OF NEW YORK
Douglas Mitchell Gatrell
083375
LICENSED PROFESSIONAL ENGINEER
Douglas M. Gatrell EXP. 11/30/08
Douglas M. Gatrell
NY P.E. LICENSE NO. 083375-1

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DATE: DECEMBER 2006
SCALE: 1" = 100'
DRAWING NO.: 42746-00(004)CI-DE035
DESIGNED BY: D. GATRELL
DRAWN BY: D. GILLESPIE
CHECKED BY: S. WILSEY

CRA Infrastructure & Engineering, Inc.
CONESTOGA-ROVERS & ASSOCIATES
NIAGARA FALLS, NY

SENECA MEADOWS SOLID WASTE MANAGEMENT FACILITY
SENECA FALLS, NEW YORK
6 NYCRR PART 360 APPLICATION
LANDFILL EXPANSION DESIGN

GCCS DESIGN PLAN

E-W CROSS SECTION (STAGES 3 THROUGH 6)

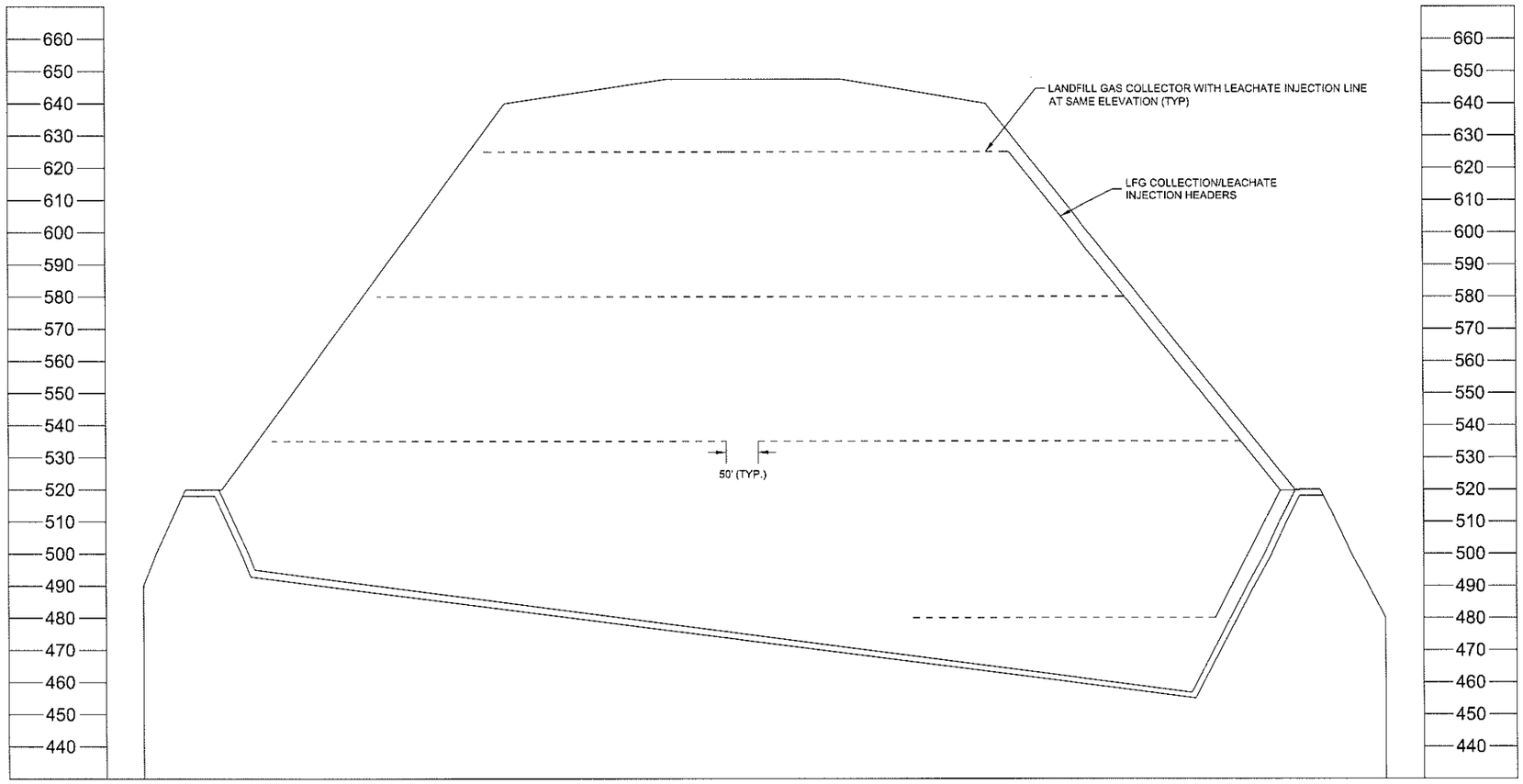
PROJECT NO. 42746-00

DRAWING NO. LFG-35

I: DRAWINGS \42000S \42746 \42746-REPD01 \42746-00(001) 42746-00(004)GI 42746-00(004)CI-DE035.DWG 12/01/2006 LAYOUT: LFG-35

LEGEND

LFG HORIZONTAL EXTRACTION WELL



WEST

TYPICAL CROSS SECTION

EAST

NOTES

1. CONSTRUCTION OF LEACHATE INJECTION LINES SHALL FOLLOW DESIGN SHOWN. HOWEVER, ACTUAL NUMBER OF LINES/VALVES WILL DEPEND ON FIELD CONDITIONS AND AMOUNT OF LEACHATE GENERATED.
2. SOLID LFG PIPING TO BE 100 FEET FROM PERIMETER OF LANDFILL TO PERFORATED PIPING.
3. LFG HORIZONTAL EXTRACTION WELLS SEPARATED BY 50 FEET EXCEPT AT ELEVATION 580 AND ABOVE. LEACHATE INJECTION LINES ARE CONTINUOUS ACROSS WASTE (NOT SHOWN ON DRAWING).

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STATE OF NEW YORK
Douglas Mitchell Gatrell
083375
LICENSED PROFESSIONAL ENGINEER
SEAL

Douglas M. Gatrell
NY P.E. LICENSE NO. 083375-1

EXP. 11/30/08

DATE: DECEMBER 2006
SCALE: 1"=100'
CAD FILE NO.: 42746-00(004)CI-DE036
DESIGNED BY: K. G. GATRELL
DRAWN BY: D. GILLESPIE
CHECKED BY: S. WILSEY

CRA Infrastructure & Engineering, Inc.

CONESTOGA-ROVERS & ASSOCIATES
NIAGARA FALLS, NY

SENECA MEADOWS SOLID WASTE MANAGEMENT FACILITY
SENECA FALLS, NEW YORK
6 NYCRR PART 360 APPLICATION
LANDFILL EXPANSION DESIGN

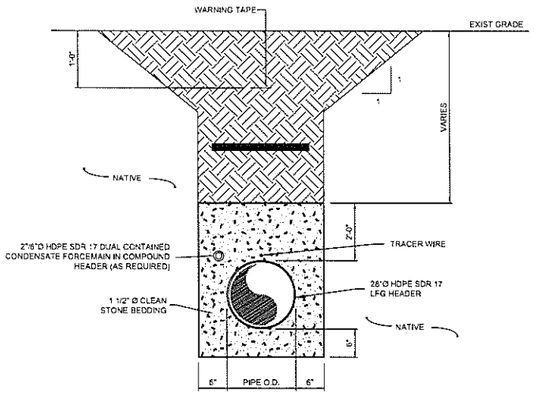
GCCS DESIGN PLAN

E-W CROSS SECTION (STAGES 7, 8 & 9)

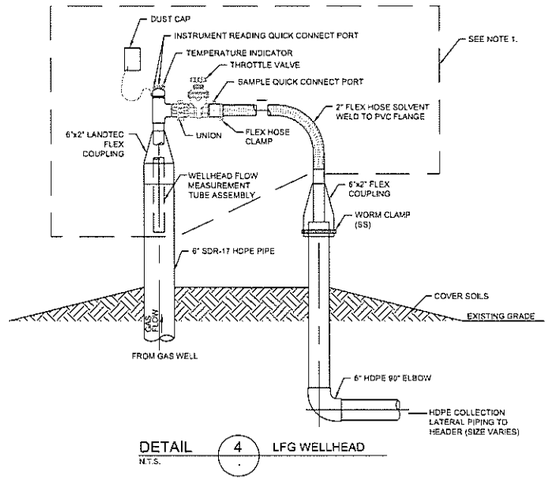
PROJECT NO. 42746-00

DRAWING NO. LFG-36

I:\DRAWINGS\42005\42746\42746-REPORT\42746-99(001)\42746-00(004)D\42746-00(004)D-DE036.DWG 12/01/2006 LAYOUT: LFG-36



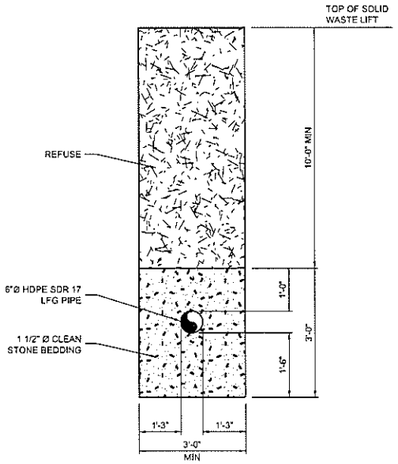
DETAIL 1 N.T.S. LFG HEADER TRENCH



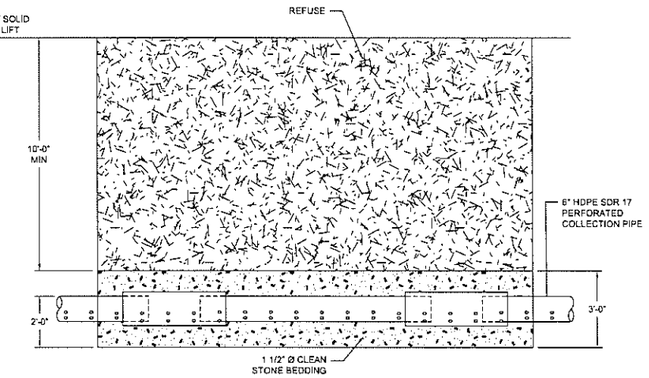
DETAIL 4 N.T.S. LFG WELLHEAD

NOTE

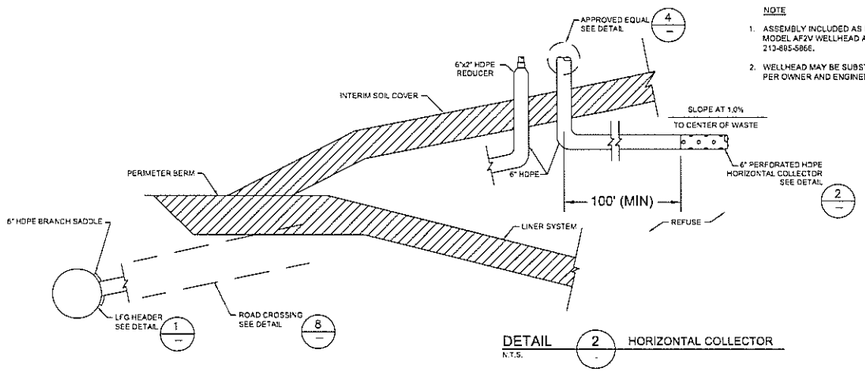
1. ASSEMBLY INCLUDED AS PART OF LANDTEC ACCU-FLO MODEL AF2V WELLHEAD ASSEMBLY, TEL. 1-800-LANDTEC, FAX 213-685-5866.
2. WELLHEAD MAY BE SUBSTITUTED WITH AN APPROVED EQUAL PER OWNER AND ENGINEER.



DETAIL 2 N.T.S. TYPICAL HORIZONTAL LFG EXTRACTION PIPING TRENCH (SECTION)



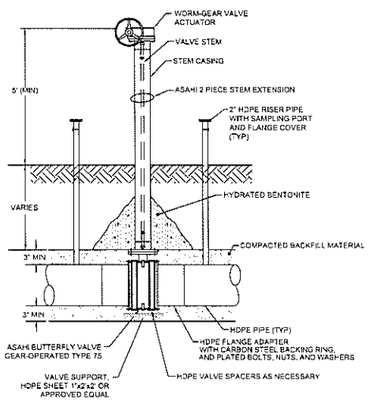
DETAIL 2 N.T.S. TYPICAL HORIZONTAL LFG EXTRACTION PIPING TRENCH (PROFILE)



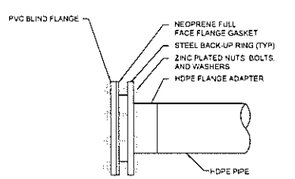
DETAIL 2 N.T.S. HORIZONTAL COLLECTOR

NOTES:

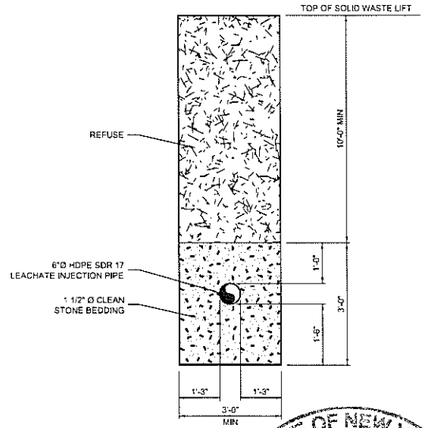
1. THE WELLHEAD MUST BE INSTALLED WITH THE SAMPLING APPARATUS LOCATED ON THE "SUPPLY" SIDE OF THE VALVE. INSTALL SO AS NOT TO CREATE A LOW POINT WHERE CONDENSATE MAY COLLECT.
2. INSTALL 6" HDPE END CAP (BUTT FUSION WELDED) ON END OF HORIZONTAL COLLECTOR PIPE.



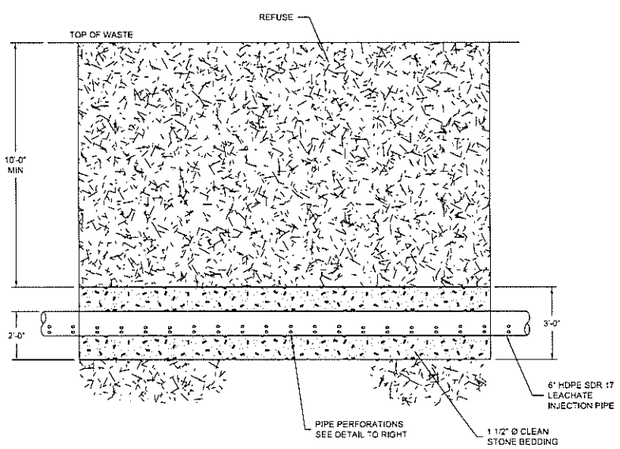
DETAIL 5 N.T.S. ISOLATION VALVE



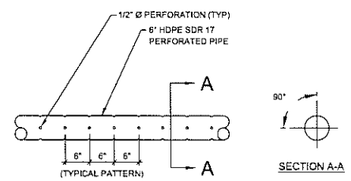
DETAIL 6 N.T.S. BLIND FLANGE



DETAIL 3 N.T.S. LEACHATE INJECTION WELL (PIPING TRENCH SECTION)



DETAIL 3 N.T.S. TYPICAL HORIZONTAL LEACHATE INJECTION PIPING TRENCH (PROFILE)



NOTE: USE No. 2 STONE ADJACENT TO PERFORATED PIPE SECTIONS. INSTALL 6" SCH 40 PVC END CAP AT TERMINATION OF LEACHATE INJECTION LATERAL.

NOTE: LEACHATE INJECTION PIPE TO BE DUAL CONTAINED 6"/10" SDR 17 FOR 40 FEET INTO THE WASTE MASS WITH A END SEAL PRIOR TO PERFORATED SECTION.
LEACHATE INJECTION PIPING FOR STAGE 1 TO HAVE 6" END CAP ON WESTERN END FOR FUTURE CONNECTION TO STAGE 2 LEACHATE INJECTION PIPING. THE PIPING IS TO BE CONNECTED TOGETHER PRIOR TO COMPLETING WASTE PLACEMENT.

STATE OF NEW YORK
Douglas M. Gatrell
083375
LICENSED PROFESSIONAL ENGINEER
Douglas M. Gatrell
NY P.E. LICENSE NO. 083375
EXP. 11/30/08

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REV. NO	DESCRIPTION OF REVISION	APPROVAL	DATE	REV. NO.	DESCRIPTION OF REVISION	APPROVAL	DATE
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4				4			
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6				6			
7				7			

DATE: DECEMBER 2006
SCALE:
CAD FILE: 42746-00(004)CI-DE037
DESIGNED BY: D. GATRELL
DRAWN BY: D. GILLESPIE
CHECKED BY: S. WILSEY

CRA Infrastructure & Engineering, Inc.
CONESTOGA-ROVERS & ASSOCIATES
NIAGARA FALLS, NY

SENECA MEADOWS SOLID WASTE MANAGEMENT FACILITY
SENECA FALLS, NEW YORK
6 NYCRR PART 360 APPLICATION
LANDFILL EXPANSION DESIGN

GCCS DESIGN PLAN

PIPING DETAILS

PROJECT NO. 42746-00
DRAWING NO. LFG-37

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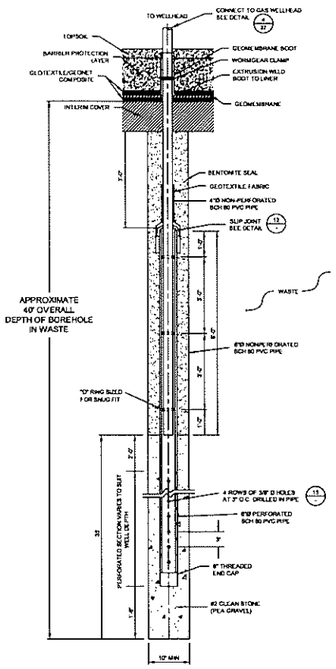
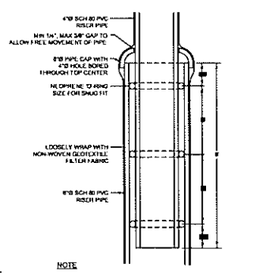
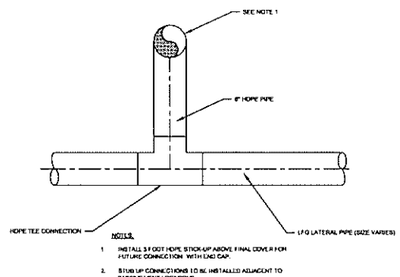


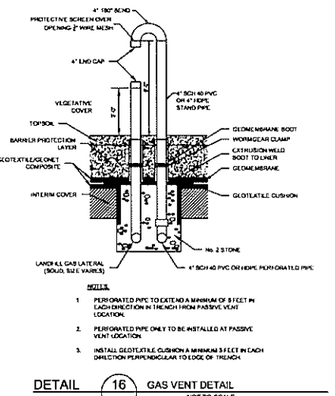
DETAIL 11 TYPICAL LANDFILL GAS WELL
NOT TO SCALE



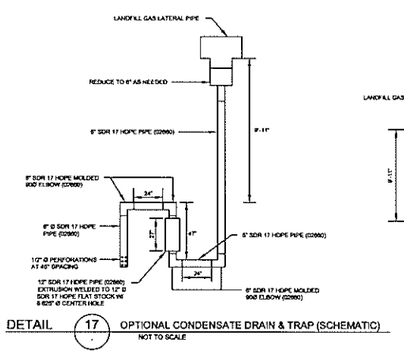
DETAIL 12 SLIP JOINT
NOT TO SCALE



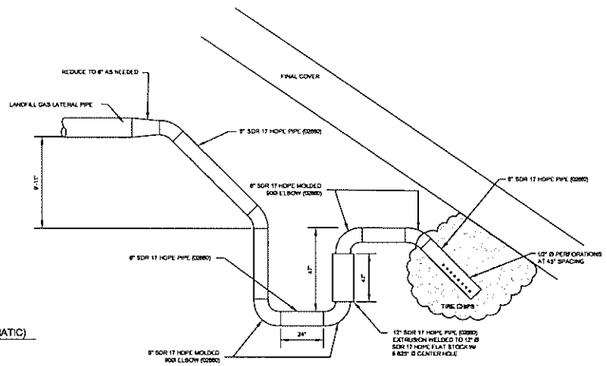
DETAIL 14 LATERAL PIPING (PLAN VIEW)
NOT TO SCALE



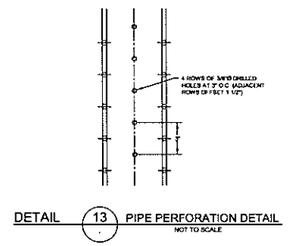
DETAIL 16 GAS VENT DETAIL
NOT TO SCALE



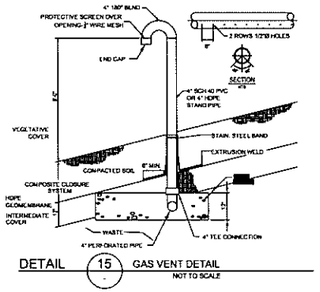
DETAIL 17 OPTIONAL CONDENSATE DRAIN & TRAP (SCHEMATIC)
NOT TO SCALE



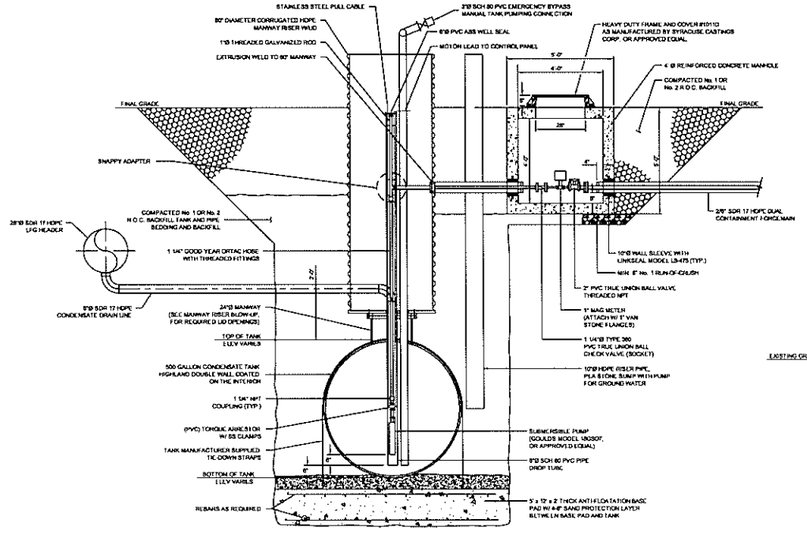
DETAIL 18 OPTIONAL CONDENSATE DRAIN & TRAP (PROFILE)
NOT TO SCALE



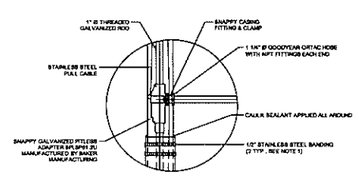
DETAIL 13 PIPE PERFORATION DETAIL
NOT TO SCALE

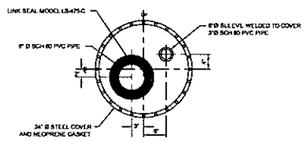


DETAIL 15 GAS VENT DETAIL
NOT TO SCALE

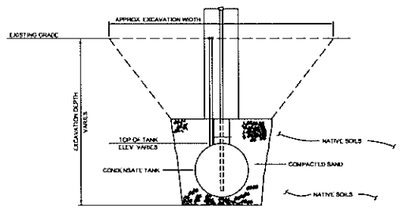


SNAPPY ADAPTER BLOW-UP
NOT TO SCALE

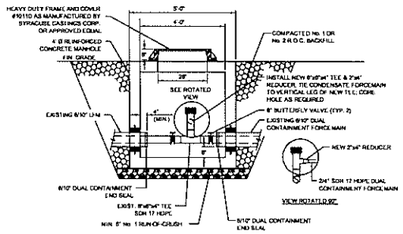




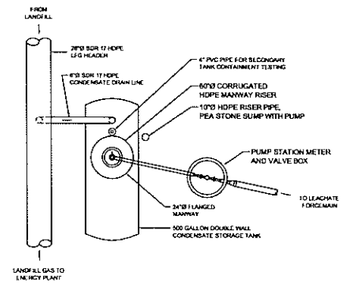
MANWAY RISER BLOW-UP
NOT TO SCALE



SECTION
EXCAVATION DETAIL
NOT TO SCALE



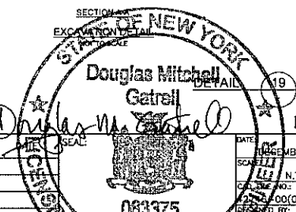
LFM VALVE BOX
NOT TO SCALE



PLAN VIEW

CONDENSATE TANK DETAIL
NOT TO SCALE

DETAIL 19 CONDENSATE TANK PUMP STATION DETAIL
NOT TO SCALE



Douglas Mitchell Gatrell
EXP. 11/30/08

NY P.E. LICENSE NO. 063375-1

WARNING
IT IS A VIOLATION OF SECTION 7209, SUBDIVISION 2, OF THE NEW YORK STATE EDUCATION LAW FOR ANY PERSON, OTHER THAN WHOSE SEAL APPEARS ON THIS DRAWING, TO ALTER IN ANY WAY AN ITEM ON THIS DRAWING. IF AN ITEM IS ALTERED, THE ALTERING ENGINEER SHALL AFFIX TO THE ITEM HIS SEAL AND THE NOTATION "ALTERED BY" FOLLOWED BY HIS SIGNATURE AND THE DATE OF SUCH ALTERATION, AND A SPECIFIC DESCRIPTION OF THE ALTERATION.

REV. NO.	DESCRIPTION OF REVISION	APPROVAL	DATE	REV. NO.	DESCRIPTION OF REVISION	APPROVAL
1				7		
2				8		
3				9		
4				10		
5				11		
6				12		

DATE: DECEMBER 2006
SCALE: AS NOTED N.T.S.
CONTRACT NO.: 42746-00(004)CI-DE040
DESIGNED BY: D. GATRELL
DRAWN BY: D. GILLESPIE
CHECKED BY: S. WILSEY

CRA Infrastructure & Engineering, Inc.
CONESTOGA-ROVERS & ASSOCIATES
NIAGARA FALLS, NY

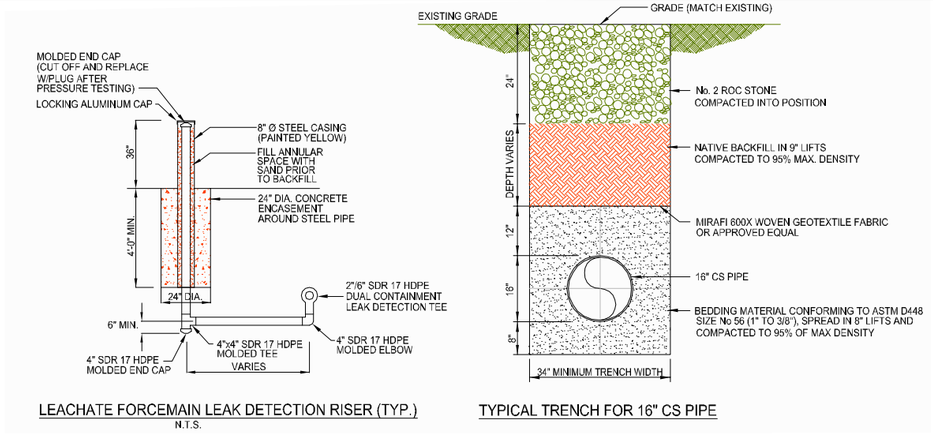
SENECA MEADOWS SOLID WASTE MANAGEMENT FACILITY
SENECA FALLS, NEW YORK
6 NYCRR PART 360 APPLICATION
LANDFILL EXPANSION DESIGN

GCCS DESIGN PLAN

DETAILS

PROJECT NO. 42746-00
DRAWING NO. LFG-40

I:\DRAWINGS\42000S\42746\42746-REPORT\42746-00(001)\42746-00(004)DE\42746-00(004)DE-DE040.DWG 12/07/2006 LAYOUT: LFG-40



SCALE VERIFICATION: THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.

No	Revision	Date	Initial
4	AS BUILT	8-21-08	LVN
3	GENERAL PIPE SUPPORT AND PIPE MODIFICATION	10-18-06	BAB
2	SITE GRADE ELEVATION CHANGED TO 480'-0"	8-22-06	BAB
1	NYSDEC PART 360 SUBMITTAL	7-14-06	BAB

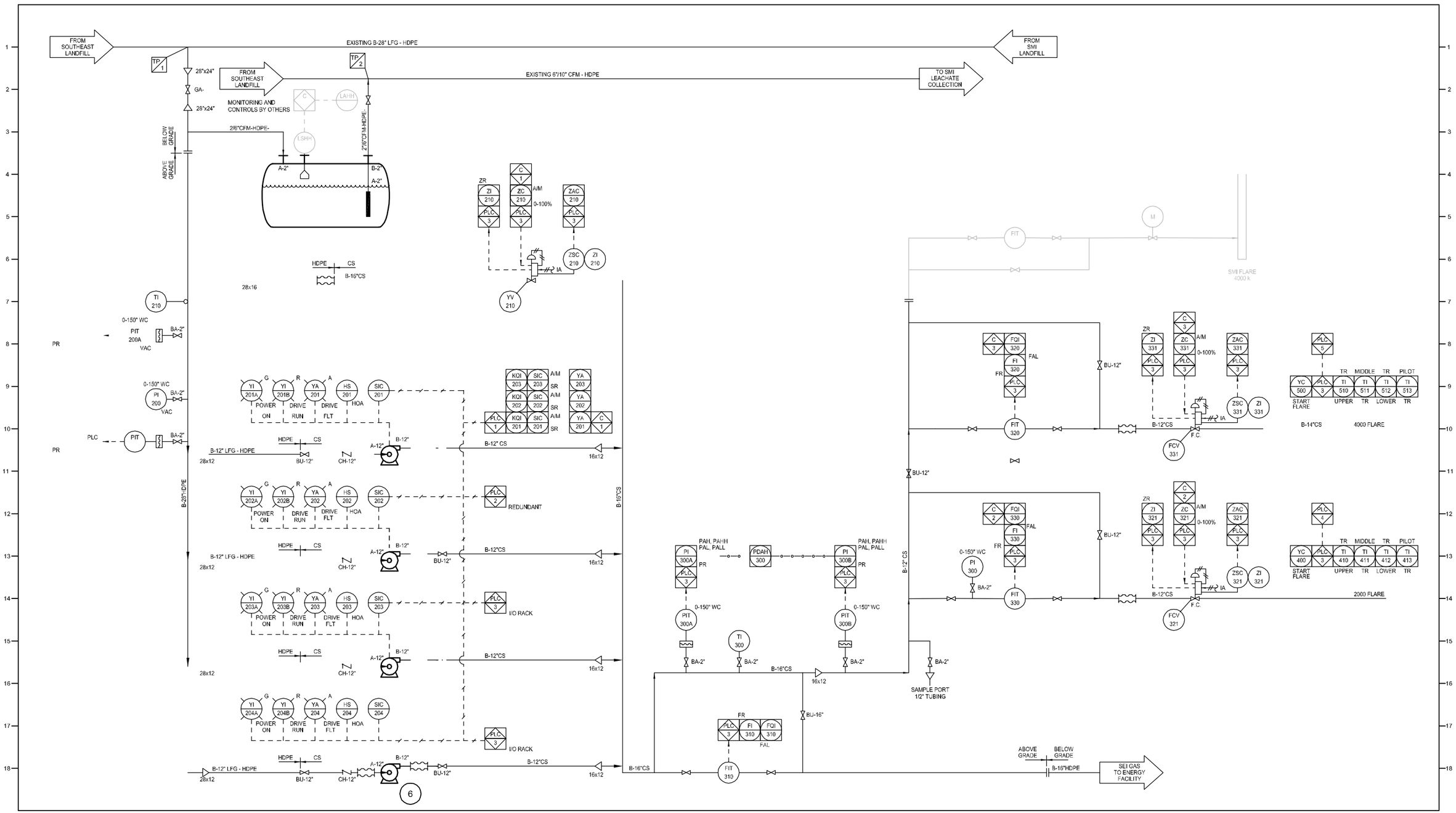
SENECA MEADOWS, INC.
WATERLOO, NEW YORK

LANDFILL GAS COLLECTION AND CONTROL SYSTEM

SITE PLAN

CRA Infrastructure & Engineering, Inc.

Source Reference:			Date: 7-14-06
Project Manager: S. WILSEY	Reviewed By: D. GATRELL	Designed By: D. GATRELL	Drawn By: B.A. BEEBE
Scale: 1"=50'	Project No: 42864-00	Report No: 000	Drawing No: MP-01



PLANT ID.	1	2	3	4	5	6	7	8	9	10	11	12	
NAME						LFG BLOWER No.4							
EQUIPMENT: MATERIAL						CAST IRON							
SIZE						12"x12"							
CAPACITY						3500 SCFM							
TEMP/PRESS						202/115 inWC							
HP/VRPM						250/460/3570							
WEIGHT						5500 lbs.							
MANUFACTURE						HOUSTON SERVICE IND.							
MODEL						HSI 12607							
VENDOR													

No	Revision	Date	Initial
3	AS-BUILTS	8-21-08	LVN
2	ISSUED FOR FINAL REVIEW	8-4-08	BAB
1	NYSDEC PART 360 SUBMITTAL	7-14-06	BAB

CRA Infrastructure & Engineering, Inc.

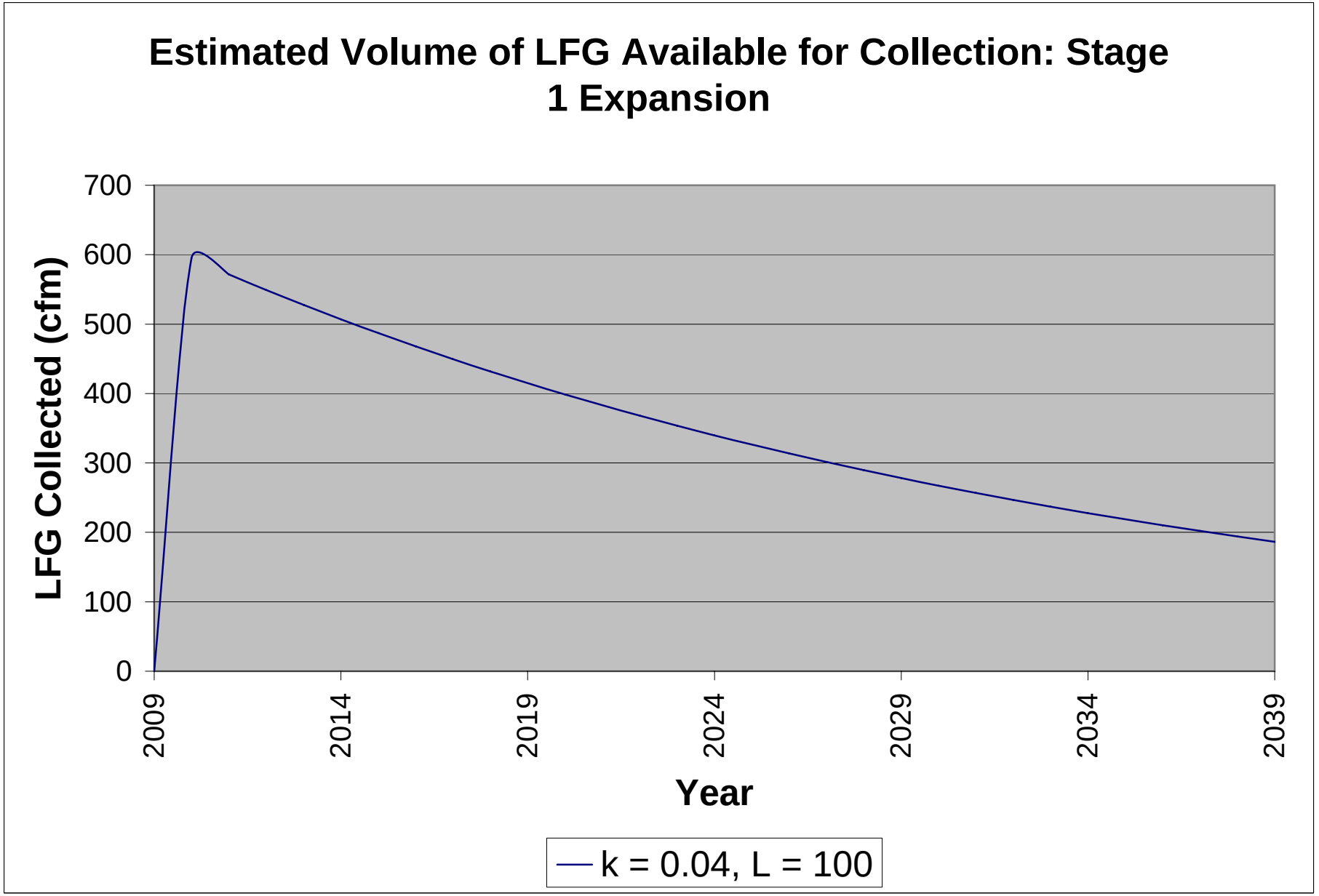
Source Reference: Date:

Project Manager: Reviewed By: Designed By: Drawn By:

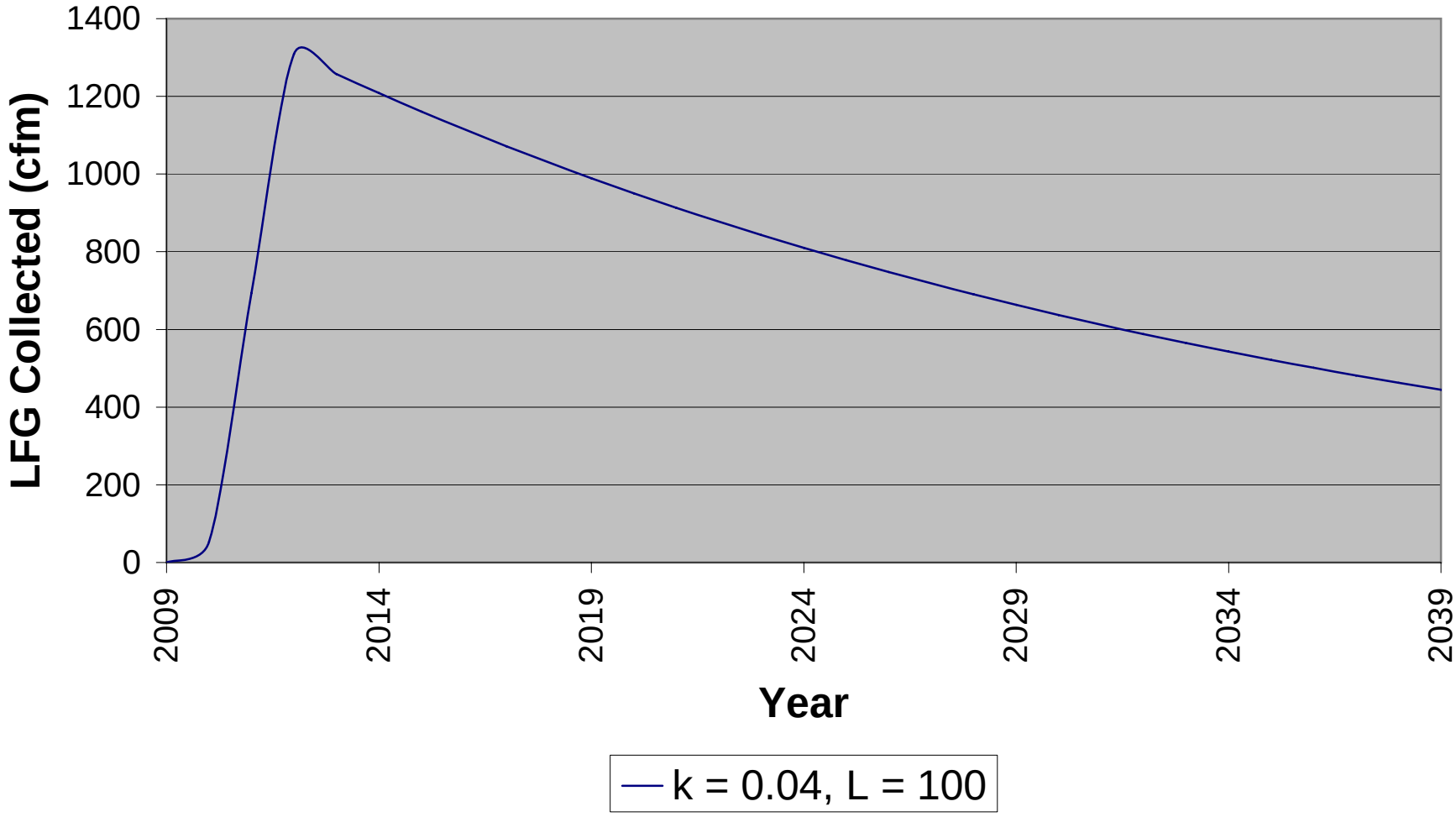
Scale: Project No: Report No: Drawing No:

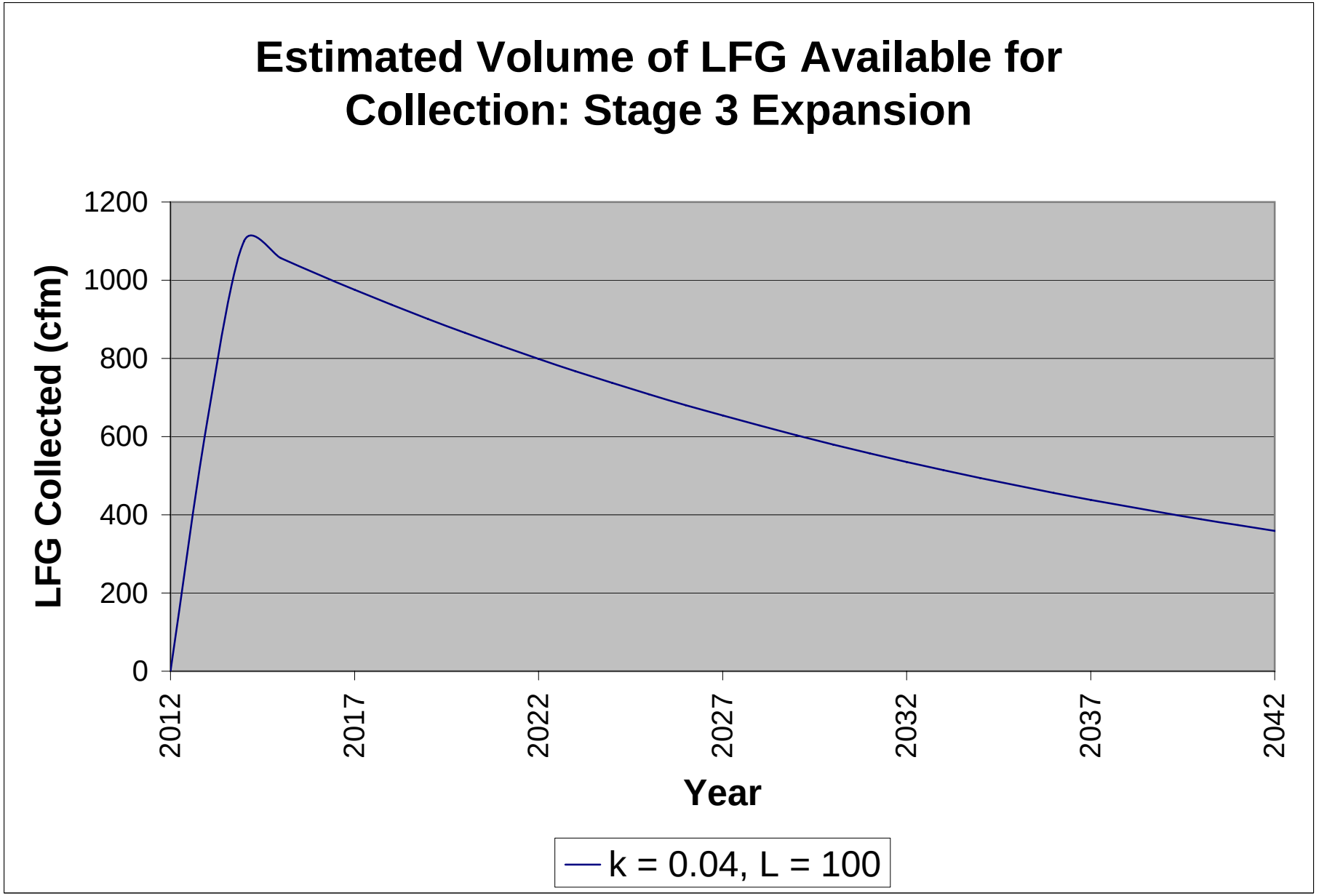
APPENDIX B

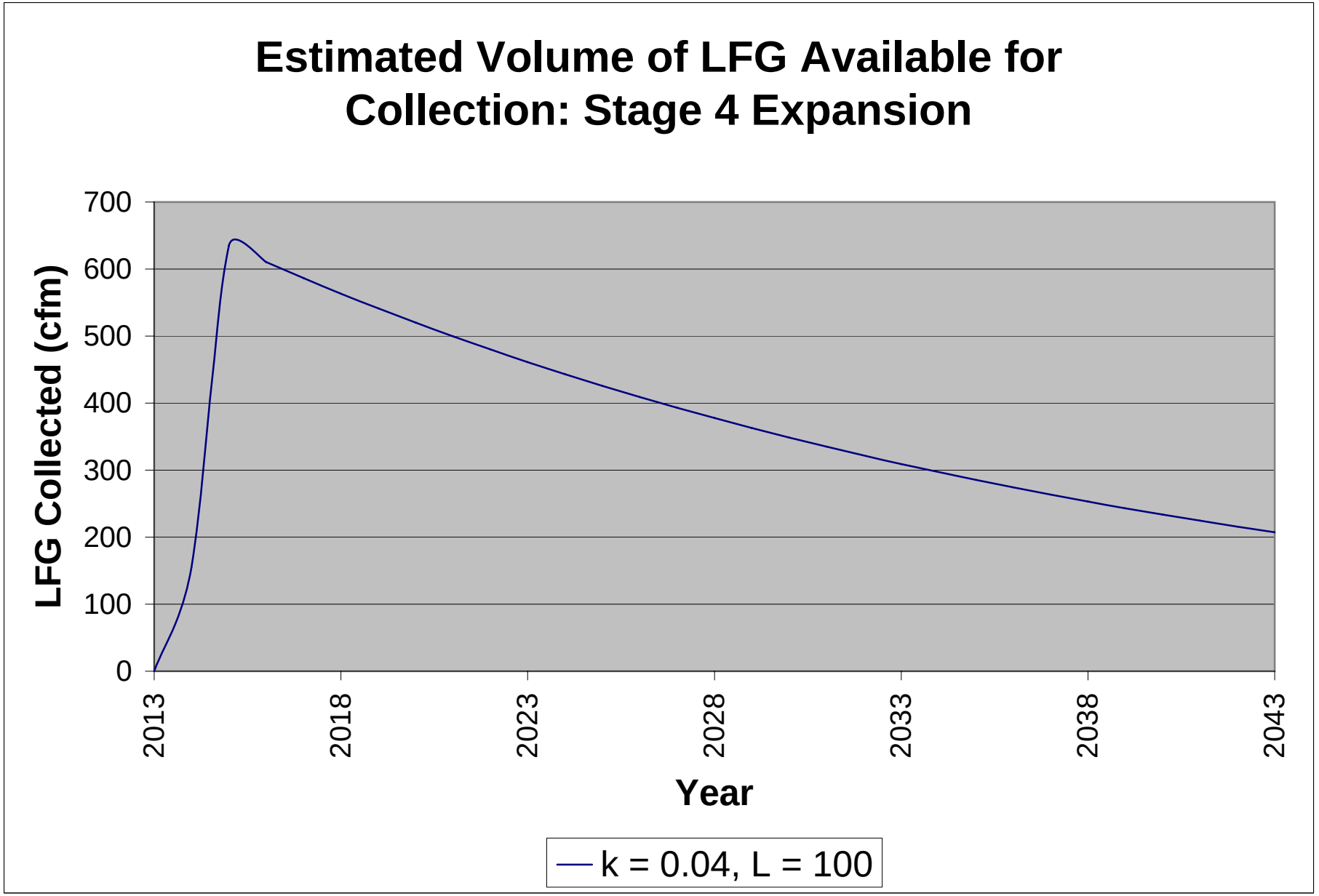
PROJECTED LANDFILL GAS AVAILABLE FOR COLLECTION – EXPANSION LANDFILL


Estimated Volume of LFG Available for Collection: Stage 1 Expansion
LFG Collected (cfm)
700
600
500
400
300
200
100
0
2009
2014
2019
2024
2029
2034
2039
Year
k = 0.04, L = 100

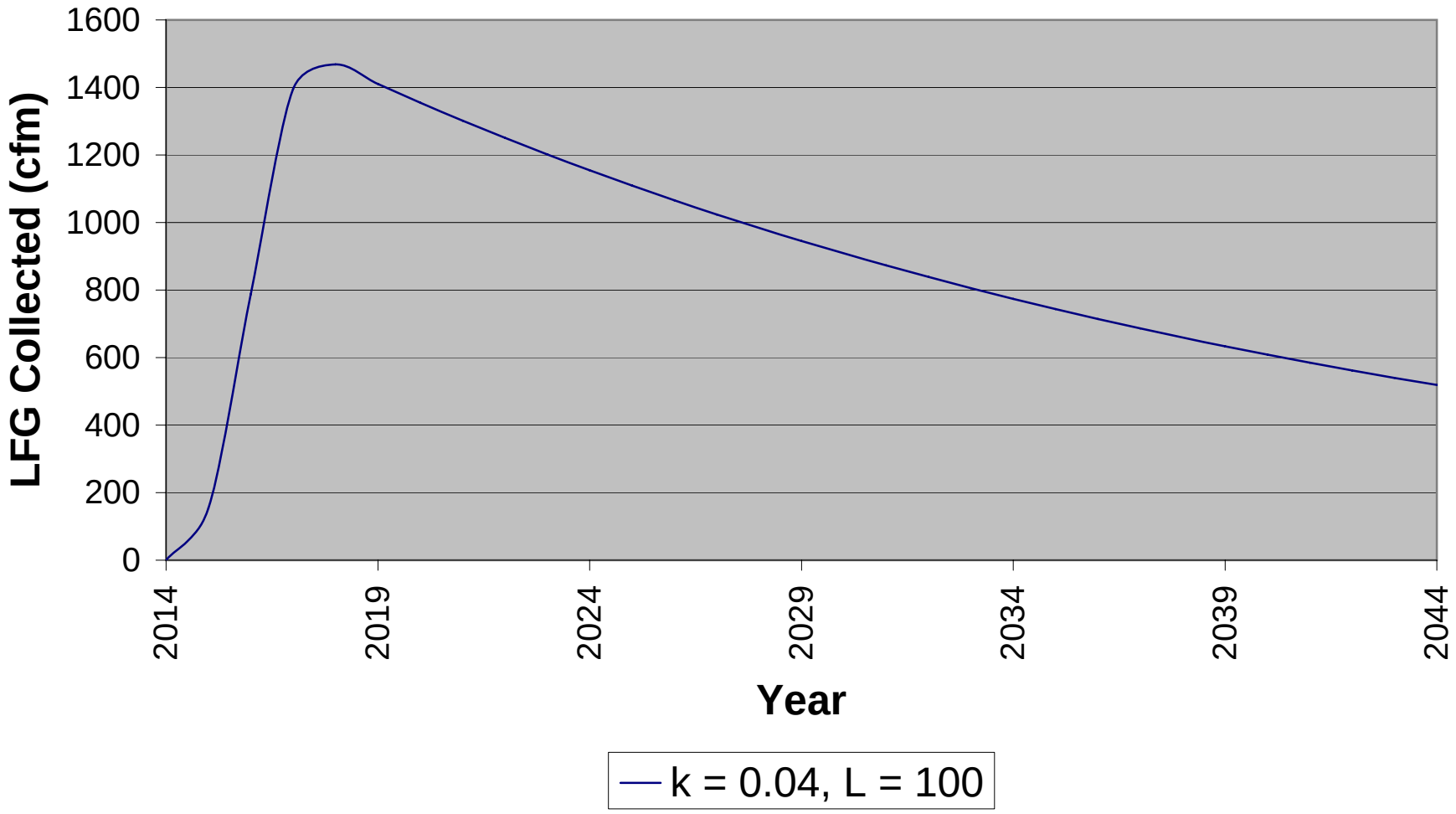
Estimated Volume of LFG Available for Collection: Stage 2 Expansion



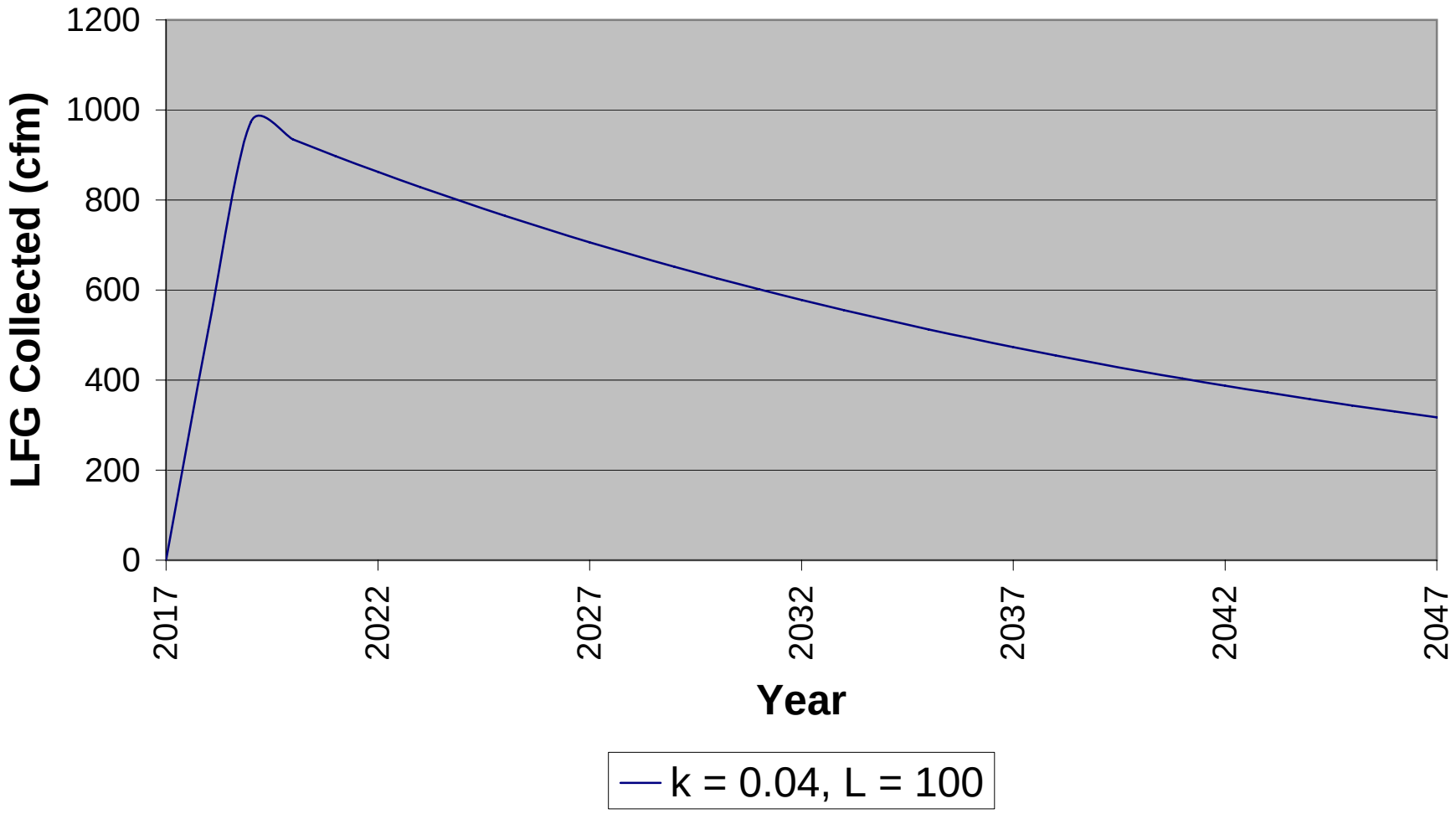

Estimated Volume of LFG Available for Collection: Stage 3 Expansion
LFG Collected (cfm)
1200
1000
800
600
400
200
0
2012
2017
2022
2027
2032
2037
2042
Year
k = 0.04, L = 100

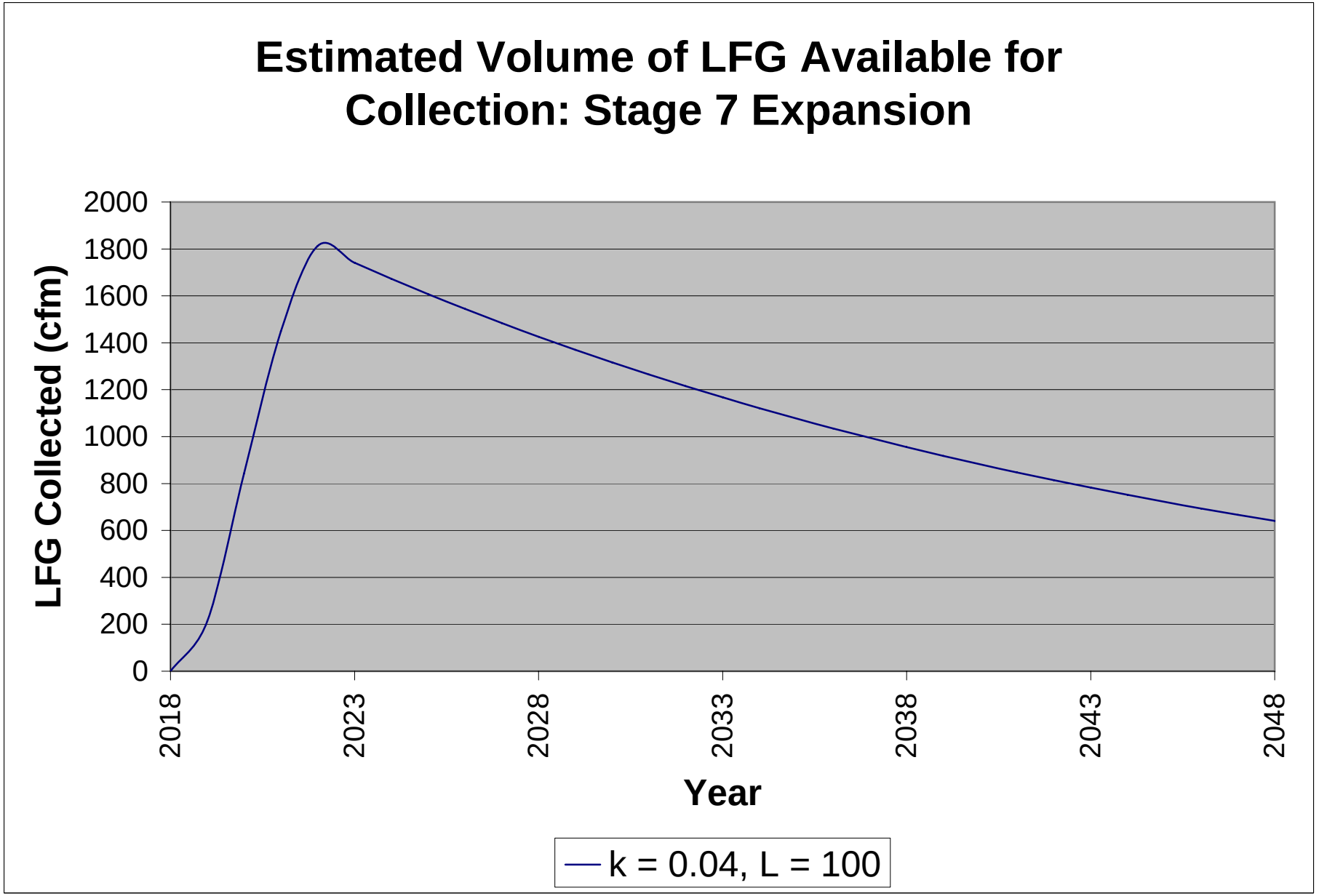

Estimated Volume of LFG Available for Collection: Stage 4 Expansion
LFG Collected (cfm)
700
600
500
400
300
200
100
0
2013
2018
2023
2028
2033
2038
2043
Year
k = 0.04, L = 100

Estimated Volume of LFG Available for Collection: Stage 5 Expansion

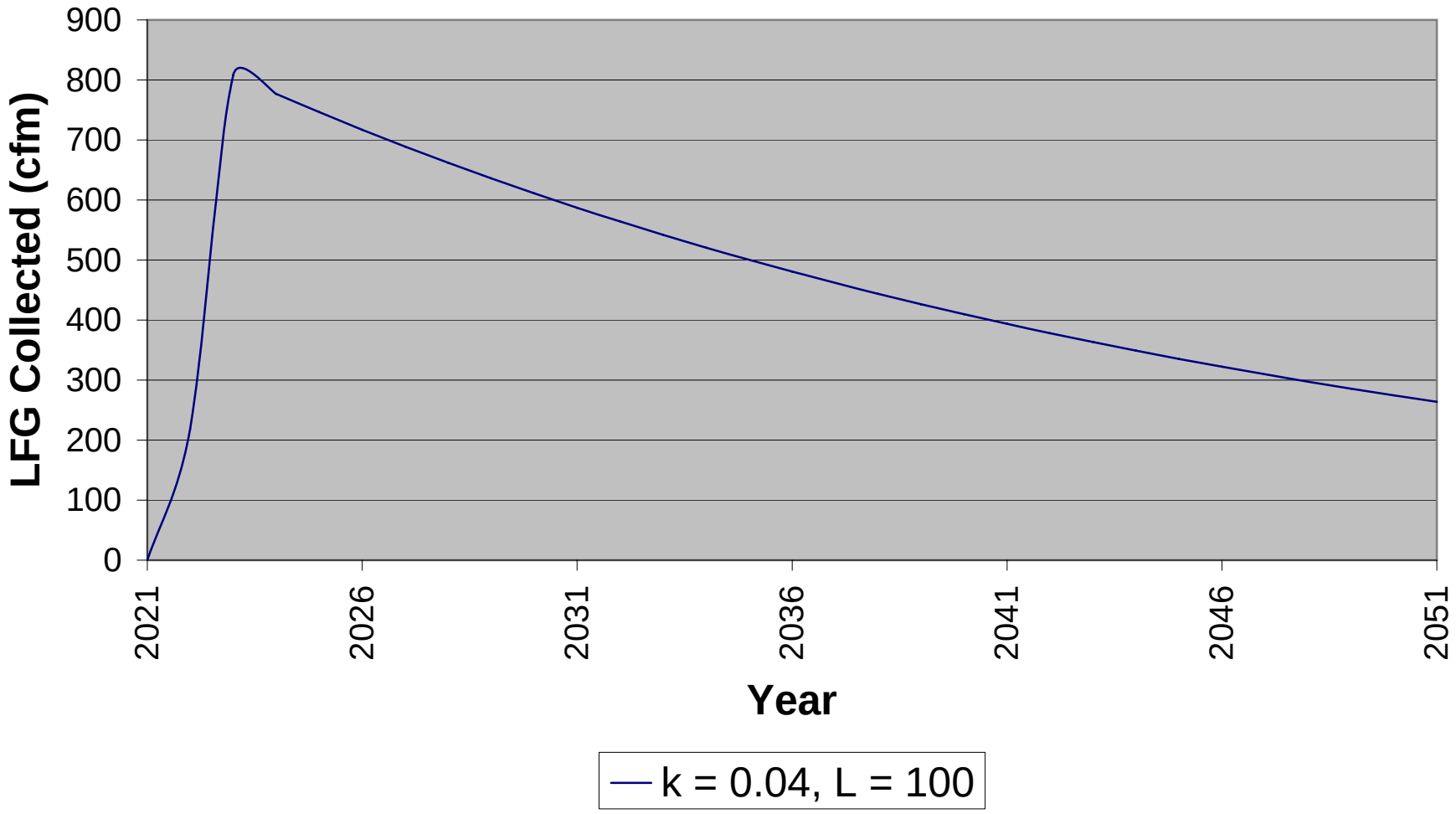


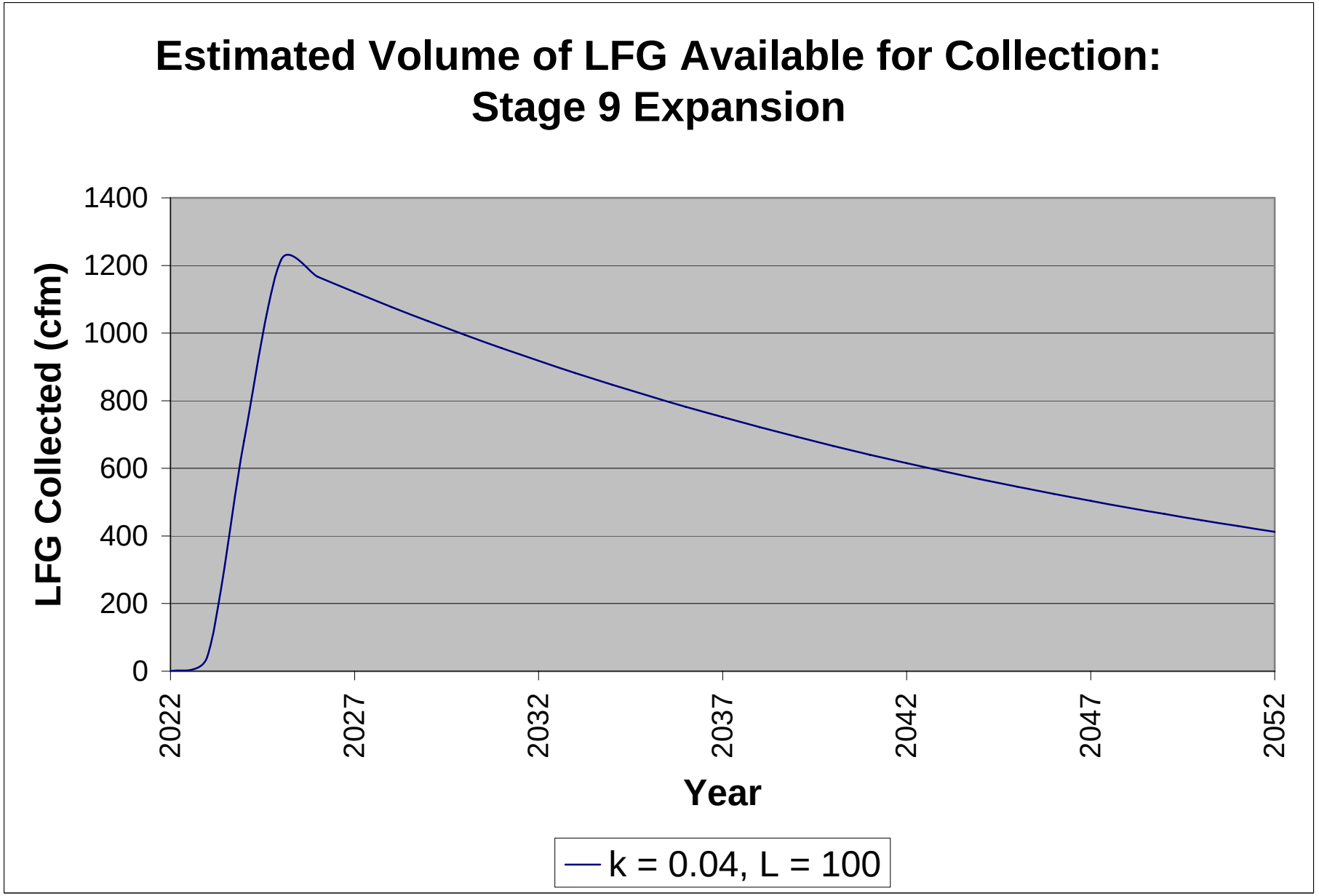
Estimated Volume of LFG Available for Collection: Stage 6 Expansion

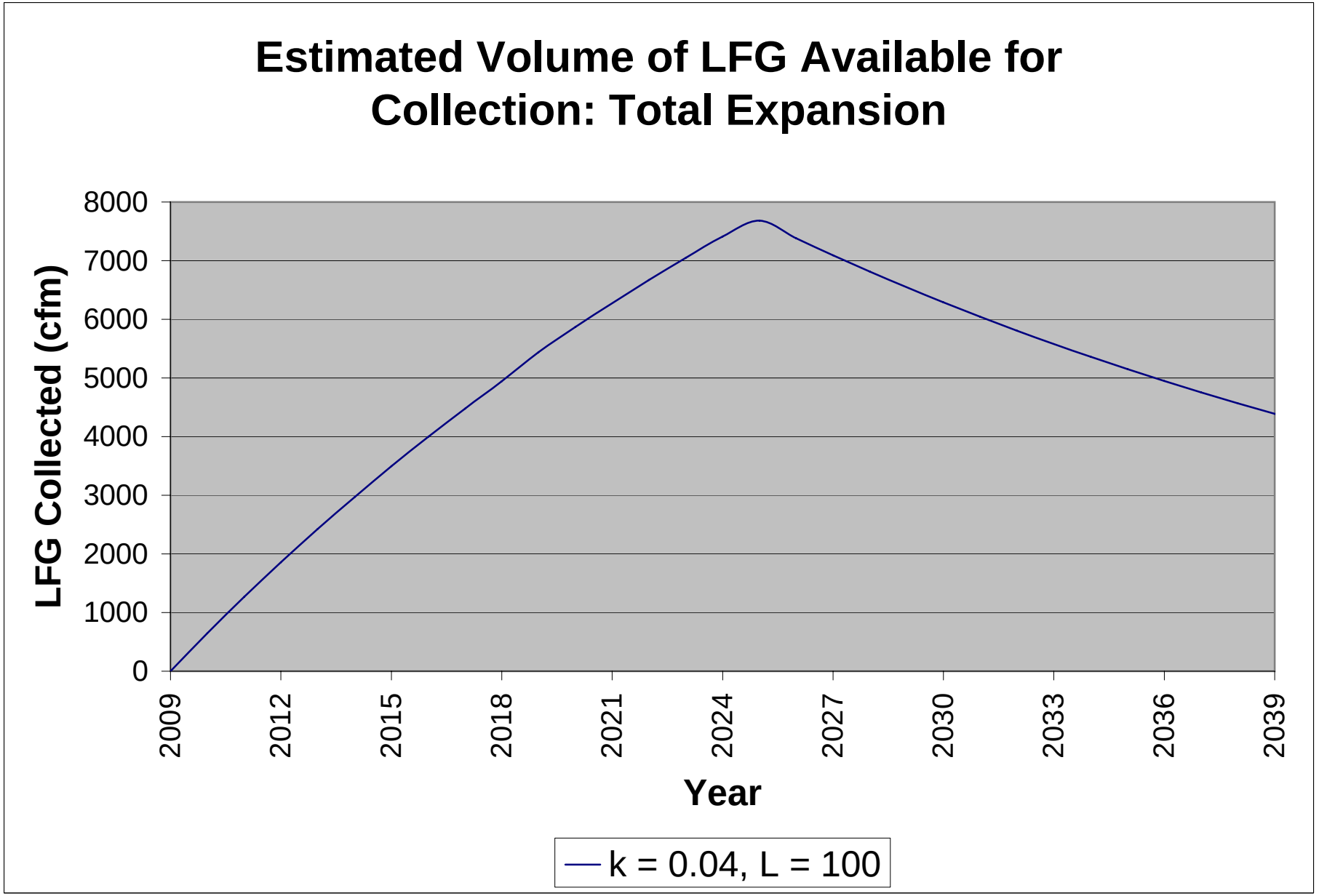



Estimated Volume of LFG Available for Collection: Stage 7 Expansion
LFG Collected (cfm)
2000
1800
1600
1400
1200
1000
800
600
400
200
0
2018
2023
2028
2033
2038
2043
2048
Year
k = 0.04, L = 100

Estimated Volume of LFG Available for Collection: Stage 8 Expansion




Estimated Volume of LFG Available for Collection:
Stage 9 Expansion
LFG Collected (cfm)
1400
1200
1000
800
600
400
200
0
2022
2027
2032
2037
2042
2047
2052
Year
k = 0.04, L = 100


Estimated Volume of LFG Available for Collection: Total Expansion
LFG Collected (cfm)
8000
7000
6000
5000
4000
3000
2000
1000
0
2009
2012
2015
2018
2021
2024
2027
2030
2033
2036
2039
Year
k = 0.04, L = 100

APPENDIX C

MANUFACTURER SPECIFICATIONS – LFG SPECIALTIES ENCLOSED FLARES

2. Enclosed Flares

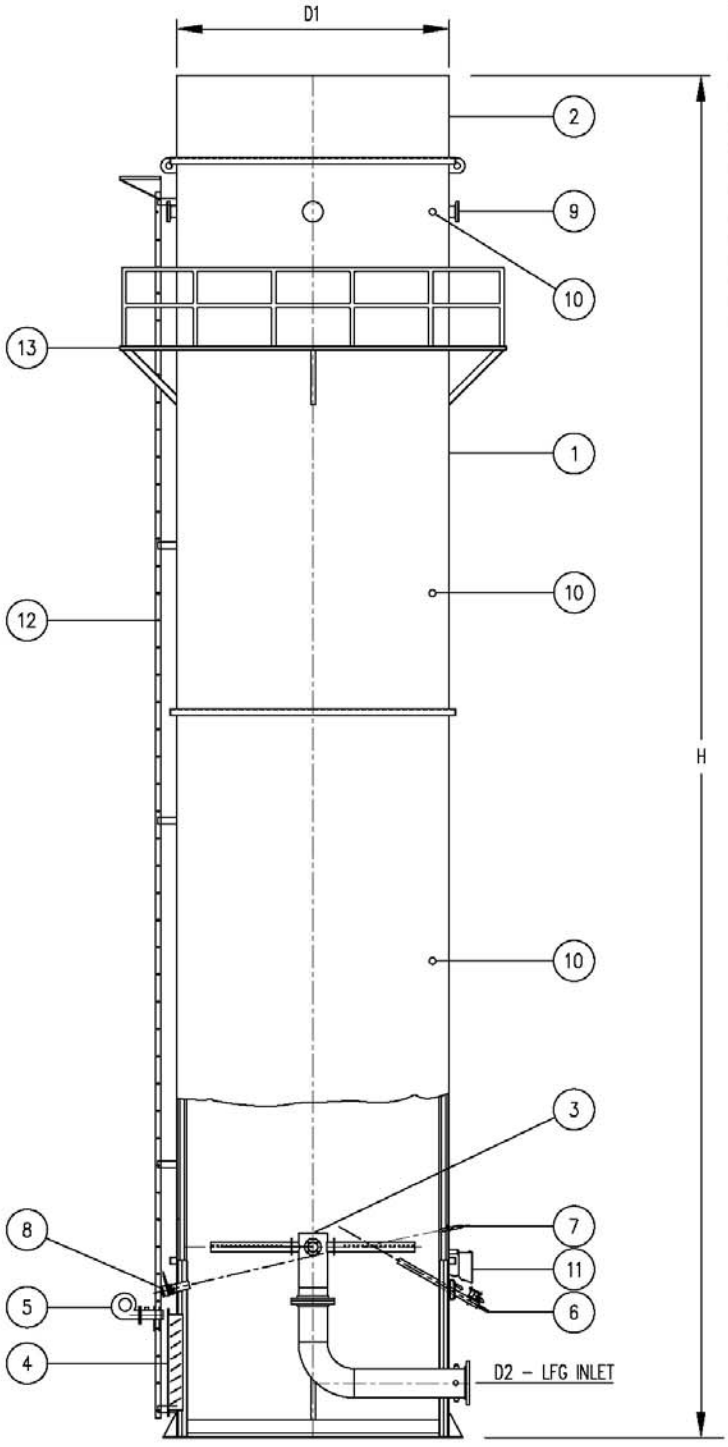
LFG Specialties manufactures a full range of enclosed landfill gas and biogas flares, specifically designed for high-efficiency combustion, guaranteeing 99% destruction efficiency. Our flares are equipped with technically advanced controllers (see Section 10, Controls) and can be packaged with blower skids with various options (see Section 6, Blower Skids).

In addition to offering the standard and optional equipment listed below, LFG Specialties will also custom design and manufacture flares and control systems to meet specific customer conditions and specifications.

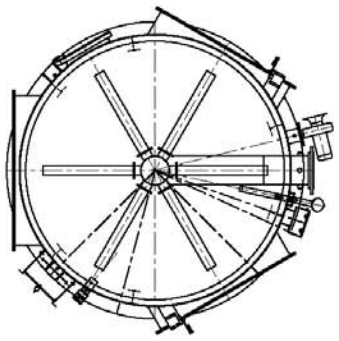
Features

- Guaranteed to meet state and federal emission standards for LFG disposal.
- Combustion systems comply with NFPA 86 to ensure safe operation.
- Full range of standard sizes from 30 to 6,100 scfm.
- Flares may be skid-mounted or free standing.
- Fully factory assembled and tested to minimize customer installation.
- Delivery is 12 to 14 weeks for most flares, and less with expedited schedules.
- Flares are supplied with drawings and O&M manuals.
- Full service and parts support, including customer training and emergency service.

Enclosed Flare Layout



ITEM	DESCRIPTION
1	FLARE SHELL - CARBON STEEL
2	FLARE SHELL - STAINLESS STEEL
3	BURNER ASSEMBLY
4	AIR DAMPER
5	PURGE AIR BLOWER
6	IGNITOR
7	UV FLAME DETECTOR
8	SITE PORT
9	SAMPLE PORT
10	THERMOCOUPLE
11	JUNCTION BOX
12	LADDER (OPTIONAL)
13	PLATFORM (OPTIONAL)



Standard Equipment

The following items come standard on all enclosed flares:

Flare Stack – Carbon steel construction with ANSI 150 lb flanged inlet connection. Top portion of flare stack is 304 stainless steel. Carbon steel shell is internally insulated with ceramic fiber insulation, and painted inside and out with high temperature paint.

Burner Assembly – All 304 stainless steel construction. Burner is suitable for operation over a 6:1 turndown range. (Proper blower and drive selection is required to realize the full 6:1 turndown range)

Igniter Assembly – The igniter is a small burner used to light the main burner. Typically fueled with bottled propane gas, the igniter assembly consists of a 304 stainless steel burner tube with spark plug ignition and type K thermocouple for flame confirmation. The spark plug is supplied with high temperature leads and a transformer in a NEMA 4 enclosure.

Flame Supervision – Typically consists of an ultraviolet flame detector to confirm flame integrity.

Temperature Control – A dedicated closed loop temperature controller is used to maintain flare temperature setpoint. Process temperature is selectable from among multiple thermocouples, and control is maintained by modulating combustion air dampers at the flare base.

Flare System Controllers – Enclosed flares all use the Flame-Trol IV PLC-based control system. This is a technically advanced, fully automatic flare system controller specifically designed for maximum operating flexibility and efficiency. (See Section 6, Controls for further details.)

Sample Ports – Sample ports are provided near the flare top as per EPA requirements to allow for emissions compliance testing.

Flame Arrestor – This device prevents flame flash back in the event of high oxygen concentrations in the landfill gas. The standard flame arrestor is equipped with an aluminum core assembly.

Standard Insulation – The enclosed flare interior is insulated with a nominal 2 inches of ceramic fiber blanket insulation. This amount of insulation will result in a hot metal skin temperature which is useful in preventing acid gas condensation from occurring on the metal shell ID.

Optional Equipment

The following options are available for enclosed flares:

Condensate Injection – These systems are used to dispose of condensate streams by injecting them into the flare for thermal destruction. The system includes all necessary pumps, filters, valves, gauges, spray nozzles and connecting piping.

Corrosion Resistance – This option should be used when handling landfill gas which contains more than 1000 ppmv of H2S, which is corrosive. Selecting this option changes the following equipment selection:

- Burner construction upgraded from Schedule 10, 304 stainless steel to Schedule 40, 310 stainless steel.
- Shell insulation provided with 304 stainless steel foil vapor barrier, and impaling pins and keepers upgraded from Inconel 600 to 310 stainless steel.
- Flame arrestor core upgraded from aluminum to 304 stainless steel.
- Dampers may be upgraded from galvanized steel to 304 stainless steel.
- Conduit may be upgraded from galvanized steel to PVC-coated steel.

Flame Arrestor DP – A differential pressure gauge is installed across the flame arrester to detect excessive pressure drop, indicating a dirty, fouled, or corroded element.

Heat Shields – Expanded metal heat shields are provided for personnel protection and can be located around the base section of the flare, and/or around the ladder and thermocouples.

Ladder – Located along side thermocouples to provide easy access for maintenance. Ladder is equipped with a harness track for added safety.

Platform – Located near top of flare to provide easy access to the sample ports. Platform designs available for accesses to 2 or all 4 sample ports.

Continuous Pilot – The igniter (pilot) may be operated in a continuous fashion to keep the flare operating under low or intermittent flow conditions. Such conditions are typical on systems which deliver gas to off-site users. To reduce propane consumption, continuous pilots can be operated on landfill gas.

Fuel Enrichment – Landfill gas which contains methane at concentrations below the recommended low limit of 30% (or 300 Btu/scf) may still be reliably burned by enriching the gas stream with supplemental fuel, such as natural gas or propane.

Additional Insulation – The enclosed flare interior is insulated with a nominal 3 inches of ceramic fiber blanket insulation. This amount of insulation will result in a skin temperature that is cooler and safer than the standard insulation design.

Equipment Specifications

The following are the standard enclosed flare equipment specifications.
Other custom designs are available upon request.

Enclosed Flare Model No.	Minimum Flow (scfm)	Maximum Flow (scfm)	Overall Height H (feet)	Shell Diameter D1 (feet)	Inlet Diameter D2 (inches)
EF420I3	30	160	20	4	3
EF525I4	50	300	25	5	4
EF630I6	100	600	30	6	6
EF735I6	170	1,000	35	7	6
EF840I8	250	1,500	40	8	8
EF945I10	370	2,200	45	9	10
EF1050I12	500	3,000	50	10	12
EF1150I12	600	3,600	50	11	12
EF1250I14	700	4,200	50	12	14
EF1360I16	1,020	6,100	60	13	16

Notes:

1. Nominal flow range represents a 6:1 turndown. Operating below minimum flow rates may result in reduced burner life. Proper blower and drive selection may be required to realize the full 6:1 turndown range.

2. Calculation of maximum flow rates assumes operation at an exhaust temperature of 1650 F with a 1.0 second residence time for nominal landfill gas at 500 feet above sea level. Nominal landfill gas composition taken as 50% CH4 + 37.8% CO2 + 5% N2 + 1% O2 + 6.2% H2O, all percentages taken on a wet volume basis.

3. Minimum recommended CH4 concentration is 30% vol (300 Btu/scf) wet basis. Operation below this value may result in unstable flare operation.

4. Design based on 100 mph wind loadings, as per ANSI/ASCE 7-88.

5. The EF840I8 is the largest unit which can be skid mounted.

APPENDIX D

MANUFACTURER SPECIFICATIONS – MAGNETROL THERMATEL MODEL TA2 MASS FLOW METER

Thermatel® Model TA2

Installation and Operating Manual

Thermal

Dispersion

Mass Flow

Transmitter

Magnetrol®

STI

Read this Manual Before Installing

This manual provides information on the TA2 Thermal Dispersion Mass Flow Transmitter. It is important that all instructions are read carefully and followed in sequence. Detailed instructions are included in the Installation section of this manual.

Conventions Used in this Manual

Certain conventions are used in this manual to convey specific types of information. General technical material, support data, and safety information are presented in narrative form. The following styles are used for notes, cautions, and warnings.

NOTES

Notes contain information that augments or clarifies an operating step. Notes do not normally contain actions. They follow the procedural steps to which they refer.

Cautions

Cautions alert the technician to special conditions that could injure personnel, damage equipment, or reduce a component's mechanical integrity. Cautions are also used to alert the technician to unsafe practices or the need for special protective equipment or specific materials. In this manual, a caution box indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

WARNINGS

Warnings identify potentially dangerous situations or serious hazards. In this manual, a warning indicates an imminently hazardous situation which, if not avoided, could result in serious injury or death.

Safety Messages

Follow all standard industry procedures for servicing electrical equipment when working with or around high voltage. Always shut off the power supply before touching any components.

WARNING! Explosion hazard. Do not connect or disconnect equipment unless power has been switched off or the area is known to be non-hazardous.

Low Voltage Directive

For use in Category II installations. If equipment is used in a manner not specified by manufacturer, protection provided by equipment may be impaired.

Notice of Trademark, Copyright, and Limitations

Magnetrol & Magnetrol logotype, STI & STI logotype, and Thermatel are registered trademarks of Magnetrol International. Thermatel Model TA2 Thermal Dispersion Mass Flow Transmitter is a tradename of Magnetrol International, Incorporated.

Performance specifications are effective with date of issue and are subject to change without notice. Magnetrol reserves the right to make changes to the product described in this manual at any time without notice. Magnetrol makes no warranty with respect to the accuracy of the information in this manual.

Warranty

All Magnetrol/STI electronic level and flow controls are warranted free of defects in materials or workmanship for one full year from the date of original factory shipment.

If returned within the warranty period; and, upon factory inspection of the control, the cause of the claim is determined to be covered under the warranty; then, Magnetrol will repair or replace the control at no cost to the purchaser (or owner) other than transportation.

Magnetrol shall not be liable for misapplication, labor claims, direct or consequential damage or expense arising from the installation or use of equipment. There are no other warranties expressed or implied, except special written warranties covering some Magnetrol products.

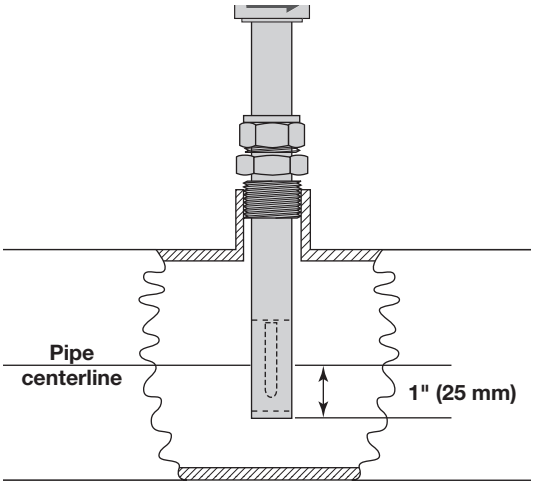
Quality Assurance

The quality assurance system in place at Magnetrol guarantees the highest level of quality throughout the company. Magnetrol is committed to providing full customer satisfaction both in quality products and quality service.

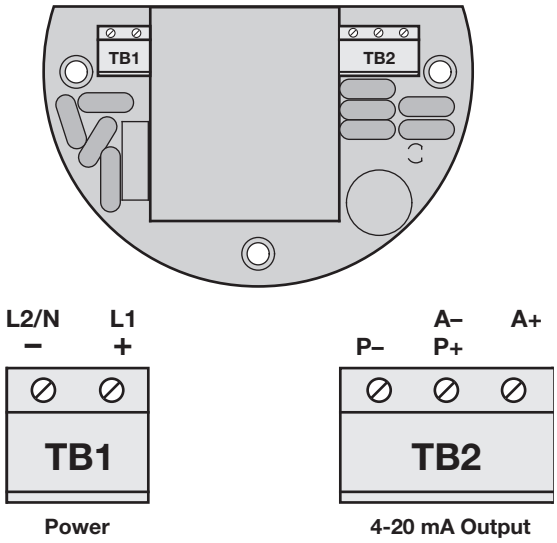
Magnetrol's Corporate quality assurance system is registered to ISO 9001 affirming its commitment to known international quality standards providing the strongest assurance of product/service quality available.

Thermatel Model TA2
Thermal Dispersion Mass Flow Transmitter

Table of Contents



Probe Installation into pipe or duct using a compression fitting



Wiring Connections

1.0 Quick Start Installation

The TA2 is pre-configured with the information supplied to Magnetrol with the order. The instrument can be installed, wired, and put directly into operation.

1.1 Probe Installation

Insert the probe into the pipe or duct at the appropriate location. It is recommended that the sensor be located on the center line of the pipe and that the flow arrow be positioned in the direction of flow.

1.2 Wiring

Warning: Explosion Hazard. Do not connect or disconnect equipment unless power has been switched off or the area is known to be non-hazardous.

NOTE: Make sure the electrical wiring to the TA2 is complete and in compliance with all regulations and codes.

1. Remove the cover of the wiring compartment.
2. Pull power supply and control wiring through conduit connection.
3. Connect power leads to proper terminals to TB1.
   a. 120 VAC – Connect the "hot" wire to terminal L1 and the "neutral" wire to terminal L2/N.
   b. 240 VAC – Connect one wire to terminal L1 and the other wire to L2/N.
   c. 24 VDC – Connect wires to terminal (+) and (-) on the terminal block.

NOTE: The green ground screw in the rear of the housing should be used for earth ground.

4. Connect the 4-20 mA signal wiring to TB2. Make connections to A-, A+ for an active output signal (power supplied by TA2) or P-, P+ for a passive signal using an external power supply.
5. Replace the housing cover.

1.3 Configuration

The TA2 is pre-configured using the information supplied with the order. If desired, the user can view or change any of the configuration data. See *Configuring the Transmitter, Section 2.5*.

2.0 Installation

2.1 Unpacking

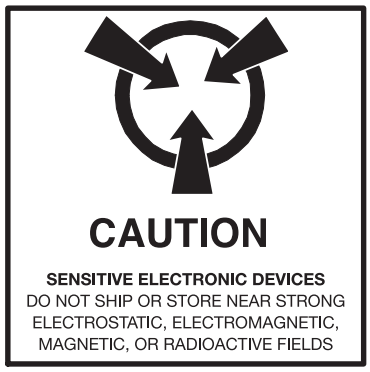
Unpack the instrument carefully making sure all components have been removed from the packing material. Inspect all components for damage. Report any concealed damage to the carrier within 24 hours. Check the contents of the carton making sure they correspond with the packing slip and purchase order. Save the Calibration Certificate containing the calibration and configuration data for future reference.

Verify that the model number imprinted on the nameplate matches the number on the packing slip and the purchase order. Report any discrepancies to the factory. Record the serial number for future reference when ordering parts.

Model Number _____

Serial Number _____

2.2 Electrostatic Discharge (ESD) Handling Procedure



Magnetrol's electronic instruments are manufactured to the highest quality standards. These instruments utilize electronic components which may be damaged by static electricity present in most work environments. The following steps are recommended to reduce the risk of component failure due to electrostatic discharge:

1. Ship and store circuit boards in anti-static bags. If an anti-static bag is not available, wrap board in aluminum foil. Do not place boards on foam packing materials.
2. Use a grounding wrist strap when installing and removing circuit boards. A grounded workstation is also recommended.
3. Handle printed circuit boards only by the edges. Do not touch components or connector pins.
4. Ensure that all electrical connections are completely secure and none are partial or floating. Ground all equipment to a good earth ground.

NOTE: The instrument is rated per IEC 1010 for use in Installation Category II, Pollution Degree 2.

2.3 Mounting

2.3.1 Electronics

The instrument is rated for use in Class I, Division 1 and Class I, Division 2 areas. The enclosure is also rated NEMA 4X. Remote electronics (optional) should be installed in an easy to access location within 50 feet (15 meters) of the sensor (longer cable lengths are available—consult factory). The electronics should not be installed in areas where ambient temperature exceeds +160° F (+70° C). If ambient temperature is between -4° to -40° F (-20° to -40° C), the unit will operate but the display will not be readable.

Provide watertight seals for all wiring entrances in the enclosure to maintain the NEMA 4X rating. Use appropriate NEC section when installing the instrument.

NOTE: A switch or circuit breaker should be installed in close proximity to the equipment and within easy reach of the operator. It should be marked as the disconnecting device for the equipment.

2.3.2 Probe

Proper installation of the probe in the pipe or duct is essential for accurate air or gas flow measurement. Normal procedures for installing any type of flow element should be followed. See Magnetrol bulletin 54-131 or STI bulletin 95-165 for additional information on probe location.

A flow arrow is etched on the sides of the probe to designate flow direction. The instrument is calibrated with the flow in this direction. Ensure that the flow arrow is aligned in the direction of flow. The instrument is unable to recognize flow direction if inserted with the flow arrow in the wrong direction.

It may be necessary to rotate the head of the instrument to view the display while maintaining the proper flow orientation.

It is generally recommended that the sensor be located in the center of the pipe. This location provides less sensitivity to changes in flow profile. Sensors mounted through compression fittings have the ability to field adjust the sensor to the desired location by using the dimensions as shown in Figure 1a.

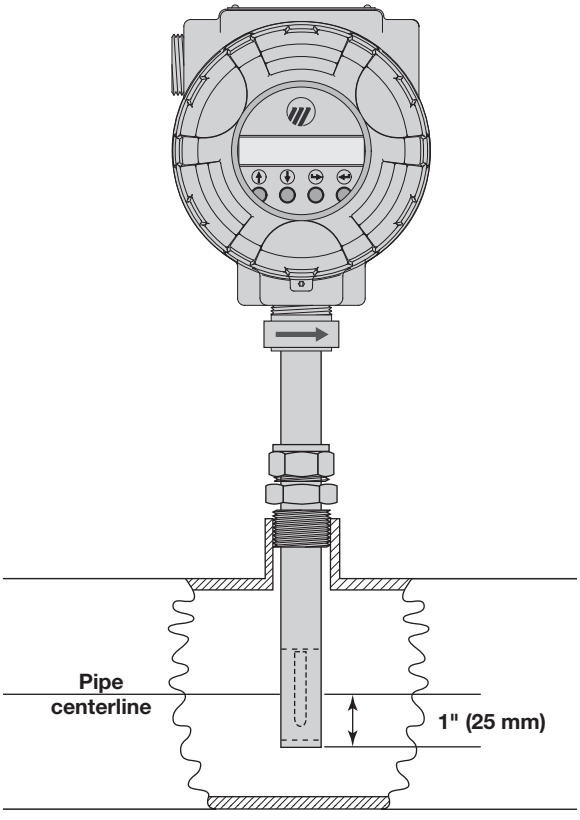


Figure 1a
Probe Installation into Pipe or Duct Using a Compression Fitting

Various methods of mounting the probe include compression fittings, threads, and flanged connections. Refer to probe model numbers. The insertion probe can be installed through a compression fitting. The use of a bored-through fitting with ¾" or 1" NPT connection for ¾" outside diameter tube is recommended.

Pressure ratings of the compression fitting:

Stainless steel ferrules:
1500 psig at +70° F (103 bar at +20° C)
1375 psig at +400° F (95 bar at +200° C)

Teflon ferrules:
100 psig (7 bar)

The use of Teflon ferrules should be considered if repeated reposition of the sensor is considered. The stainless steel ferule can only be tightened once as it makes a permanent indentation on the probe. If using a compression fitting with stainless steel ferrules, ensure that the probe is in the desired location before tightening.

NOTE: The TA2 flow measurement is based on a fully developed turbulent flow profile in a pipe with the specified inner diameter. Accuracy will be affected if these conditions are not obtained. Installing the probe in a tee is not recommended as the flow profile and the flow area are distorted (See figure 1b).

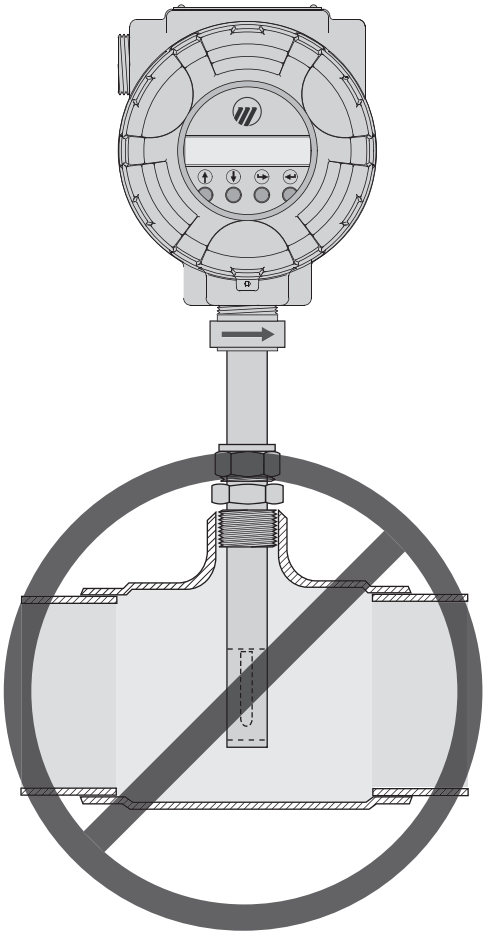


Figure 1b
Probe Installation into a Tee Fitting is Not Recommended

For applications where it is desirable to install or remove the probe without having to shut down the process, Magnetrol's Retractable Probe Assembly (RPA) can be utilized. See the TA2 Sales Brochure (Magnetrol bulletin 54-130/STI bulletin 95-164) for more information.

WARNING To avoid potential damage or injury, never loosen a compression fitting while sensor is under pressure.

NOTE: Remote electronics is recommended for operating temperatures greater than +250° F (+120° C) or in locations where the temperature of the electronics will exceed +160° F (+70° C). Optionally, an insertion probe with extended probe length to provide at least four inches (100 mm) between the electronics and the compression fitting can be utilized.

NOTE: The sensor must be installed in a location where moisture cannot drip or come in contact with the heated element. Any contact with condensed moisture in the gas flow will cause a false high flow indication. Consider mounting the probe at a 45° angle from top, from the side or bottom of the pipe to minimize possibility of condensed moisture running down the probe and contacting the sensor. In extreme cases, it may be necessary to insulate or even heat trace the pipe to prevent the condensation of moisture.

The TA2 with an insertion probe provides a point measurement and assumes that the velocity profile is uniform over the entire width of the pipe or duct. The user has the ability to compensate the flow measurements based upon flow profile considerations under the Advanced Configuration section of the software. *See Section 2.5.9.*

NOTE: If equipment is used in a manner not specified by manufacturer, protection provided by equipment may be impaired.

2.4 Wiring

There are two holes in the electronics enclosure for ¾" NPT or M20 connections, one for input power and one for the 4-20 mA output signal.

2.4.1 Power and Signal Connection

The instrument is factory wired to accept 24 VDC, 120 VAC, or 240 VAC. Check the nameplate to ensure that the instrument matches the desired input power. All power wiring connections are made to terminal block TB1. Refer to Figure 3.

NOTE: The terminal blocks accept 14 - 26 AWG wire for power wires. For supply connection, use wire with a minimum rating of +167° F (+75° C) as required by process conditions.

Caution: OBSERVE ALL APPLICABLE ELECTRICAL CODES AND PROPER WIRING PROCEDURES.

1. Make sure the power source is turned off.
2. Unscrew and remove housing cover of wiring section. Refer to Figure 2.
3. Pull power supply and control wires through conduit connection.
4. Connect power leads to proper terminals of the terminal block TB1. Refer to Figure 3.

a. 120 VAC - Connect "hot" wire to terminal marked L1 and the "neutral" wire to the terminal marked L2/N.

b. 240 VAC - Connect one wire to terminal marked L1 and the other wire to the terminal marked L2/N.

c. 24 VDC - Connect wires to terminals (+) and (-) on the terminal block.

NOTE: The green screw in the rear of the housing should be used for earth ground.

5. Connect the 4-20 mA signal wiring to terminal block TB2. Refer to *Section 2.4.3*.
6. Replace housing cover. Installation is complete.

Caution: In hazardous areas, do not apply power to the unit until the conduit is sealed and the enclosure cover is screwed down securely.

NOTE: Install using Teflon tape at all conduit entries (maximum 2 turns)

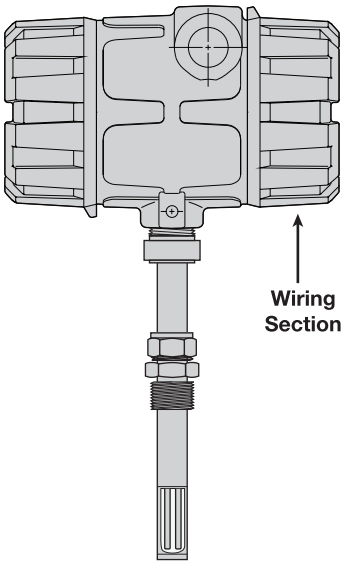


Figure 2
Wiring Housing Cover

2.4.2 Ground Connection

The instrument must be grounded in accordance with Article 250 of the National Electric Code.

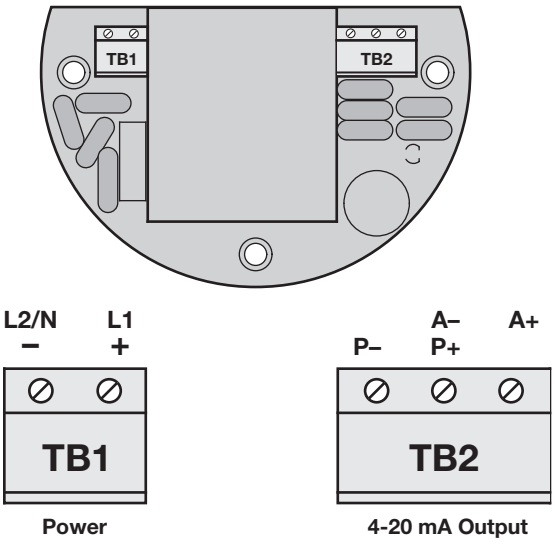


Figure 3
Wiring Connections
Input Wiring Board

2.4.3 4-20 mA Output

A 4-20 mA output of the flow rate is available at terminal block TB2. The output signal is isolated from the instrument. An active or a passive connection is available.

Active Connection:
Use the active connection when the TA2 is providing power for the 4-20 mA signal. Use connections A- and A+ (see figure 3). The active connection will drive a 1000 ohm loop resistance.

Passive Connection:
Use the passive connection when an external power supply or the control system is used to power the 4-20 mA loop. Use connections P- and P+ (see figure 3). The resistance is dependent upon the customer supplied power supply.

2.4.4 Remote Electronics

If the electronics are remote from the probe a terminal block is provided in the enclosure on the probe. The connection between the probe and electronics should be an 8 conductor shielded cable (Belden 8104). This cable length can be adjusted in the field. Maximum cable length is 50 feet (15 meters). Longer lengths available when provided by Magnetrol.

Caution: The probe and electronics are calibrated and shipped as a matched set. The model number is indicated on both the electronics nameplate and the probe nameplate; verify that they are the same.

2.4.4.1 Probe Wiring

The probe housing contains a terminal block for ease of wiring between the probe and the electronics. Connections from the probe to the terminal strip are prewired at the factory. An 8-wire shielded interconnecting cable (Belden 8104) from the probe housing to the instrument is required. Refer to Figure 4 for wiring connections in the probe enclosure. The connections to the circuit board are located in the main electronics shown in Figure 5.

1. Remove electrical power to the instrument
2. Remove and unplug the display module if provided.
3. Remove the two hex head fasteners using a ¼" socket. This will remove a board set consisting of the logic circuit board and the power supply circuit board.
4. Unplug the electrical connections at J1. Refer to Figure 5.
5. Probe wiring connections are made to TB3 on the back side of the power supply PCB assembly. Refer to Figure 5.
6. Ensure that the bare shield wire does not touch the circuit board. If using Magnetrol/STI supplied cable, protection of the shield is provided; if using customer supplied cable, the bare shield wire must be covered.
7. Re-attach the electrical connections to J1
8. Reassemble the circuit boards in the enclosure
9. Reinstall the display module if provided
10. Apply power to the instrument.

Caution: Ensure that the shield wire does not contact the circuit board.

Wiring Color Code

Wire	Terminal	Sensor
White	Sensor 1	Temp Sensor
Blue	Sensor 2	Flow Sensor
Black	Sensor 3	Ground
Brown	Sensor 4	Heater Ground
Orange	Sensor 5	Heater

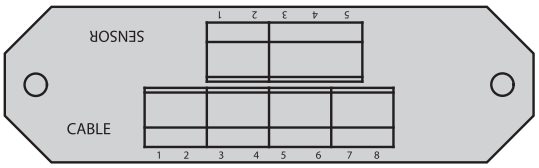


Figure 4
Remote Probe Wiring Connection

Probe Enclosure/Terminal Strip

Wire	Remote Terminal	Sensor interface board (TB3)
Green/White	Cable 1	1
White/Green	Cable 2	2
Blue/White	Cable 3	3
White/Blue	Cable 4	4
Brown/White	Cable 5	5
White/Brown	Cable 6	6
Orange/White	Cable 7	7
White/Orange	Cable 7	7
Shield	Cable 8	8

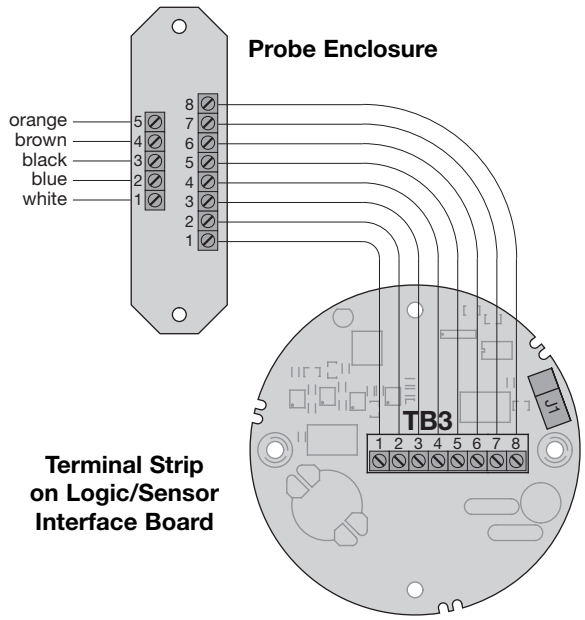


Figure 5

2.5 Configuring the Transmitter

The TA2 electronics are easy to set up and configure to the user's specifications. If specified with the order, the configuration settings are programmed into the instrument at the factory. If not, or if the user wants to modify the configuration settings, follow these instructions for configuring the instrument. The primary structure of the software is divided into seven main groups:

Measured Values	View Selected Values
System Config	Configuration of essential programming information
I/O Config	Configure all input/output functions
Advanced Config	Additional configuration which affects the unit operation
Diagnostics	Test operation of instrument
Factory Configuration	Factory calibration information
Run mode	Normal operating mode

All necessary information can be input using the 4 button keypad located on the display module or via HART if supplied.

2.5.1 Initialization

When power is first applied to the TA2 there is an initialization period for the sensor to reach stabilization. During this time the TA2 will output a 4 mA signal and the display (if provided) will read "Initializing TA2".

Only after the sensor has stabilized and a valid flow measurement is obtained will the display show a flow measurement. The output signal will be active and the totalizer will begin counting.

2.5.2 Operator Keypad

↑ UP arrow	Scroll to the previous item.
↓ DOWN arrow	Scroll to the next item.
↵ DELETE	Exit the current item/menu level or delete an entry.
↵ ENTER	Enter next menu level or enter information for the current menu item.

When the symbol ↕ is displayed on the top line, press ↵ to program this selection, or press ↑ or ↓ to proceed to the next selection.

To change the value on the bottom line, press ↑ or ↓; then press ↵ to accept.

NOTE: Pressing ↵ will back out of the configuration menu and return to run mode.

NOTE: If a key is not pressed for 5 minutes, the display returns to the run mode.

2.5.3 Data Entry

There are three basic types of data which are easily entered with the key pad. These are Selection, Numeric, and Alphanumeric

2.5.3.1 Selection

Data is selected from a pre-specified list of entries. When ↵ is depressed on a menu item that refers to a list of selections, key functions are

Up (↑)	Previous selection in the list.
Down (↓)	Next selection in the list.
Del (↵)	Returns to menu mode without changing present selection.
Enter (↵)	Accepts the present selection and returns to menu mode.

2.5.3.2 Numeric Entry

Numeric entries are left justified with the left most position used for either a "-" negative symbol or blank which implies a positive value. The values are entered from left to right.

This mode is entered when ↵ is depressed on a menu item requiring a saved numeric value. The ↑ and ↓ keys scroll through numeric values at the cursor location. The → and ↵ keys move the cursor.

Up (↑)	Scroll forward through digits in the sequence 0, 1, …, 9, '.', 0. In the left position, cycles between "-" (minus symbol) and blank.
Down (↓)	Scroll through digits in the sequence 9, 8, …, 0, '.', 9. In the left position, cycles between "-" (minus symbol) and blank.
Del (→)	Moves the cursor to the left. All characters to the right of the new cursor location are blanked. If the cursor is located at the left most position, the value is deleted and the saved value is redisplayed.
Enter (↵)	Moves the cursor to the right. If the cursor is located at a blank position, the new value is saved and the display returns to the previous menu.

If ↑ or ↓ is depressed for 1.5 seconds, the character sequence scrolls at 3 per second until the key is released.

2.5.3.3 Alphanumeric Entry

The Tag line permits the user to identify the instrument with a title. This mode is selected in the Advanced Configuration menu selection. See *Section 2.5.9*. When this mode is entered, a cursor marks the left-most character on the 2nd line.

Up (↑)	Scrolls forward through graphic characters
Down (↓)	Scrolls backward through graphic character
Del (→)	Moves the cursor to the left. If the cursor is located at the left most character position, the tag line is deleted and the saved tag line is immediately redisplayed
Enter (↵)	Moves the cursor to the right. If the cursor is located at the rightmost character position, the new tag line is saved and the previous menu is displayed

If the ↑ or ↓ is depressed for 1.5 seconds, the character sequence scrolls at 3 per second until the key is released.

2.5.4 Password

A password protection system restricts access to portions of the menu which affect the unit's operation and configuration. A password will be requested whenever programming changes are requested. The password may be changed to any three digit number. This procedure is described under Advanced Configuration menu. See *Section 2.5.9*.

An additional password is provided if probe replacement is required. See *Probe Replacement, Section 3.6.1*.

Caution: The instrument is shipped from the factory with the password of 200. The user can change the password. If the password is misplaced or forgotten, please consult the factory for assistance. See *Troubleshooting Guide, Section 3.5.5.*

2.5.5 Main Menu

The Run Mode is the normal display for the TA2. The top line of the display can be titled to provide a location of the instrument (see Title Line in the Advanced Configuration section 2.5.9). The information the second line will depend upon the user selection of "mA controlled by" in the I/O Configuration sub menu. The user has the option of selecting other displayed values such as Flow, Mass, Temperature, Totalized Flow, or mA output. These values will rotate at 1.5 second intervals on the display during operation. Run Mode appears on power-up or after a 5 minute period with no keypad activity.

The main menu is used to access the various subroutines. From the Run mode, press any key to enter the Main Menu. The following chart defines the various selections available.

Display	Option	Action if ↵ is pressed
Measured Value ↕	Press ↵ to select or ↑ or ↓ to continue	Enter Measured Values menu
System Config ↕	Press ↵ to select or ↑ or ↓ to continue	Enter System Configuration menu
I/O Config ↕	Press ↵ to select or ↑ or ↓ to continue	Enter Input/Output Configuration menu
Adv Config ↕	Press ↵ to select or ↑ or ↓ to continue	Enter Advanced Configuration menu
Diagnostics ↕	Press ↵ to select or ↑ or ↓ to continue	Enter Diagnostic menu
Factory Config ↕	Press ↵ to select or ↑ or ↓ to continue	Enter Factory Configuration menu
Run mode ↕	Press ↵ to select or ↑ or ↓ to continue	Return to Run Mode

2.5.6 Measured Values

The Measured Values menu is used to display the current values measured by the TA2 and determine which parameters will be shown on the display during run mode. Enter this section by pressing ↵ when Measured Values ↕ is displayed from the Main Menu.

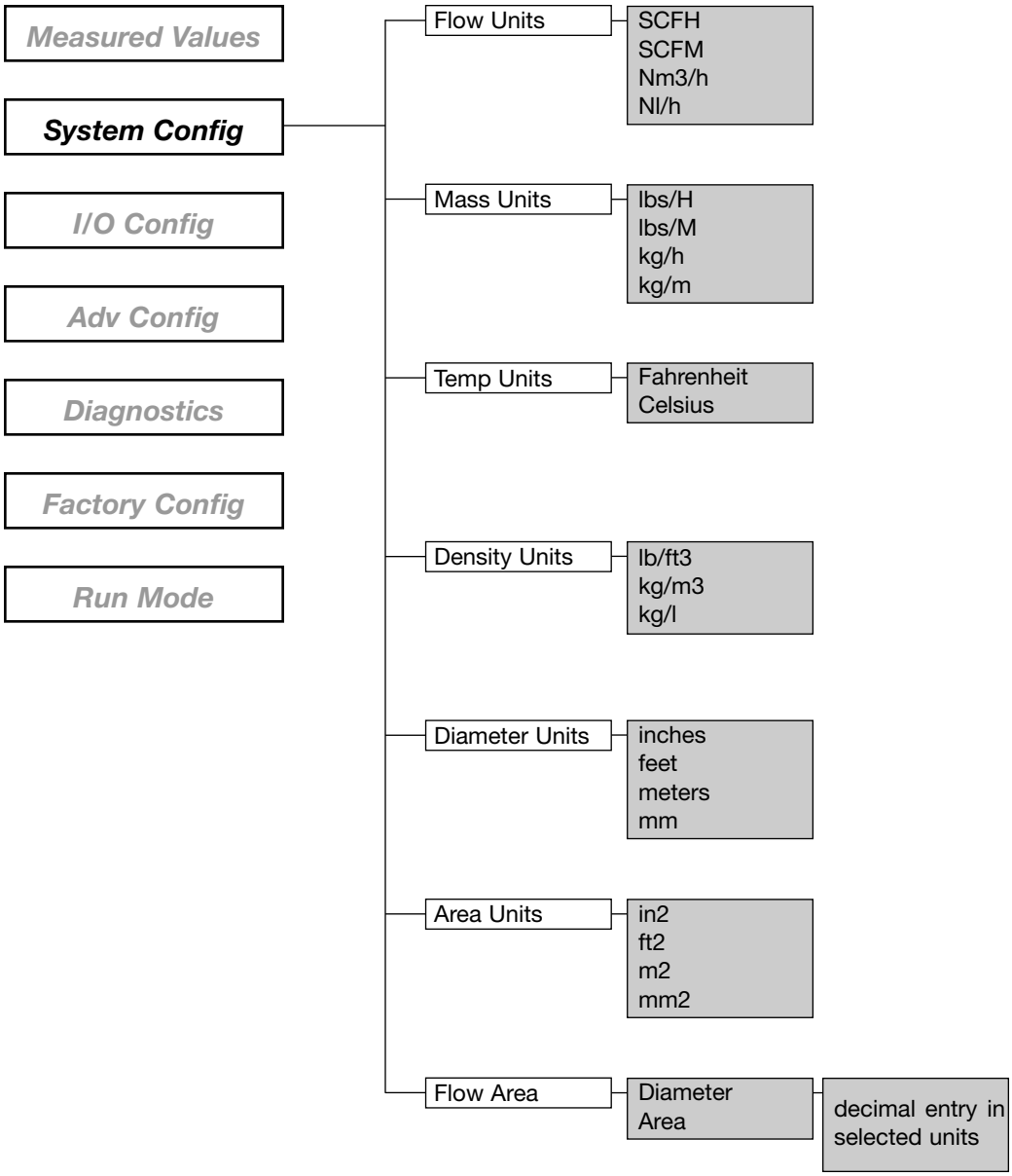
Display	Option	Action	Comments
Volume Flow ↕ xxxx units	Press ↵ to select or ↑ or ↓ to continue	Press ↑ or ↓ to cycle between On Main Display and Off Main Display; press ↵	
Mass Flow ↕ xxxx units	Press ↵ to select or ↑ or ↓ to continue	Press ↑ or ↓ to cycle between On Main Display and Off Main Display; press ↵	
Temperature ↕ xxxx units	Press ↵ to select or ↑ or ↓ to continue	Press ↑ or ↓ to cycle between On Main Display and Off Main Display; press ↵	Temperature measurements are not accurate at velocity below 50 SFPM
Loop Current ↕ xxxx units	Press ↵ to select or ↑ or ↓ to continue	Press ↑ or ↓ to cycle between On Main Display and Off Main Display; press ↵	
Totalized Flow ↕ xxxx units	Press ↵ to select or ↑ or ↓ to continue	Press ↑ or ↓ to cycle between On Main Display and Off Main Display; press ↵	
Previous Menu ↕ ↵ to select	Press ↵ to select or ↑ or ↓ to continue		Returns to previous menu or cycle through measured values

2.5.7 System Configuration Menu

The System Configuration menu is used to select the display units and enter specific information for the application. Access this section by pushing ↵ when System Config ↕ is displayed from the Main Menu.

To calculate the flow or mass, it is necessary to accurately enter the area of the pipe or duct. If the pipe or duct is circular, simply enter the value of the inside diameter; the cross sectional area of the pipe is automatically calculated. If the duct is rectangular, skip over the entry of diameter, and directly enter the cross sectional area in the area section. The instrument will then back calculate an equivalent diameter.

Display	Option	Action	Comments
Flow Units ↕ SCFM	Press ↵ to select units or ↑ or ↓ to continue	Press ↑ or ↓ to scroll between selections; press ↵	Choice of standard cubic feet per hour (SCFH), standard cubic feet per minute (SCFM), normal cubic meters per hour (Nm3/h), normal liters per hour (Nl/h)
Mass Units ↕ LBS/H	Press ↵ to select units or ↑ or ↓ to continue	Press ↑ or ↓ to scroll between selections; press ↵	Choice of pounds per minute (lbs/M), pounds per hour (lbs/H), kilograms per minute (kg/m), kilograms per hour (kg/h)
Temp Units ↕ Fahrenheit	Press ↵ to select units or ↑ or ↓ to continue	Press ↑ or ↓ to scroll between selections; press ↵	Choice of Fahrenheit, Celsius
Density Units ↕ LB/ Ft3	Press ↵ to select units or ↑ or ↓ to continue	Press ↑ or ↓ to scroll between selections; press ↵	Choice of pounds per cubic foot (lb/ft3), kilograms per liter (kg/liter), kilograms per cubic meter (kg/m3)
Diameter Units ↕ Feet	Press ↵ to select units or ↑ or ↓ to continue	Press ↑ or ↓ to scroll between selections; press ↵	Choice of inches, feet, meters, millimeters (mm)
Area Units ↕ Ft2	Press ↵ to select units or ↑ or ↓ to continue	Press ↑ or ↓ to scroll between selections; press ↵	Choice of square inches (in2), square feet (ft2), meters squared (m2), millimeters squared (mm2)
Flow Area ↕ ↵ to select	Press ↵ to enter flow area or ↑ or ↓ to continue	Press ↑ or ↓ to scroll between selections; press ↵	Enter the cross sectional area of the pipe or duct, or the inside diameter
		Diameter xxx units	Enter the inside diameter (if circular), press ↵ to accept or press ↑ or ↓
		Area xxx units	The cross sectional area is calculated based on the diameter. If rectangular, enter the flow area
Previous Menu ↕ ↵ to select	Press ↵ to select units or ↑ or ↓ to continue		Returns to previous menu or cycle through System Configuration



Default Password is 200

2.5.8 I/O Configuration Menu

The I/O Configuration menu is used to set up the operations of 4–20 mA output, the totalizer, and the HART Poll Address. Access this section by pushing ↵ when I/O CONFIG ↕ is displayed.

2.5.8.1 4-20 mA

To access the 4-20 mA signal, scroll ↑ or ↓ until the display shows 4-20 mA CONFIG ↕, press ↵.

Display	Option	Action	Comments
CONTROLLED BY ↕ FLOW	Press ↵ to select units or ↑ or ↓ to continue	Press ↑ or ↓ to cycle between options	Choice are Flow, or Mass
4 mA SET POINT ↕ XXXXX UNITS	Press ↵ to select units or or to continue	Set mA point using keypad	Enter value for 4 mA point. Units are based upon selection "Controlled by"
20 mA SET POINT ↕ XXXX UNITS	Press ↵ to select units or ↑ or ↓ to continue	Set mA point using keypad	Enter value for 20 mA point
FAULT MODE ↕ XX mA	Press ↵ to select units or ↑ or ↓ to continue	Press ↑ or ↓ to cycle between 22 mA, 3.6 mA or hold	Select status of 4-20 mA loop in event of fault
PREVIOUS MENU ↕ ↵ TO SELECT	Press ↵ to select or or ↑ or ↓ continue		Returns to previous menu or cycle through 4-20 mA

2.5.8.2 Totalizer

The totalizer maintains a continuous, running total of the flow in selectable units. It also provides elapsed time since the last totalizer reset. The totalizer utilizes eeprom memory, eliminating the need for a battery backup. The totalizer can be reset to zero via the software configuration menu or by the HART communication. When power is interrupted, the totalizer will restore to its last saved value.

To configure the Totalizer operation, scroll ↑ or ↓ until the display shows TOTALIZER ↕, press ↵.

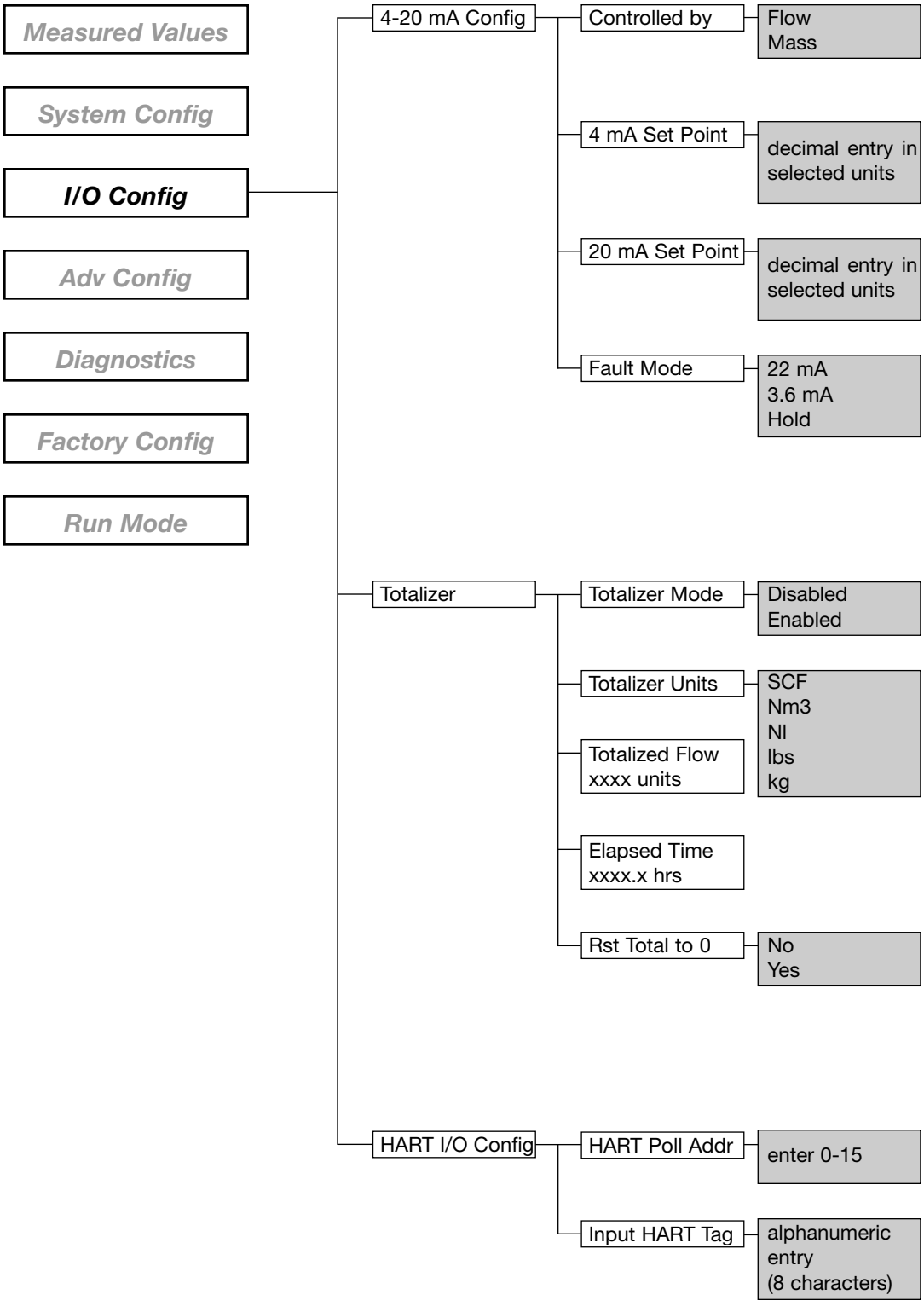
Display	Option	Action	Comments
TOTALIZER MODE ↕ DISABLED	Press ↵ to select units or ↑ or ↓ to continue	Press ↑ or ↓ to cycle through options	Enables or disables totalizer operation
TOTALIZER UNITS ↕ XXXXX UNITS	Press ↵ to select units or ↑ or ↓ to continue	Press ↑ or ↓ to cycle through options	Cycles between SCF, Nm3, pounds, kilograms
TOTALIZED FLOW ↕ XXXXX UNITS	Press ↑ or ↓ to continue		Displays the totalized flow since last reset
ELAPSED TIME ↕ XX.X HOURS	Press ↑ or ↓ to continue		Displays the elapsed time since the totalizer was last reset
RST TOTAL TO 0 ↕ ↵ TO SELECT	Press ↵ to select units or ↑ or ↓ to continue	Press ↵ to reset or to return	Resets the totalizer to 0000
PREVIOUS MENU ↕ ↵ TO SELECT	Press ↵ to select or or ↑ or ↓ continue		Returns to previous menu or cycle through Totalizer operation

2.5.8.3 HART Configuration

To configure the HART address, scroll ↑ or ↓ until the display shows HART I/O CONFIG ↕, press ↵. Note that this menu selection will appear even on units that are not equipped with HART. If HART communication is desired, ensure that the correct model is ordered.

NOTE: A non-zero polling address should only be used for multipoint network configuration. In this situation loop current is held at 4 mA regardless of the flow rate.

Display	Option	Action	Comments
HART POLL ADDR ↕ 0	Press ↵ to select or ↑ or ↓ to continue	Enter value of 0-15 using keypad	
INPUT HART TAG ↕ ↵ TO SELECT	Press ↵ to select or ↑ or ↓ to continue	Enter alphanumeric entry for HART display title	See section 2.5.3.3 for information on alphanumeric entry
PREVIOUS MENU ↕ ↵ TO SELECT	Press to select or ↑ or ↓ or to continue		Returns to previous menu or cycle through HART Configuration selection

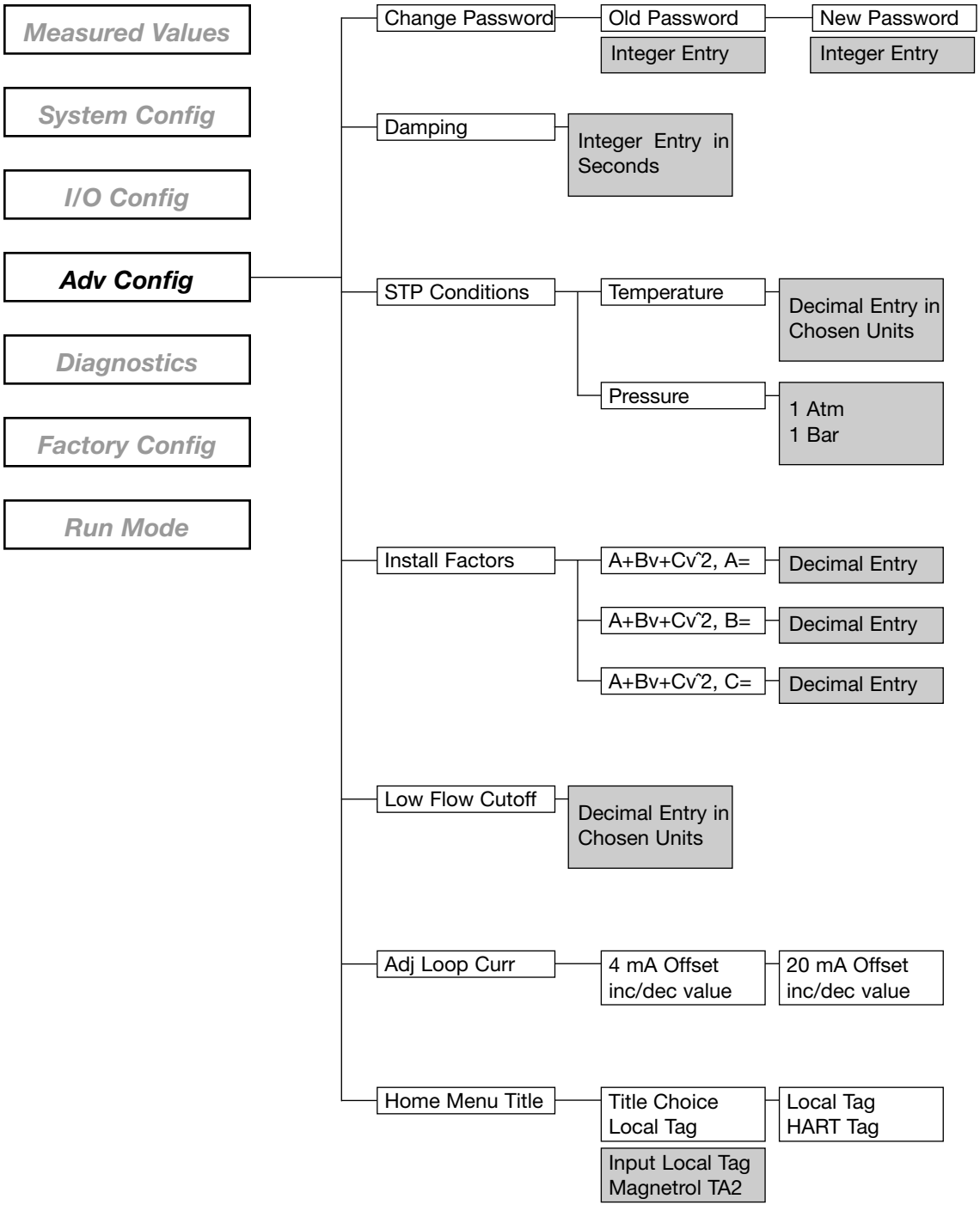


Default Password is 200

2.5.9 Advanced Configuration

The Advanced configuration menu sets advance parameters not normally used in the operation of the instrument. To access Advanced Configuration, scroll ↑ or ↓ until the display shows ADV CONFIG ↕, press ↵.

Display	Option	Action	Comments
CHANGE PASSWORD ↕ ↵ TO SELECT	Press ↵ to select or ↑ or ↓ to continue	ENTER OLD PASSWORD ENTER NEW PASSWORD	Change the instrument password
DAMPING (0-15) ↕ 0.0 SECS	Press ↵ to select or ↑ or ↓ to continue	Using the key pad, enter new Damping value 0.0 to 15.0 sec.	Damping factor is given in time constants
STP CONDITIONS ↕ ↵ TO SELECT	Press ↵ to select or ↑ or ↓ to continue	Enter value for Standard Temperature and select Standard Pressure value	Permits user to change STP conditions See Configuration Definitions on pg.51
INSTALL FACTORS ↕ ↵ TO SELECT	Press ↵ to select or ↑ or ↓ to continue	Enter new values for A, B & C	Permits user to adjust flow measurement. See Configuration Definitions on pg.51
LOW FLOW CUTOFF ↕ XXX UNITS	Press ↵ to select or ↑ or ↓ to continue	Enter new low flow dropout value in selected units of measurement	The TA2 will ignore flow readings below this value; See Section 3.5.4
ADJ LOOP CURR ↕ ↵ TO SELECT	Press ↵ to select or ↑ or ↓ to continue (password protected)		
		4 MA OFFSET	Use ↑ or ↓ to adjust loop output until 4 mA is exact
		20 MA OFFSET	Use ↑ or ↓ to adjust loop output until 20 mA is exact
HOME MENU TITLE ↕ ↵ TO SELECT	Press ↵ to select or ↑ or ↓ to continue	Press ↵ then ↑ or ↓ to cycle between local tag and HART tag.	The display will show either a local tag or the HART tag.
		Press ↓ to input LOCAL TAG	See section 2.5.3.3 for information on alphanumeric entry.
PREVIOUS MENU ↕ ↵ TO SELECT	Press ↵ to select or ↑ or ↓ to continue		Returns to previous menu or cycle through Advanced Configuration

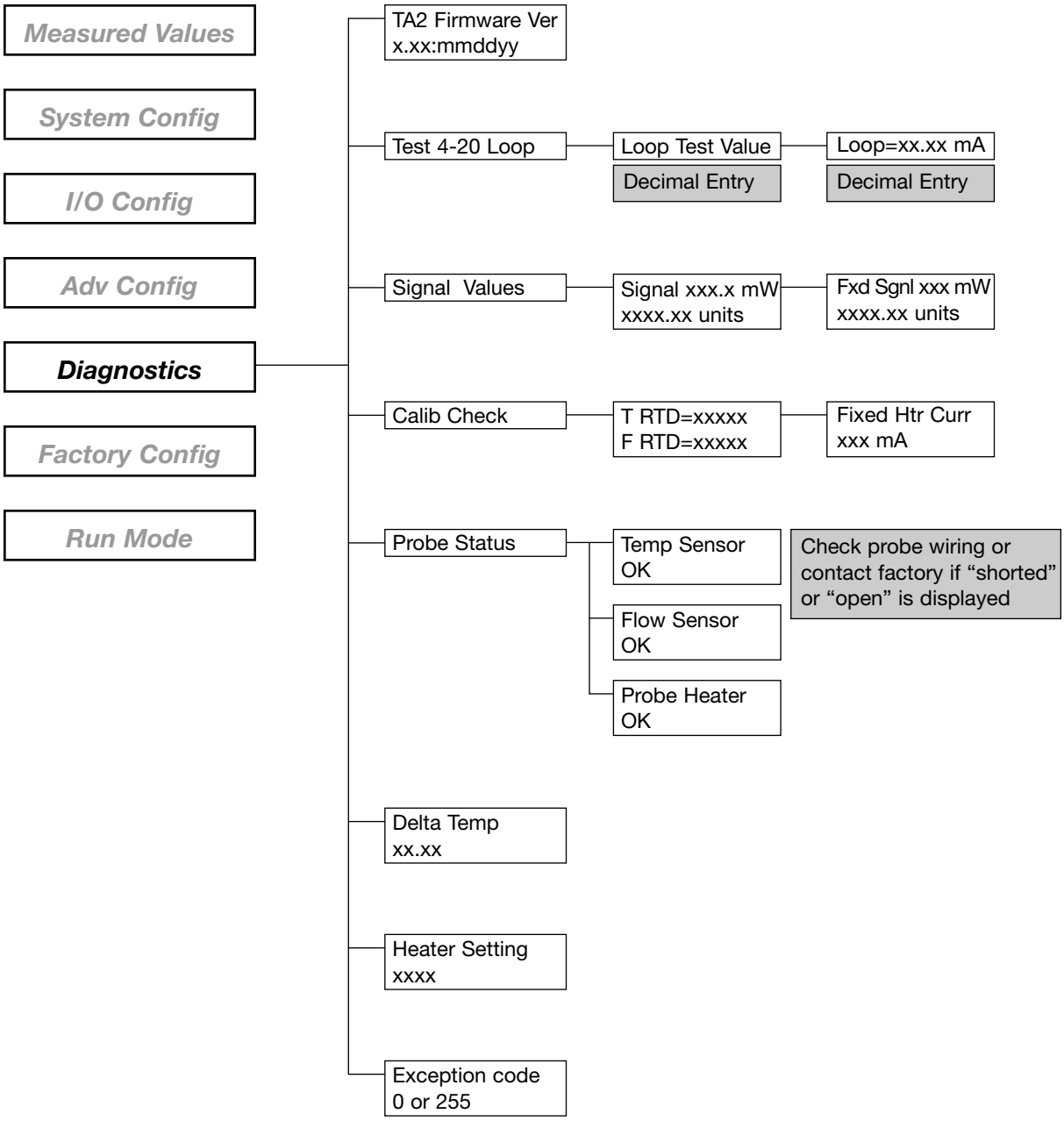


Default Password is 200

2.5.10 Diagnostics Menu

The Diagnostics menu provides a method of testing the instrument's functionality. It also has useful information for troubleshooting. To access Diagnostics, scroll ↑ or ↓ until the display shows DIAGNOSTICS ↕, press ↵.

Display	Option	Action	Comments
TA2 FIRMWARE VER ↕ X.X MMDDYY	Press ↑ or ↓ to continue		Display firmware version number and date
TEST 4-20 LOOP ↕ ↵ TO SELECT	Press ↵ to select or ↑ or ↓ to continue (password protected)	Enter desired current output	Allows user to output desired 4-20 mA signal. Press ↵ when complete to return to normal operation.
SIGNAL VALUE ↕ ↵ TO SELECT	Press ↵ to select or ↑ or ↓ to continue	Displays Sensor signal strength and corresponding flow rate. ↑ or ↓ permits user to change signal strength and view calculated flow rate	Allows user to vary signal strength and view flow rate. Press any button when complete to return to normal operation. Compare readings with original calibration certificate.
CALIB CHECK ↕ ↵ TO SELECT	Press ↵ to select or ↑ or ↓ to continue	Displays various A/D values. Press ↵ to view Heater Current, press ↵ to exit	This is used with the Probe Simulation Module.
PROBE STATUS ↕ ↵ TO SELECT	Press ↵ to select or ↑ or ↓ to continue	Press ↑ or ↓ to cycle between the temperature sensor, flow sensor and heater	Displays status of the sensors and the heater. Status will be either "OK", "Shorted", or "Open". Consult Magnetrol if a problem is noted.
DELTA TEMP ↕ NN.MM	Press ↑ or ↓ to continue		Displays the set point temperature difference which the TA2 is controlling
HEATER SETTING ↕ AAAA	Press ↑ or ↓ to continue		Displays the heater setting used to obtain the desired temperature difference. Ranges between 0 and 4095
EXCEPTION CODE ↕ 0	Press ↑ or ↓ to continue		Magnetrol use only. Advise Magnetrol if other than 0 or 255
PREVIOUS MENU ↕ ↵ TO SELECT	Press ↵ to select or ↑ or ↓ to continue		Returns to previous menu or cycle through Diagnostics Menu.



Default Password is 200

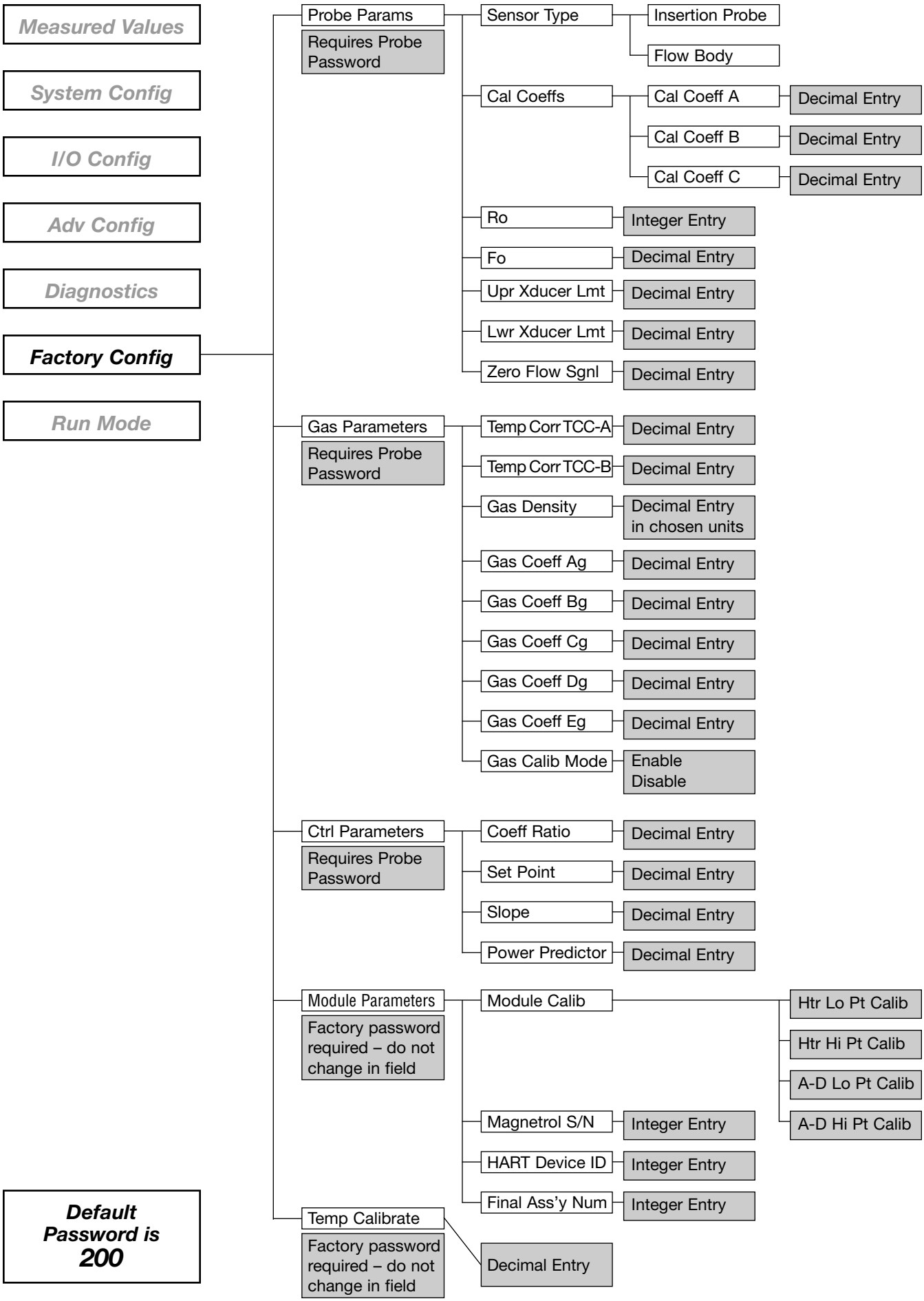
2.5.11 Factory Configuration

The Factory Configuration is used during initial calibration of the instrument. Access to this section is generally only required for review of the information.

Replacement of either the probe or the logic circuit board will require re-entry of calibration data. This is accomplished using the probe password of 2200. A replacement probe will be accompanied with a new calibration certificate which will provide the new calibration information. Replacement of the logic circuit board will require re-entry of the original calibration data from the initial calibration certificate. Data under Probe Params, Gas Params, and Ctrl Params will need to be verified or re-entered. See *Section 3.6*.

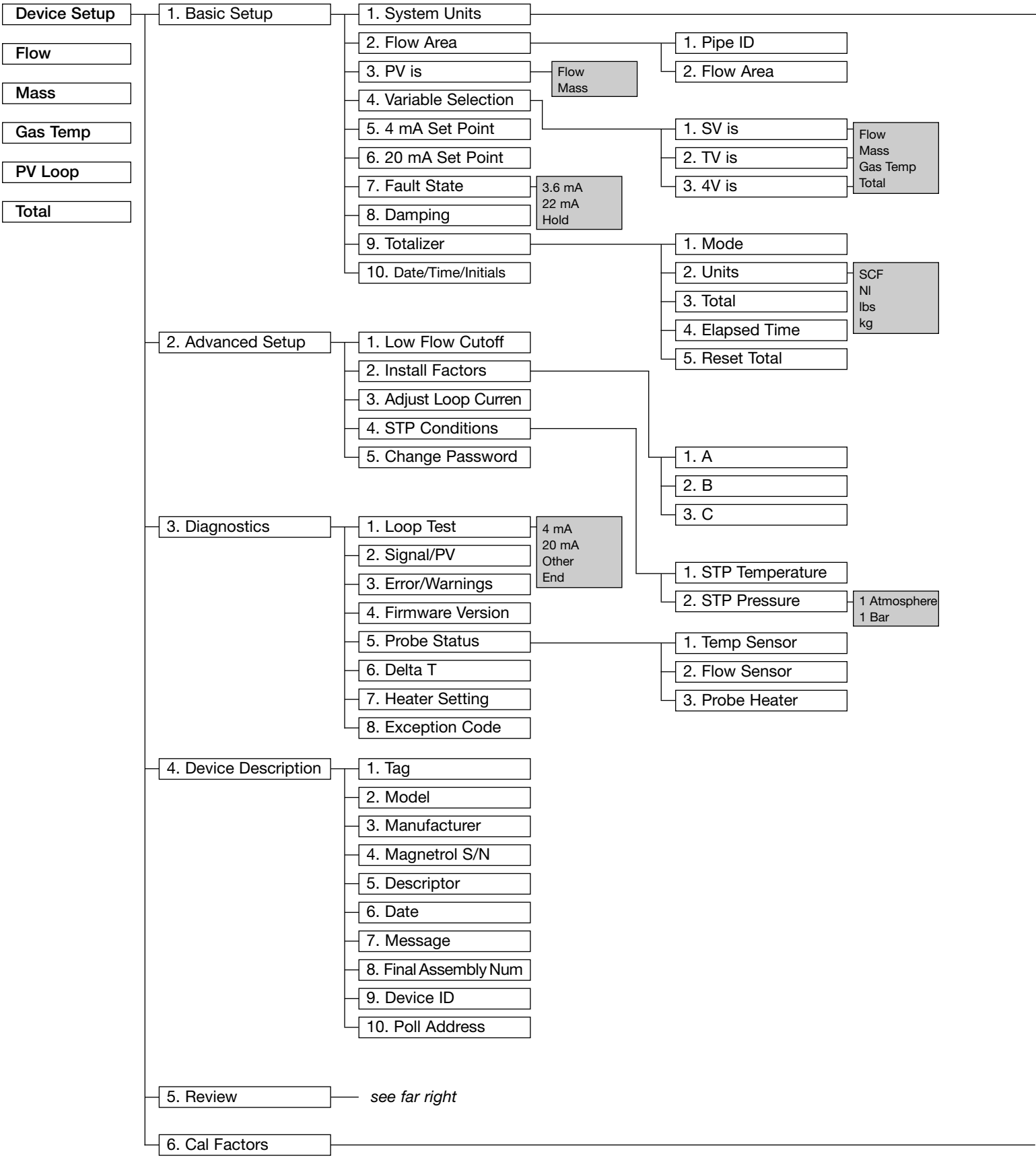
To access Factory Configurations, scroll ↑ or ↓ until the display shows FACTORY CONFIG ↕, press ↵.

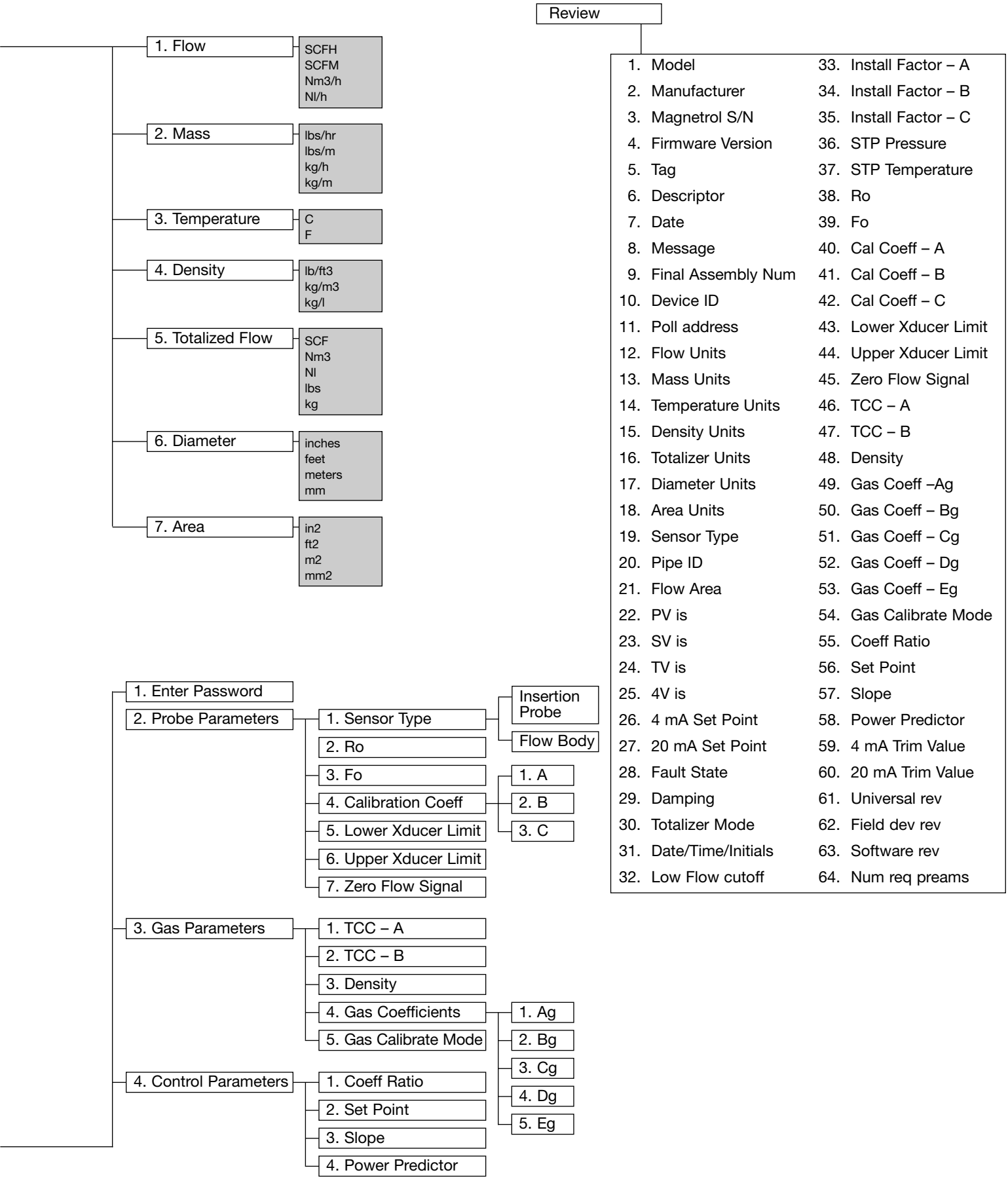
Display	Option	Action	Comments
PROBE PARAMS ↕ ↵ TO SELECT	Press ↵ to select or ↑ or ↓ to continue	Scroll through entries	These factors will require changing if probe is replaced.
GAS PARAMETERS ↵ TO SELECT	Press ↵ to select or ↑ or ↓ to continue Calibration Certificate	Scroll through entries and compare against data on the calibration certificate	These factors will require changing if probe is replaced. Gas Calib mode is used during factory calibration.
CTRL PARAMETERS ↕ ↵ TO SELECT	Press ↵ to select or ↑ or ↓ to continue	Scroll through entries and compare against data on Calibration Certificate	These factors will require changing if probe is replaced.
MODULE PARAMS ↕ ↵ TO SELECT	Press ↵ to select or ↑ or ↓ to continue	Scroll through entries	These are factory set values and should not be changed.
TEMP CALIBRATE ↕ XXX.XX	Press ↑ or ↓ to continue	Used by Magnetrol during initial calibration	This value should not be changed in field.
PREVIOUS MENU ↕ ↵ TO SELECT	Press ↵ to select or ↑ or ↓ to continue		Returns to previous menu or cycle through Factory Configuration.

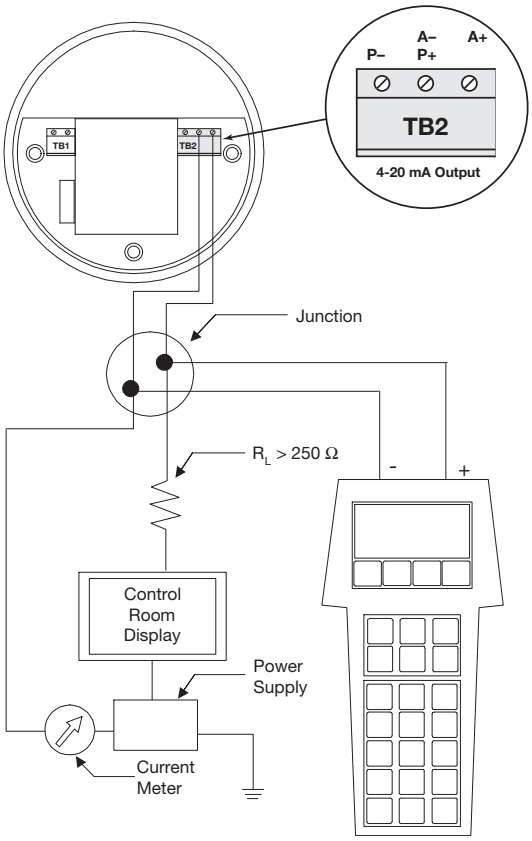

Measured Values
System Config
I/O Config
Adv Config
Diagnostics
Factory Config
Run Mode
Default Password is 200
Probe Params
Requires Probe Password
Sensor Type
Insertion Probe
Flow Body
Cal Coeffs
Cal Coeff A
Decimal Entry
Cal Coeff B
Decimal Entry
Cal Coeff C
Decimal Entry
Ro
Integer Entry
Fo
Decimal Entry
Upr Xducer Lmt
Decimal Entry
Lwr Xducer Lmt
Decimal Entry
Zero Flow Sgnl
Decimal Entry
Gas Parameters
Requires Probe Password
Temp Corr TCC-A
Decimal Entry
Temp Corr TCC-B
Decimal Entry
Gas Density
Decimal Entry in chosen units
Gas Coeff Ag
Decimal Entry
Gas Coeff Bg
Decimal Entry
Gas Coeff Cg
Decimal Entry
Gas Coeff Dg
Decimal Entry
Gas Coeff Eg
Decimal Entry
Gas Calib Mode
Enable
Disable
Ctrl Parameters
Requires Probe Password
Coeff Ratio
Decimal Entry
Set Point
Decimal Entry
Slope
Decimal Entry
Power Predictor
Decimal Entry
Module Parameters
Factory password required – do not change in field
Module Calib
Htr Lo Pt Calib
Htr Hi Pt Calib
A-D Lo Pt Calib
A-D Hi Pt Calib
Magnetrol S/N
Integer Entry
HART Device ID
Integer Entry
Final Ass'y Num
Integer Entry
Temp Calibrate
Factory password required – do not change in field
Decimal Entry

2.6 Configuration Using HART

2.6.1 Display Menu




1. Flow
SCFH
SCFM
Nm3/h
Nl/h
2. Mass
lbs/hr
lbs/m
kg/h
kg/m
3. Temperature
C
F
4. Density
lb/ft3
kg/m3
kg/l
5. Totalized Flow
SCF
Nm3
Nl
lbs
kg
6. Diameter
inches
feet
meters
mm
7. Area
in2
ft2
m2
mm2
1. Enter Password
2. Probe Parameters
1. Sensor Type
Insertion Probe
Flow Body
2. Ro
3. Fo
4. Calibration Coeff
1. A
2. B
3. C
5. Lower Xducer Limit
6. Upper Xducer Limit
7. Zero Flow Signal
3. Gas Parameters
1. TCC – A
2. TCC – B
3. Density
4. Gas Coefficients
1. Ag
2. Bg
3. Cg
4. Dg
5. Eg
5. Gas Calibrate Mode
4. Control Parameters
1. Coeff Ratio
2. Set Point
3. Slope
4. Power Predictor
Review
1. Model
2. Manufacturer
3. Magnetrol S/N
4. Firmware Version
5. Tag
6. Descriptor
7. Date
8. Message
9. Final Assembly Num
10. Device ID
11. Poll address
12. Flow Units
13. Mass Units
14. Temperature Units
15. Density Units
16. Totalizer Units
17. Diameter Units
18. Area Units
19. Sensor Type
20. Pipe ID
21. Flow Area
22. PV is
23. SV is
24. TV is
25. 4V is
26. 4 mA Set Point
27. 20 mA Set Point
28. Fault State
29. Damping
30. Totalizer Mode
31. Date/Time/Initials
32. Low Flow cutoff
33. Install Factor – A
34. Install Factor – B
35. Install Factor – C
36. STP Pressure
37. STP Temperature
38. Ro
39. Fo
40. Cal Coeff – A
41. Cal Coeff – B
42. Cal Coeff – C
43. Lower Xducer Limit
44. Upper Xducer Limit
45. Zero Flow Signal
46. TCC – A
47. TCC – B
48. Density
49. Gas Coeff –Ag
50. Gas Coeff – Bg
51. Gas Coeff – Cg
52. Gas Coeff – Dg
53. Gas Coeff – Eg
54. Gas Calibrate Mode
55. Coeff Ratio
56. Set Point
57. Slope
58. Power Predictor
59. 4 mA Trim Value
60. 20 mA Trim Value
61. Universal rev
62. Field dev rev
63. Software rev
64. Num req preams



2.6.2 Connection

The TA2 can be used with a HART remote unit to provide communication of the process variables. The communicator can also be used for configuration of the transmitter.

The dynamic variables which can be transmitted over HART are Flow, Mass, Temperature, Totalized Flow and Mass Velocity. The Primary Variable can be Flow or Mass.

Virtually all configuration and diagnostics available via the user interface with the key pad and display is accessible via HART. See *System Configuration Menu, Section 2.5.*

A HART device can be connected to either the active or passive 4-20 mA output loop from the TA2.

2.6.3 HART Revision Table

HART Version	HCF Release Date	Compatible with TA2 Software
Dev V1 DD V2	July 2002	Version 1.0B
Dev V2 DD V1	September 2002	Version 1.1A
Dev V3 DD V1	June 2004	Version 1.2A

2.6.4 HART Display Menu

When connected, the top line of each menu displays the model (TA2) and its tag number or address.

Open the TA2 online menu tree by pressing alphanumeric key 1 to enter the Device Setup menu. *See Display Menu, Section 2.6.1.*

3.0 Reference Information

3.1 Description

The Thermatel Model TA2 Mass Flow Transmitter provides mass flow measurement of air and other gases. The TA2 consists of a probe with electronics either integrally mounted on the probe or remotely located.

The electronics enclosure is rated for use in explosion proof service. The electronics accept 24 VDC, 120 VAC or 240 VAC input power. Output from the TA2 is a 4-20 mA signal of the mass flow. Optional HART communication provides an output of the temperature and totalized flow.

The optional plug in display module with four button keypad permits the user to easily configure the TA2 for application specific conditions. The display provides an indication of the mass flow, temperature and totalized flow.

Each instrument is calibrated and configured by the factory for the type of gas, pipe size, flow area and flow rate. Calibration is performed in a NIST traceable flow stand to provide highest level of accuracy.

The advanced microprocessor provides accurate temperature compensation due to process temperature changes. The electronics permit the user to re-configure the instrument for the pipe or duct size, zero and span, units of measurement, and other user specific requirements.

3.2 Theory of Operation

The flow element of the TA2 Mass Flow Transmitter utilizes a heater and two resistance temperature detectors (RTDs). The heater and the active RTD are contained in one sensor. The second sensor contains the reference RTD and a mass balancing element.

The reference RTD measures the temperature of the process where the flow element is installed. A variable power is provided to the heater. The active RTD measures the temperature of the heated sensor in a feedback loop to the electronics. The electronics vary the power to the heater to maintain a constant temperature difference between the active and reference RTD. As the mass flow rate increases, there is a cooling effect on the heated sensor. The power to the heated sensor is controlled to maintain a constant temperature difference. The amount of power required to maintain this temperature difference provides the measurement of the mass flow.

There is an inherent non-linear relationship between heater power and the mass flow rate. The microprocessor based electronics convert the heater power to provide a linear measurement of the mass flow rate. The electronics also provide advanced temperature compensation which automatically adjusts the flow measurements for changes in process temperature over the entire operating range of the instrument.

The 4–20 mA output signal can be adjusted to provide maximum resolution of flow measurement over the calibrated range of the instrument. The 4–20 mA signal can be wired for either active or passive operation.

The temperature measured by the reference RTD and the totalized flow can be viewed on the display and is also available over HART communications.

3.3 Display Module

The TA2 has a plug in, rotatable display module. The display module consists of a 2 line × 16 character Liquid Crystal Display with four push button key pad for configuring the instrument.

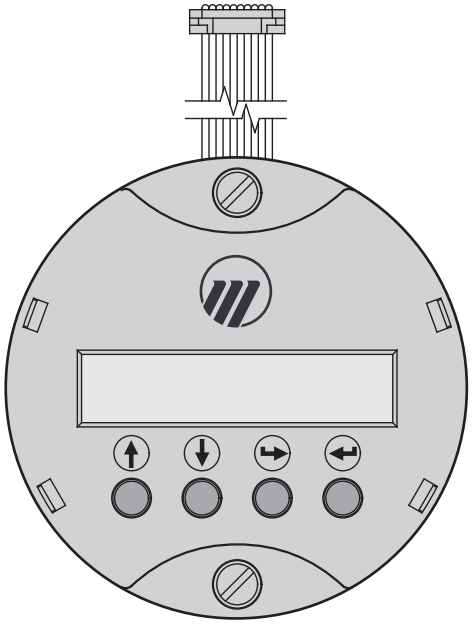


Figure 6
Display Module

The display can be rotated in 90 degree increments to permit viewing from various orientations. To rotate the display, remove the two screws on the front of the display module, rotate to the desired position, and re-attach the screws.

The module is suitable for temperatures to -40° F (-40° C). At temperatures below -4° F (-20° C) the display will go blank. The display will recover once the temperature rises above -4° F (-20° C).

The plug in display module is intended to be factory installed but can be added in the field at a later date if desired.

Caution: The power to the instrument must be turned off when connecting the display module. The display plugs into the Logic board at J3. Damage to the instrument may occur if the display is plugged in with the instrument powered on.

3.4 Flow Blockage

The TA2 Mass Flow Transmitter measures the velocity flowing past the sensor, and then determines the mass flow rate by multiplying the area by the mass velocity. The probe blocks a portion of the pipe reducing the effective cross sectional area of the pipe and creating a higher velocity through to sensor. The TA2 compensates for this effect by correcting the measured flow by a probe blockage factor.

3.5 Calibration Verification Procedure

The TA2 measures heat transfer and relates heat transfer to mass flow rate during the calibration. One way to verify the calibration of the TA2 is to verify heat transfer characteristics of the sensor under controlled conditions. The following procedure checks heat transfer at two conditions of no flow and a simulated high flow.

Equipment

Temperature water bath (approximately 1 liter). Temperature bath must be located on a sturdy table without vibrations.

Procedure

Record the initial (as received) heat transfer characteristics of the sensor then repeat procedure at a future time to verify performance.

1. No Flow Condition:

a. Power up the TA2. Wrap the sensor in paper and allow it to stabilize. Select Diagnostics/Signal Values from the TA2 menu and read the Signal in mW.

b. This is referred to as the Zero Flow Signal (zfs). Record this value

2. High Flow Condition:

a. Select Factory Config/Ctrl Parameters/Set Point from the TA2 menu.

Record the set point value as received. Change the Set Point value to 15° C (password of 2200 is required). The main display may indicate "Initializing." This is expected and will not affect this procedure.

Vertically hang the probe in a water bath at room temperature (+60° to +80° F or +15° to +26° C) with the sensor submerged. The water bath must be perfectly still without any vibration. To minimize the effect of convective heat flow on the sensor, it is important that the probe be in the vertical position. If not, this test may not produce repeatable results due to natural convection currents.

If a flow body, either submerse the entire flow body in water, or block off one end and fill the flow body with water assuring that the flow arrow is pointed in the same direction for each test.

b. Select Diagnostics/Delta Temp from the TA2 menu. Wait for the Delta Temp reading on the TA2 display[1] to stabilize. This represents the temperature difference between the heated and reference sensors. Record this value.

c. **IMPORTANT:** At the completion of obtaining this data, return to the Factory Config/Ctrl Parameters/Set Point menu and change the set point back to the original value recorded during step 2a.[2]

Verification Procedure

Repeat the procedure recording the Zero Flow Signal and the Delta Temp values.

1. The initial and the new zero flow signals should compare within 5 mW.
2. The initial and the new Delta Temp values should agree within 0.125° C (0.225° F).
3. If the two values agree, then the heat transfer characteristics of the sensor have not changed.
4. If they do not agree then:

a. Clean the pins on the sensor and retest.

b. Check for a bent pin on the sensor.

c. Contact the factory for recalibration of the unit.

[1] The displayed temperature rise will typically drift approximately ± .03° C around the average value due to natural convection currents induced by the heated pin. Use average readings.

[2] The operating Set Point can also be found on the calibration certificate supplied with the unit.

DATA COLLECTION

TA2 SERIAL NUMBER	
TAG NUMBER	
DATE OF INITIAL TEST	
INITIAL ZFS mW (Step 1b)	mW
SET POINT VALUE (Step 2a)	°C
INITIAL DELTA TEMP (Step 2b)	°C

VERIFICATION DATE	
ZFS	mW
DELTA TEMP	°C

3.6 Troubleshooting

3.6.1 Error Messages

Message	Action
Usr Passwd Req'd Prb Passwd Req'd	Re-enter data and correct password. Contact factory technical support for assistance
Err New Pwd Failed	When changing the password, the second entry of the new password does not match the first entry
Error:max =	Entry of numeric data is outside the acceptable range. Maximum allowed value is displayed
Error:min =	Entry of numeric data is outside the acceptable range. Minimum allowed value is displayed
Fct Passwd Req'd	You are attempting to access Factory Calibration data. This requires the Factory Password. This data should not be changed in the field.

The TA2 has continuous self diagnostics which detect many specific faults. In the unlikely event of a fault, one or more of the following messages may appear on the display. If there is more than one error message, the messages will alternate. During the time a fault is detected, the loop current is held at the fault level (selected under I/O Configuration) and the totalizer does not accumulate.

Message	Action
No Probe Signals Probe Hdwr Fault	Check Probe Status section of Diagnostics to determine cause of problem. Check probe wiring

The following displays will occur on re-initialization or in the event of non-volatile memory error. The instrument may need to be reconfigured following the procedure in *System Configuration, Section 2.5.7*.

Message	
Prb Params Reset	Re-enter the probe calibration data using the probe password
Usr Params Reset	Reconfigure the instrument for flow area and 4-20 mA setup
Initializing TA2	The TA2 is going through initialization. Flow measurement will begin after completion of the initialization.
Module Cal Req'd	The TA2 electronics require re-calibration. The instrument continues to operate at reduced accuracy, contact factory technical support.

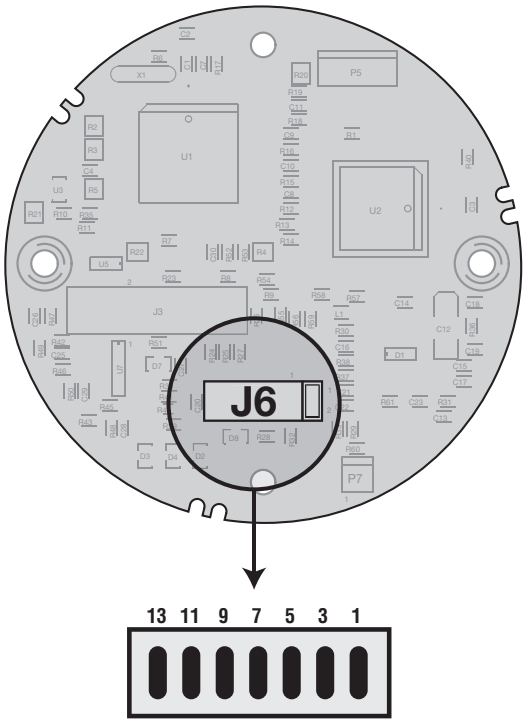


Figure 7a
J6 Terminal Block Pin Location

Figure 7b
Remote Probe Housing

3.6.2 Resistance Values

The resistance values for the probe can be checked using J6 on the logic board. To check resistances, turn off power and open the enclosure. Remove the plug in display board if provided. The following table gives the expected resistances. Refer to Figure 7a for pin locations.

Pin	Function	Expected Resistance
1-9	Reference RTD	1000 to 1770 ohms
3-9	Reference RTD	1000 to 1770 ohms
5-9	Heated RTD	1000 to 1770 ohms
7-9	Heated RTD	1000 to 1770 ohms
13-9	Heater	20 ohms

The resistance can be calculated using the formula

$$R = 1000 \times (1+0.00385 \times \text{Temperature °C})$$

Resistance on the other pins will be dependent upon wire length but will be less than 3 ohms.

If remote electronics are provided the following table provides expected resistances in the probe housing. Refer to Figure 7b for pin locations.

Pin	Function	Expected Resistance
1–3	Reference RTD	1000 to 1770 ohms
2–3	Heated RTD	1000 to 1770 ohms
4–5	Heater	20 ohms

3.6.3 Heater Power

Measuring the voltage between pins 13 and 9 can approximately determine the power to the heated sensor. The power can be estimated by the following formula:

$$\text{Power} = \text{Voltage}^2 \div 20 \text{ ohms}$$

(Voltage in volts)

This value can be compared against the Signal Strength measured in the Diagnostics menu.

3.6.4 Troubleshooting - Hardware/Application

Symptom	Problem	Solution
No output signal No display	No input power	Verify that LED D6 on the wiring board is on. If not, check connection TB1 on input wiring board. Check wiring connection to J1 on power supply board.
No output signal	4-20 mA output not operational	Verify that 4-20 mA connections are made to active terminals See section 2.4.3.
Flow Rate too high or too low	Instrument configuration does not match customer set up	Check value entered for Flow Area under System Configuration Check STP conditions under Advanced Configuration
Flow Rate too high	Flow Profile Considerations	User can correct for variations in flow profile using the "Install Factors" under Advanced Configuration–Section 2.5.9.
	Moisture in the Gas	Condensed moisture will cool the sensor more than gas flow. This will temporarily indicate a higher than expected flow rate. Relocate the probe to another location.
Flow rate too low	Probe incorrectly oriented	Check orientation of the probe in the pipe. Flow arrow on probe must be pointed in the direction of flow
	Sensor is dirty	Build up on the sensor will reduce heat transfer and produce lower than expected signal. Clean the sensor
Flow is measured under a no flow condition	Increased heat transfer. This can occur under no flow, high pressure condition	Increase the low flow cutoff to a value greater than the displayed flow rate. The TA2 will ignore flow readings below this value.

3.6.5 Troubleshooting Guide - Firmware

Symptom	Problem	Solution
Password Invalid	User changed password, but does not remember new password	Go to "Change Password" under "Advanced Configuration" Press ↵. Enter any value under "Enter Old Passw" and press ↵. The display will give an encrypted number. Notify factory technical support of the encrypted number. We can then convert the encrypted number to the password which the user previously selected.
Totalizer not operating	Totalizer not Enabled	Insure that the totalizer operation is enabled under the Totalizer section of the I/O Configuration Menu-Section 2.5.8.2
Flow measurement on display is correct but Output signal always 4 mA	HART Poll Address is not 0	Change HART Poll Address to 0. See section 2.5.8.3.
HART devices only: handheld will only read Universal Commands	The most current Device Descriptions (DDs) are not installed in the handheld.	Contact local HART service center for the latest DDs.

3.7 Maintenance

3.7.1 Probe Replacement

The probe and the electronics are calibrated together to form a matched set. If a probe needs to be replaced, the factory will provide new probe calibration information which the user can configure into the instrument. The replacement probe will have a new serial number. Record this number for reference.

NOTE: The serial number for the electronics remains unchanged. Serial numbers of the probe and electronics match when originally provided.

NOTE: When replacing the probe in the field, the accuracy may be slightly effected.

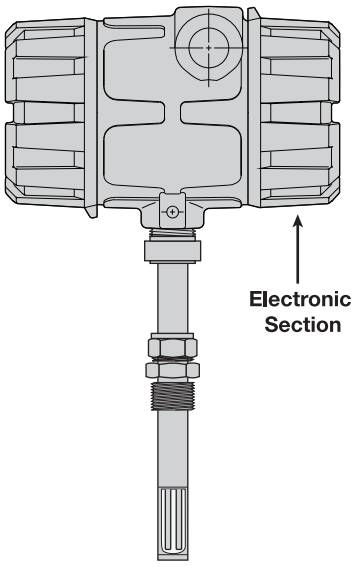


Figure 8

3.7.1.1 Integral Electronics

1. Make sure the power source is turned off.
2. Remove the cover on the electronics section. Refer to Figure 8.
3. Remove and unplug the display module if provided.
4. Remove the two hex head fasteners using a ¼" socket. This will remove a board set consisting of the logic board and the power supply board.
5. Probe wiring connections are made on the back side of the logic board at TB3. Refer to Figure 5.
6. Disconnect the electrical wires at J1.
7. Disconnect the wires at TB3.
8. Disconnect the probe from the enclosure.
9. Reinstall the new probe making sure that the flow arrow is in the direction of flow.

NOTE: Install using Teflon tape at probe connection (maximum 2 turns).

10. Re-connect the probe wiring to the terminal block using the following connections:

Wire Color	Terminal
White	1
Blue	3
Black	5
Brown	6
Orange	7

11. Reconnect the electrical wires at J1.
12. Reinstall the circuit boards in the enclosure and the display module if provided.
13. Apply power.
14. Skip to *Programming, Section 3.7.1.3*.

Wiring Color Code

Wire	Terminal	Sensor
White	Sensor 1	Temp Sensor
Blue	Sensor 2	Flow Sensor
Black	Sensor 3	Ground
Brown	Sensor 4	Heater Ground
Orange	Sensor 5	Heater

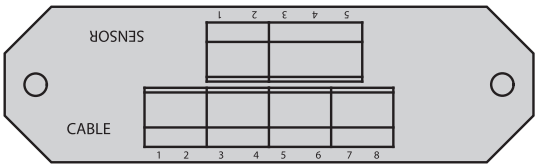


Figure 9
Remote Probe Wiring Connection

3.7.1.2 Remote Electronics

1. Make sure the power source is turned off.
2. Remove the cover from the probe enclosure.
3. Remove the wires connecting the probe to the five position sensor terminal block.
4. Remove the probe from the enclosure and carefully pull out the wires from the bottom of the enclosure. Optionally, it may be easier to temporarily remove the terminal block from the enclosure by removing the two attachment screws.
5. Install new probe and make probe connections as shown in Figure 9.

3.7.1.3 Programming

At this point the TA2 needs to be reconfigured with the new probe calibration information. This can be accomplished with either the display module or via HART.

Before reprogramming the TA2, first record the value for Zero Flow Signal. This is obtainable from either the original calibration certificate or from the value presently stored in the instrument under Factory Config/Probe Params/Zero Flow Sgnl. If using HART, this value is found under Device Setup/Cal Factors/Probe Parameters/Zero Flow Signal.

3.7.1.3.1 Display Module

1. Press ↓ until the display shows Factory Config ↕, press ↵.
2. Press ↓ until the display shows Probe Params ↕, press ↵.
3. Press ↓ and enter the information under Probe Params listed in Table 1. This information is provided on the Probe Calibration Certificate which is included with the replacement probe. The password is 2200; it is also specified on the Probe Calibration Certificate. This password cannot be changed.
4. If there are questions entering numeric data with the display module, see *Section 2.5.3.2*.
5. Repeat for entry of data for Gas Parameters and Ctrl Parameters shown in Table 1.

NOTE: For more information on firmware menu, *see Section 2.5.11*.

6. Skip to *Section 3.7.1.3.3*.

Probe Params	Gas Parameters	Ctrl Parameters
Cal Coeffs A, B, C	Gas Density	Coeff Ratio
R_O	TCC–A	Set Point
F_O	TCC–B	Slope
UL	Gas Coeff Ag, Bg, Cg, Dg, Eg	PPF
LL		
ZFS		

Table 1

3.7.1.3.2 HART

Using the HART handheld, from the Main Menu go to Device Setup/Cal Factors. Enter the probe password of 2200. Then enter the new calibration data from the Calibration Certificate into the appropriate sections of Probe Parameters, Gas Parameters, and Control Parameters/Zero Flow Signal. See Table 1 for list of new parameters.

3.7.1.3.3 Complete the Programming

A new set point must be calculated to complete the reconfiguration

1. Place the probe in ambient temperature air where there is no flow across the sensor. This can be accomplished by wrapping the sensor tip with a piece of paper.
2. Display Module – Go to Diagnostics/Signal value. HART – Go to the Device/Setup/Diagnostics/Signal PV. Allow time for the signal to stabilize to within ±1 mW. Record the signal.
3. Calculate a new Set Point value by using the following formula:

New Set Point=Set Point × (Zero Flow Signal ÷ Signal)

- The Set Point is the value on the new cal cert
- Zero Flow Signal is the original value obtained in Section 3.7.1.
- Signal is the value measured under step 2.

NOTE: If the TA2 is calibrated for a gas other than air, there are two ZFS values on the certificate. One is ZFS-air and the second is ZFS-gas. Use the ZFS-air value when making an adjustment in air.

4. Enter this New Set Point Value (instead of the value on the calibration certificate) into the TA2 under Factory Config/Ctrl Parameters or if using HART at Device Setup/Cal Factors/Control Parameters/Set Point.
5. Return to the Signal value as shown in step 2 ensuring that there is no flow over the sensor. The Signal Value should now agree with the original Zero Flow Signal within 1%. If desired, steps 2 through 5 can be repeated.

3.7.2 Logic Board Replacement

Replacement of the Logic circuit board also requires re-entry of the calibration data from the original calibration certificate. Follow the procedure in *Section 3.7.1.3*.

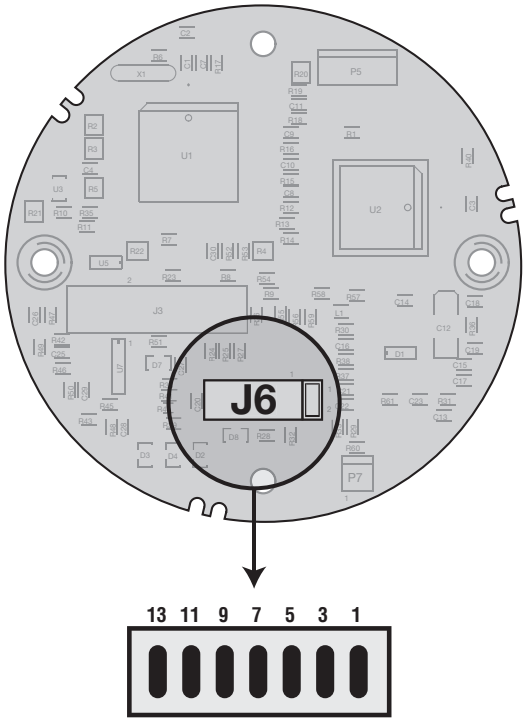


Figure 10
J6 Terminal Block Pin Location

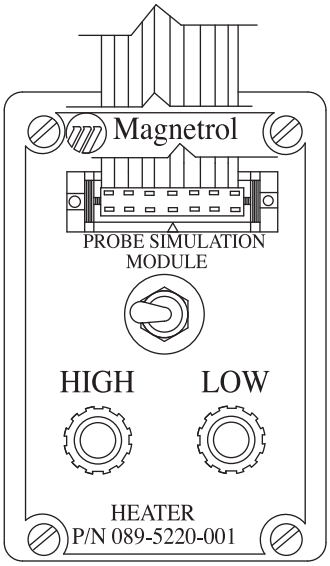


Figure 11
TA2 Calibrator Box

3.7.3 Probe Simulation Module

The Magnetrol Probe Simulation Module (089-5220-001) can be used with the TA2 Thermal Dispersion Mass Flow Meter to compare the readings of the transmitter against a reference.

Using the Probe Simulation Module requires the use of the Display in the TA2.

3.7.3.1 Connecting the probe simulation module

1. Unscrew cover and remove the screws attaching the display. Do not disconnect the display from the circuit board.
2. Remove the jumper from J6. Refer to Figure 10.
3. Plug in the cable from the probe simulation module into J6. This removes the probe from the circuit and readings are now from the module (TA2 display will read Probe Hdwe Fault).
4. Put the switch to the High position.
5. Using the TA2 display, move to Diagnostics/Calib Check and record the values of T RTD and F RTD below.
6. Put the switch to the Low position and record the values of T RTD and F RTD below.

NOTE: If there is little change between readings in the High and Low position, turn the plug in J6 over and try again.

7. Press Enter and the display will read:

   Fixed Htr Curr
   Xxx mA

   Record these values below.

	High	Low
T RTD		
F TRD		
Fixed Htr Curr		
Voltage		

8. Measure and record the voltage between the two pins on the probe simulation module.
9. At a future date compare the readings with the values recorded above.

3.8 Agency Approvals

AGENCY	APPROVED MODEL	PROTECTION METHOD	AREA CLASSIFICATION
FM	TA2-XXXX-X3X TA2-XXXX-X4X with TXR-XXX0-XXX (probe) TFT-XXXX-000 (flow body)	Explosion proof	Class I, Div 1, Groups B, C, & D Class II, Div 1, Groups E, F, & G Class III, T6 Ta = 160° F NEMA 4X, IP 66
		Non-Incendive	Class I, Div 2, Groups A, B, C, & D Class II, Div 2, Groups F & G Class III, T4 Ta = 160° F NEMA 4X, IP 66
CSA	TA2-XXXX-X3X TA2-XXXX-X4X with TXR-XXX0-XXX (probe) TFT-XXXX-000 (flow body)	Explosion proof	Class I, Div 1, Groups B, C, & D Class II, Div 1, Groups E, F, & G Class III, T6 Ta = 160° F Type 4X
The probe and flow body comply with Canadian Electric Code requirements of ANSI/ISA 12.27.01-2003 as a single seal device.		Suitable for:	Class I, Div 2, Groups A, B, C, & D Class II, Div 2, Groups E, F, & G Class III, T4 Ta = 160° F Type 4X
ATEX	TA2-XXXX-XCX TA2-XXXX-XDX with TXR-XXX0-XXX (probe) TFT-XXXX-000 (flow body)	Explosion proof	Ⓔx II 2 G EEx d IIC T6 ATEX special conditions for sale use: If the measured fluid temperature is above +55° C (+131° F), the flow transmitter, in the limits specified by the manufacturer, shall not be used in explosive atmosphere with an ignition temperature of +85° C (+185° F), increased with the difference of the fluid temperature and +55° C (+131°F).
ROS TECH/ GOST-R	TA2-XXXX-XCX TA2-XXXX-XDX	Russian Authorization Standards - Consult Magnetrol for Details	

Note: Maximum surface temperature of the probe is 73° C above process temperature.

Contact Magnetrol for information on auto ignition temperature of various gases.

CE These units have been tested to EN 61326 and are in compliance with the EMC Directive 89/336/EEC.

3.9 Replacement Parts

NOTE: Replacement of the Logic Circuit Board or the Probe requires entry of configuration data from the Calibration Certificate. See Section 3.7.2.

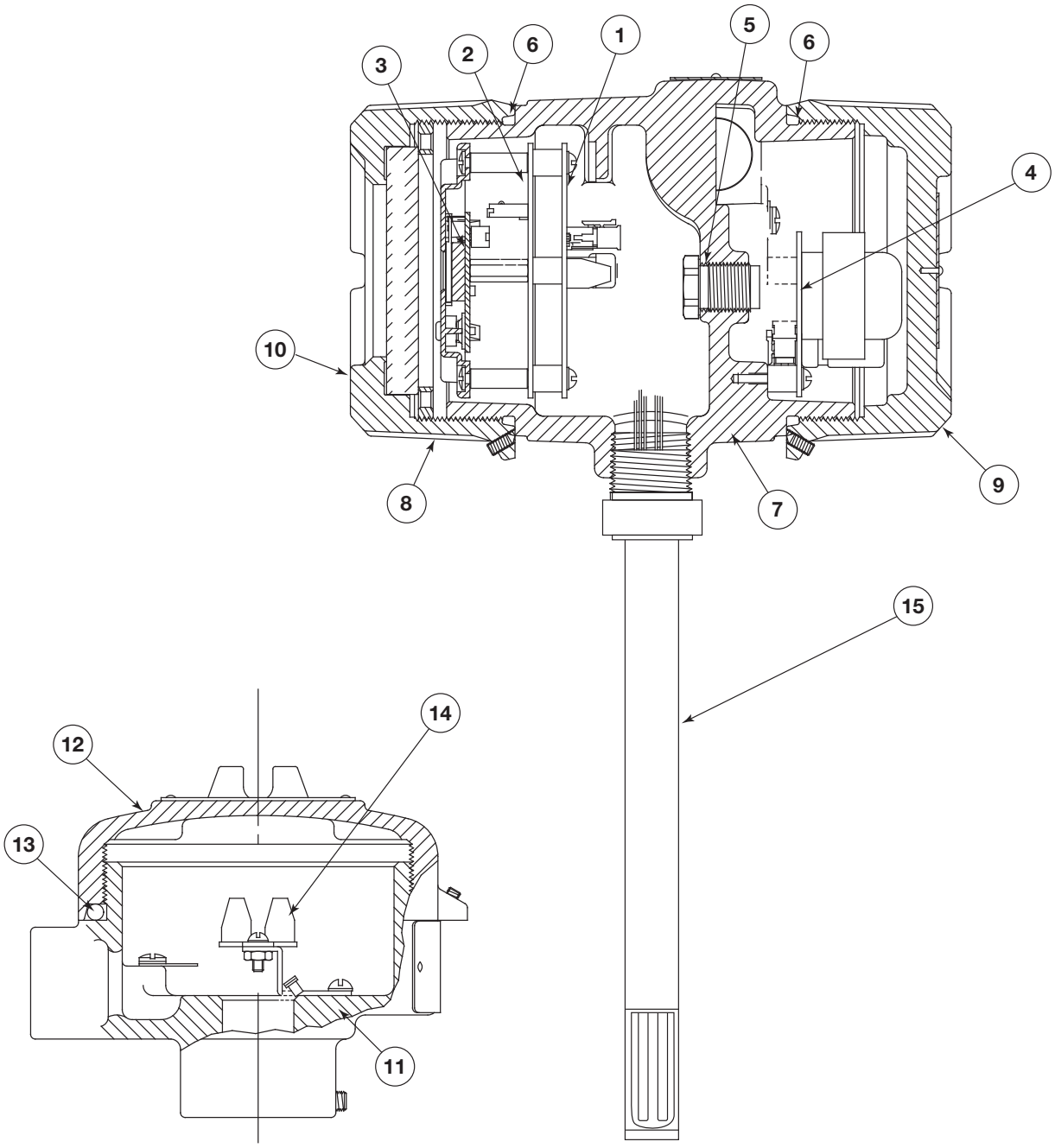
WARNING: EXPLOSION HAZARD
Substitution of components may impair suitability for Class I, Division 2

EXPLOSION HAZARD
Do not disconnect equipment unless power has been switched off or the area is known to be non-hazardous

Item	Description			Part Number
1	Power Supply Board	Integral Electronics	HART version	Z30-2226-001
			Without HART	Z30-2226-002
		Remote Electronics	HART version	Z30-2226-003
			Without HART	Z30-2226-004
2	Logic Board		English Language	Z30-2227-001
			German Language	Z30-2227-002
			French Language	Z30-2227-003
3	Display Module			Z30-2228-001
4	Input Wiring Board		120 VAC	Z30-2230-001
			240 VAC	Z30-2230-002
			24 VDC	Z30-2230-003
5	Feed Through			037-3312-001
6	Enclosure O-ring			012-2201-240
7	Enclosure Base			004-9207-XXX
8	Short Enclosure Cover *			004-9197-005
9	Tall Enclosure Cover			004-9206-008
10	Enclosure Cover with Window **			036-4411-001
11	Probe Enclosure Base			004-9104-XXX
12	Probe Enclosure Cover			004-9105-XXX
13	Probe Enclosure O-ring			012-2101-345
14	Remote PC Board			030-2231-001
15	Probe/Flow Body			See Probe/Flow Body

* Short enclosure cover used with units without display

** Enclosure cover with window used with units with display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3.10 Specifications

3.10.1 Performance

Flow range maximum	10–40,000 SFPM (0.05–200 Nm/s) air reference to standard conditions
	Higher ranges and other gases available; contact factory
Flow range minimum	10–500 SFPM (0.05–2.5 Nm/s) air reference to standard conditions
Accuracy flow	±1% of reading +0.5% of calibrated full scale
Accuracy temperature	±2° F (1° C)
Repeatability	±0.5% of reading
Linearity	Included in flow accuracy
Temperature effect	±0.04% per ° C
Turn down	100:1 typical (depending on calibrated flow range)
Calibration	NIST traceable
Ambient temperature	-40° to +160° F (-40° to +70° C); display not readable below -4° F (-20° C)
For ATEX approval:	-40° to +55° C (-40° to +131° F)
Storage temperature	-60° to +160° F (-50° to +70° C) blind units only
Display	Two-line alphanumeric LCD, 16-characters per line
Keypad	Four pushbutton
Menu Language	English, French, German
Humidity	99% Non-condensing
Supply voltage	120 VAC, 50–60 Hz, +10%/–15% VAC ~
	240 VAC, 50–60 Hz, +10%/–15% VAC ~
	24 VDC ±20% VDC ⎓
Power consumption	6 watts, 9 VA
Analog output signal Active	4–20 mA (isolated) maximum 1000 Ω loop resistance
Passive	4–20 mA (isolated) loop resistance dependent on power supply
Diagnostic Alarm	3.6 mA, 22 mA, HOLD
HART	Optional
Response time	1 to 2 second time constant typical
Cable length	50 feet; 150 feet if cable supplied by Magnetrol. Longer lengths possible.
Housing Material	Aluminum A356 (<0.2% copper)
SIL	Safe Failure Fraction (SFF) 69%

3.10.2 Probe

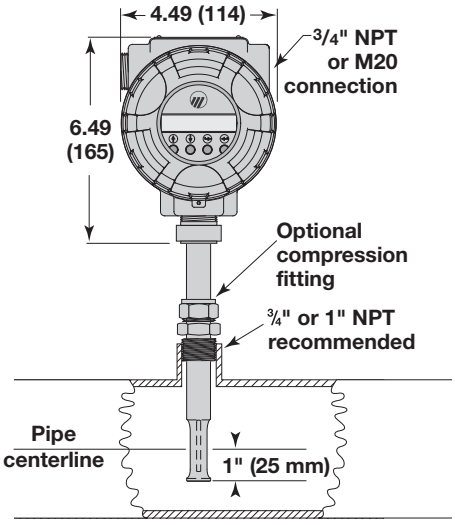
Materials	316/316L stainless steel all welded
	Hastelloy® C-276 optional
Process connections	Refer to model number, hot tap optional
Process Pressure	1500 psig @ +70° F (103 bar @ +20° C), 1375 psig @ +400° F (95 bar @ +200° C)
Temperature rating	-50° to +400° F (-45° to +200° C)①

3.10.3 Flow Body

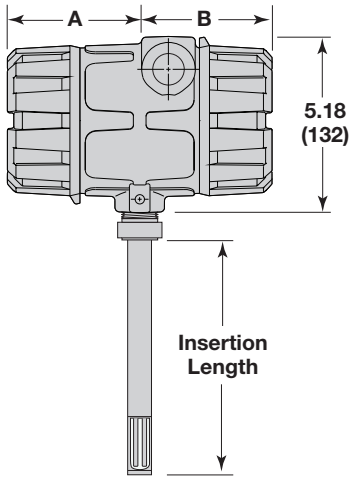
Materials	316/316L stainless steel all welded
	Carbon steel with stainless steel sensor
Process connections	NPT or 150 pound flange – Refer to model number
Pressure rating	1500 psig @ +70° F (103 bar @ +20° C), 1100 psig @ +400° F (79 bar @ +200° C)
Temperature rating	-50° to +400° F (-45° to +200° C)①

① For operating temperatures between +250° F and +400° F (+120° C and +200° C), either use remote electronics or a longer length insertion probe to provide an additional four inches (100 mm) between the electronics and the compression fitting.

3.10.4 Physical – inches (mm)



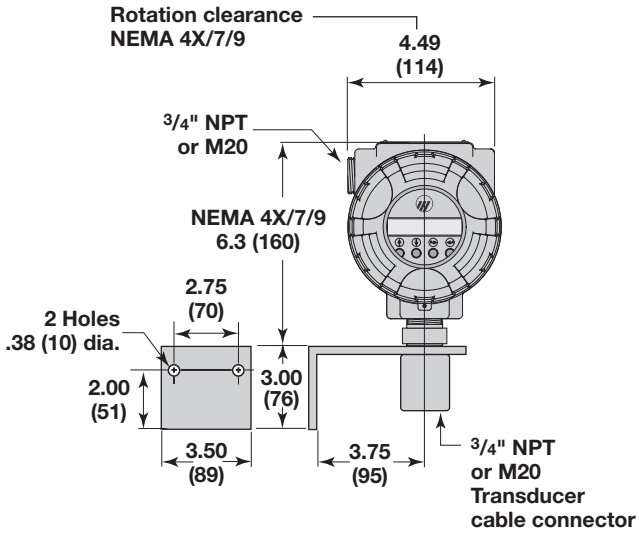
Front View



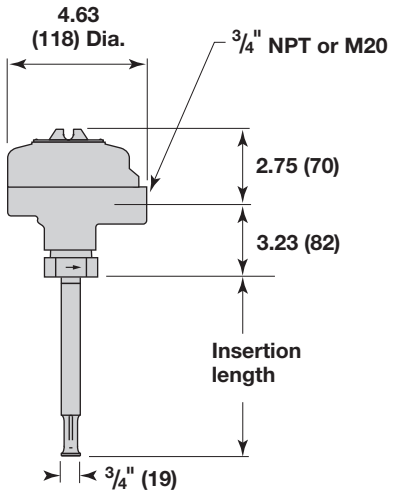
Side View

Dimension A:
3.33 (85) without display
3.88 (99) with display

Dimension B:
3.88 (99)

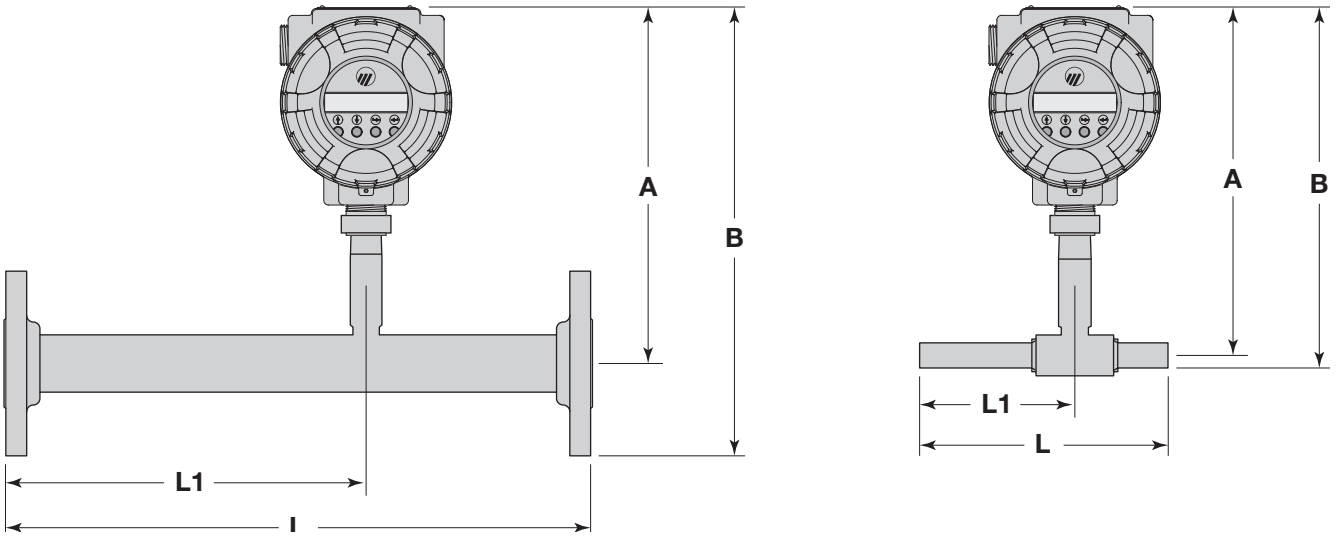


Main Electronics



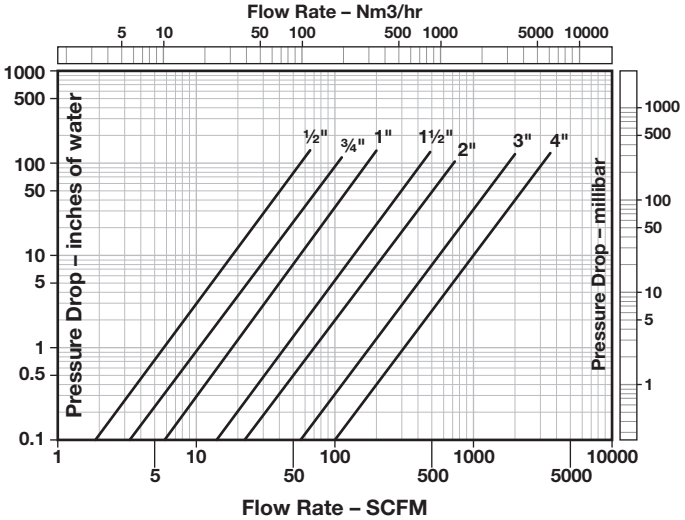
Remote Probe with Housing

3.10.4 Physical – inches (mm)

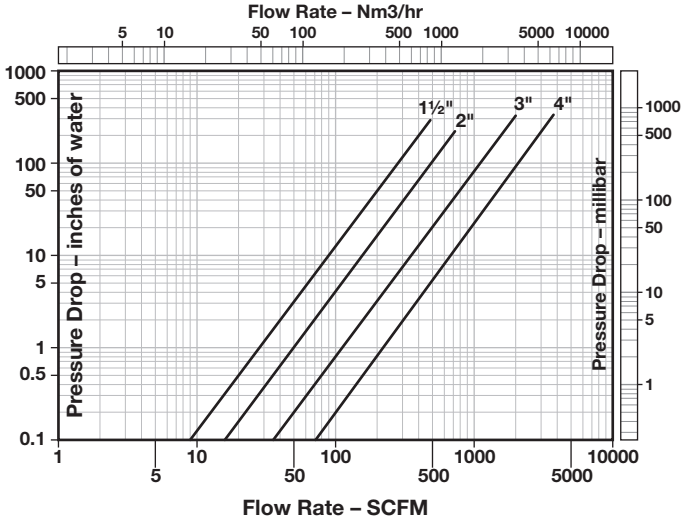


Code	Size	Length (L)		L1		Height to Centerline (A)	Overall Height (B)	
		With Flow Conditioning inches (mm)	Without Flow Conditioning inches (mm)	With Flow Conditioning inches (mm)	Without Flow Conditioning inches (mm)	inches (mm)	NPT inches (mm)	Flange inches (mm)
0	½"	8 (203)	—	5 (127)	—	8.0 (203)	8.7 (221)	9.75 (248)
1	¾"	11.25 (285)	—	7.5 (190)	—	8.0 (203)	8.7 (221)	9.9 (251)
2	1"	15 (381)	—	10 (254)	—	8.0 (203)	8.7 (221)	10.1 (257)
3	1½"	19.5 (495)	7.5 (191)	12 (305)	3.75 (95)	8.35 (212)	9.3 (236)	10.85 (276)
4	2"	26 (660)	7.5 (191)	16 (406)	3.75 (95)	9.25 (235)	10.4 (264)	12.25 (311)
5	3"	39 (991)	10 (254)	24 (610)	5 (127)	9.25 (235)	N/A	13.0 (330)
6	4"	52 (1321)	12 (305)	36 (914)	6 (152)	9.25 (235)	N/A	13.75 (349)

Pressure Drop



Pressure Drop with Flow Conditioning Plate



Pressure drop is based on air at +70° F and 1 atmosphere (density = 0.075 lb/ft³). For other gases, pressure or temperatures, estimate pressure drop by multiplying value from chart by actual density (at operating conditions) divided by 0.075.

3.10.5 Flow Body Sizing

The following table is a general guide on flow sizing. Contact Magnetrol or your local representative for specific application information.

Code	Size	Air, N_2, O_2	Natural Gas, Methane	Digester Gas	Propane	Hydrogen	CO_2, Argon
0	½"	65 SCFM 110 NM^3/h	45 SCFM 76 NM^3/h	25 SCFM 42 NM^3/h	30 SCFM 51 NM^3/h	15 SCFM 27 NM^3/h	60 SCFM 105 NM^3/h
1	¾"	120 SCFM 204 NM^3/h	85 SCFM 140 NM^3/h	45 SCFM 76 NM^3/h	55 SCFM 93 NM^3/h	30 SCFM 52 NM^3/h	110 SCFM 190 NM^3/h
2	1"	200 SCFM 340 NM^3/h	140 SCFM 238 NM^3/h	75 SCFM 127 NM^3/h	95 SCFM 161 NM^3/h	50 SCFM 85 NM^3/h	190 SCFM 320 NM^3/h
3	1½"	490 SCFM 833 NM^3/h	340 SCFM 580 NM^3/h	180 SCFM 310 NM^3/h	230 SCFM 395 NM^3/h	120 SCFM 208 NM^3/h	465 SCFM 790 NM^3/h
4	2"	715 SCFM 1220 NM^3/h	505 SCFM 855 NM^3/h	280 SCFM 480 NM^3/h	350 SCFM 600 NM^3/h	195 SCFM 332 NM^3/h	680 SCFM 1155 NM^3/h
5	3"	2000 SCFM 3400 NM^3/h	1400 SCFM 2380 NM^3/h	780 SCFM 1320 NM^3/h	690 SCFM 1170 NM^3/h	540 SCFM 920 NM^3/h	1900 SCFM 3230 NM^3/h
6	4"	3600 SCFM 6110 NM^3/h	2520 SCFM 4280 NM^3/h	1400 SCFM 2380 NM^3/h	1230 SCFM 2090 NM^3/h	970 SCFM 1650 NM^3/h	3420 SCFM 5810 NM^3/h

3.11 Model Numbers

3.11.1 Transmitter with Insertion Probe

INPUT VOLTAGE

0	120 VAC
1	240 VAC
2	24 VDC

SIGNAL OUTPUT

0	4-20 mA
1	4-20 mA with HART

DISPLAY

0	None
B	Plug-in display with keypad (with window)

LANGUAGE

1	English
3	French
4	German

CALIBRATION

Actual Gas Calibration	
0	Special
1	Air
2	Nitrogen or Oxygen
3	Hydrogen
4	Natural Gas
5	Methane
6	Digester Gas
7	Propane
Air Equivalency Calibration	
9	Air Equivalency

HOUSING LOCATION / AGENCY APPROVAL

3	Integral, general purpose, non-incendive, & explosion proof FM/CSA (class B, C, & D)
4	Remote, general purpose, non-incendive, & explosion proof FM/CSA (class B, C, & D)
C	Integral, general purpose, EEx d ATEX
D	Remote, general purpose, EEx d ATEX

ENCLOSURE TYPE

0	Aluminum, ¾" NPT
1	Aluminum, M20

T	A	2	—					—			

3.11.2 Insertion Probe

UNIT OF MEASUREMENT

TER	Length in tenths of an inch
TMR	Length in centimeters

MATERIALS OF CONSTRUCTION

A	316/316L stainless steel
B	Hastelloy C-276

PROCESS CONNECTION

00	Compression fitting utilized*	43	2" 150# ANSI raised face flange
11	¾" NPT	44	2" 300# ANSI raised face flange
21	1" NPT	BA	DN25 PN 16 EN 1092-1, Type A
22	1" BSP (G1)	BB	DN25 PN 25/40 EN 1092-1, Type A
23	1" 150# ANSI raised face flange	CA	DN40 PN 16 EN 1092-1, Type A
24	1" 300# ANSI raised face flange	CB	DN40 PN 25/40 EN 1092-1, Type A
33	1½" 150# ANSI raised face flange	DA	DN50 PN 16 EN 1092-1, Type A
34	1½" 300# ANSI raised face flange	DB	DN50 PN 25/40 EN 1092-1, Type A

* not available with Hastelloy C construction

PROBE LENGTH

2.6 to 99.9 inches (example: 8.5" = 085)
Minimum lengths: 2.6" (026) with threaded process connection
2.8" (028) with flanged process connection
4.5" (045) with compression fitting process connection

7 to 253 centimeters (example: 18 cm = 018)
Minimum lengths:
7 cm (007) with threaded or flanged process connection
11 cm (011) with compression fitting process connection

T		R	—				0	—			

3.11.3 Connecting Cable

CABLE LENGTH IN FEET

10 feet minimum, 150 feet maximum length
Example: 50 feet = 050

0	3	7	—	3	3	1	3	—			

CABLE LENGTH IN METERS

3 meters minimum, 45 meters maximum length
Example: 8 meters = 008

0	3	7	—	3	3	1	4	—			

3.11.4 Transmitter with Flow Body

INPUT VOLTAGE

0	120 VAC
1	240 VAC
2	24 VDC

SIGNAL OUTPUT

0	4-20 mA
1	4-20 mA with HART

DISPLAY

0	None
B	Plug-in display with keypad (with window)

LANGUAGE

1	English
3	French
4	German

CALIBRATION

Actual Gas Calibration	
A	Special
B	Air
C	Nitrogen or Oxygen
D	Hydrogen
E	Natural Gas
F	Methane
G	Digester Gas
H	Propane
Air Equivalency Calibration	
K	Air Equivalency

HOUSING LOCATION / AGENCY APPROVAL

3	Integral, general purpose, non-incendive, & explosion proof FM/CSA (class B, C, & D)
4	Remote, general purpose, non-incendive, & explosion proof FM/CSA (class B, C, & D)
C	Integral, general purpose, EEx d ATEX
D	Remote, general purpose, EEx d ATEX

ENCLOSURE TYPE

0	Aluminum, ¾" NPT
1	Aluminum, M20

T	A	2	—					—			

3.11.5 Flow Body

MATERIALS OF CONSTRUCTION

A	All stainless steel
1	Carbon steel body with stainless steel sensor

SIZE

0	½ inch
1	¾ inch
2	1 inch
3	1½ inch
4	2 inch
5	3 inch
6	4 inch

PROCESS CONNECTION TYPE

1	NPT Threads (only when Digit 5 = 0, 1, 2, 3, or 4
3	150# Flange

FLOW CONDITIONING PLATE (stainless steel)

0	Not provided
1	Provided (only when Digit 5 = 3, 4, 5, or 6)

T	F	T	—					—	0	0	0

3.11.6 Connecting Cable

CABLE LENGTH IN FEET

10 feet minimum, 150 feet maximum length
Example: 50 feet = 050

0	3	7	—	3	3	1	3	—			

CABLE LENGTH IN METERS

3 meters minimum, 45 meters maximum length
Example: 8 meters = 008

0	3	7	—	3	3	1	4	—			

Glossary

Atmospheric pressure: Average pressure at sea level. One atmosphere pressure is equal to 14.696 psia or 29.921 inches of mercury or 406.8 inches of water.

Bar: Unit of pressure measurement. One bar equals 14.504 pounds per square inch or 100 kilopascals.

Celsius (C): Unit of temperature measurement. At one atmosphere pressure: at zero degrees Celsius, water freezes; at 100 degrees Celsius, water boils. One degree Celsius is equal to 1.8 degrees Fahrenheit.

$$T_c = (T_f - 32) \div 1.8$$

Fahrenheit (F): Unit of temperature measurement. At one atmosphere pressure: at 32 degrees Fahrenheit, water freezes; at 212 degrees Fahrenheit, water boils.

$$T_f = 1.8 \times T_c + 32$$

Kelvin: Unit of temperature measurement referenced to absolute conditions.

Kelvin = Degrees Celsius + 273.15

NIST: National Institute of Science and Technology

Nm3/h (Normal cubic meters per hour): Flow measurement at normal (standard) conditions (STP).

PSIA: Absolute pressure in pounds per square inch. Zero psia is an absolute vacuum.

1 atmosphere pressure = 14.696 psia

PSIA = PSIG + 14.696

PSIG: Gauge pressure in pounds per square inch above atmospheric pressure.

Rankine: Unit of temperature measurement referenced to absolute conditions.

Degrees Rankine = Degrees Fahrenheit + 459.67

SCFH (standard cubic feet per hour): Flow measurement at standard (STP) conditions.

SCFM (standard cubic feet per minute): Flow measurement at standard (STP) conditions.

SFPM (standard feet per minute): Velocity of gas flowing in the pipe or duct referenced to standard (STP) conditions.

Standard Conditions: Typical is +70° F and one atmosphere pressure (14.7 psia) or 0° C and one bar pressure (14.5 psia).

STP (standard pressure and temperature): Also referred to as standard conditions.

Configuration Definitions

The following symbols and definitions are used in the software configuration:

Installation factor: Changes in flow profile will affect the measurements of the TA2. Advanced users have the ability to adjust the measurements for changes in flow profile using a polynomial relationship in the form of:

$$\text{Corrected flow} = A+Bv+Cv^2$$

The default is B = 1; and A and C = 0. To use the correction factor, develop a relationship between the velocity measured by the TA2 and the velocity measured by a second flowmeter. Curve fit the second order polynomial (above) using the output of the TA2 for v and the output of the second flowmeter for corrected flow. Units for "v" are SFPM. Then enter the appropriate values in the Advanced Configuration menu, *Section 2.5.9.*

Mass flow: Measured in various units, typically LB/Hr or Kg/h. An input of the flow area of the pipe or duct and density is required.

STP conditions: The mass flow rate is based on a given set of Standard Temperature and Pressure (STP) conditions. Magnetrol uses default of +70° F and one (1) atmosphere for STP conditions. The STP conditions may be modified to match the user's standards. If the STP conditions are modified, the TA2 will recalculate the flow rates at the specified STP conditions.

The advanced configuration menu permits the user to enter any desired temperature and cycle between selection of one (1) bar or one (1) atmosphere of pressure.

Totalized flow: Provides a measurement of the total flow in units specified.

Volume flow: Measured in various units, typically SCFM (standard cubic feet per minute), SCFH (standard cubic feet per hour) or Nm3/h (normal cubic meters per hour), referenced to standard conditions. An input of the flow area of the pipe or duct is required to obtain this value.

Tag line

Tag lines are programmable for both Display (16 character Local Tag) or HART (8 character HART tag)

Initially the local tag line on the display reads "Magnetrol TA2". This can be changed from the advanced configuration section of the software. See *Section 2.5.9.*

The cursor appears in the left position. To change the character at that location, use the ↑ or ↓ arrow keys. To move to the next position, press ↵; to return to the previous position, press ↩.

Pressing ↵ moves the cursor to the right. When it reaches the rightmost position, pressing ↵ one additional time exits and saves changes (password protected).

Pressing ↩ moves the cursor to the left. When it reaches the left most position, pressing ↩ exits the menu and restores the previous tag line.

Thermatel Model TA2
Thermal Dispersion Mass Flow Transmitter
Configuration Data Sheet

Flow Reference		Local Tag	
Gas Type		Firmware Version	
Tag Number		Signal Value	
Electronics Serial #		Temperature Sensor	
Probe Serial #		Flow Sensor	
Flow Units		Probe Heater	
Mass Units		Delta Temp	
Temp Units		Heater Setting	
Density Units		Exception code	
Diameter Units		Sensor Type	
Area Units		Cal Coeff A	
Diameter		Cal Coeff B	
Area		Cal Coeff C	
4-20 Controlled by		Ro	
4 mA Set Point		Fo	
20 mA Set Point		Upr Xducer Lmt	
Fault State		Lwr Xducer Lmt	
Totalizer Mode		Zero Flow Signal	
Totalizer Units		TCC-A	
Totalized Flow		TCC-B	
Elapsed Time		Gas Density	
HART Poll Address		Gas Coeff Ag	
HART Tag		Gas Coeff Bg	
Damping		Gas Coeff Cg	
STP Temperature		Gas Coeff Dg	
STP Pressure		Gas Coeff Eg	
Install Factor A		Gas Calibrate Mode	
Install Factor B		Coeff Ratio	
Install Factor C		Set Point	
Low Flow Cutoff		Slope	
4mA offset		Power Predictor	
20 mA offset			

Flow Application Questionnaire

Thermatel Model TA1/TA2

(Please fill out in detail.)

REFERENCE INFORMATION

Customer/Company: _____ Date: _____

Contact/Title: _____ Phone: _____ Fax: _____

Submitted by: _____

FOR OFFICE USE:

INSTRUMENT

Model Number: Electronics _____ Probe/Flow Body _____

Remote Cable: _____ Compression Fitting/RPA: _____ Quantity: _____

PROCESS DATA

Application: _____

Gas composition: _____

Condensed Moisture in Gas? ☐ No ☐ Yes Dust Buildup? ☐ None ☐ Light ☐ Heavy Type of Dust: _____

	Maximum	Normal	Minimum	Units*
Flow Rate				
Temperature				
Pressure				

Agency: ☐ FM ☐ CSA ☐ ATEX II 2G EEx d IIC T6

STP Conditions

Specify Standard Temperature and Pressure conditions (If not specified Magnetrol uses 70 F and 1 Atmosphere)

Temperature: _____ Pressure: ☐ 1 Atmosphere ☐ 1 Bar

PIPE DIMENSIONS

Pipe Diameter: _____ inch Schedule _____

or Pipe ID: _____ units _____

or Metric Pipe: _____ mm OD _____ mm wall thickness

DUCT INTERNAL DIMENSIONS

Diameter _____ units _____

Rectangular dimensions _____ units _____

FACTORY CONFIGURATION

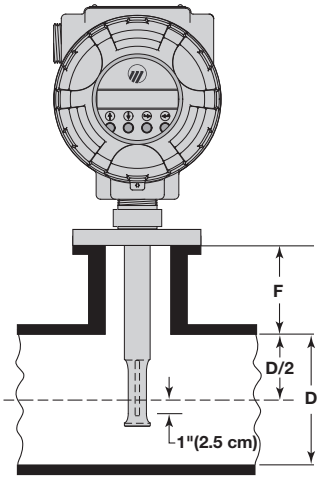
*Flow Units: ☐ SCFM ☐ lbs/hr

☐ SCFH ☐ Kg/hr ☐ Nm^3/hr

	4 mA value	20 mA value
Flow		
Temperature (TA1 only)		

PROBE LENGTH CALCULATIONS

The probe can be ordered in 0.1 inch or 1 cm increments. This is most important when used with a flange or threaded connection to ensure that the sensor is located on the centerline of the pipe. The active portion of the sensor is located 1" (2.5 cm) from the end of the probe. Refer to illustration at right.



Probe length = $F + \frac{D}{2} + 1"$ (2.5 cm)

REMARKS

Customer Notes

Customer Notes

Service Policy

Owners of Magnetrol/STI controls may request the return of a or any part of a control for complete rebuilding or replacement. They will be rebuilt or replaced promptly. Controls returned under our service policy must be returned by prepaid transportation. Magnetrol/STI will repair or replace the control at no cost to the purchaser (or owner) other than transportation if:

1. Returned within the warranty period; and
2. The factory inspection finds the cause of the claim to be covered under the warranty.

If the trouble is the result of conditions beyond our control; or, is NOT covered by the warranty, there will be charges for labor and the parts required to rebuild or replace the equipment.

In some cases it may be expedient to ship replacement parts; or, in extreme cases a complete new control, to replace the original equipment before it is returned. If this is desired, notify the factory of both the model and serial numbers of the control to be replaced. In such cases, credit for the materials returned will be determined on the basis of the applicability of our warranty.

No claims for misapplication, labor, direct or consequential damage will be allowed.

Return Material Procedure

So that we may efficiently process any materials that are returned, it is essential that a "Return Material Authorization" (RMA) number be obtained from the factory, prior to the material's return. This is available through Magnetrol's or STI's local representative or by contacting the factory. Please supply the following information:

1. Company Name
2. Description of Material
3. Serial Number
4. Reason for Return
5. Application

Any unit that was used in a process must be properly cleaned in accordance with OSHA standards, before it is returned to the factory.

A Material Safety Data Sheet (MSDS) must accompany material that was used in any media.

All shipments returned to the factory must be by prepaid transportation.

All replacements will be shipped F.O.B. factory.

Magnetrol®

5300 Belmont Road • Downers Grove, Illinois 60515-4499 • 630-969-4000 • Fax 630-969-9489 • www.magnetrol.com
145 Jardin Drive, Units 1 & 2 • Concord, Ontario Canada L4K 1X7 • 905-738-9600 • Fax 905-738-1306
Heikensstraat 6 • B 9240 Zele, Belgium • 052 45.11.11 • Fax 052 45.09.93
Regent Business Ctr., Jubilee Rd. • Burgess Hill, Sussex RH15 9TL U.K. • 01444-871313 • Fax 01444-871317

STI®

5300 Belmont Road • Downers Grove, Illinois 60515-4499 • 630-969-4028 • Fax 630-969-9489 • www.sticontrols.com

BULLETIN: 54-630.4
EFFECTIVE: September 2008
SUPERSEDES: July 2006

APPENDIX E

MANUFACTURER SPECIFICATIONS – METHANE COMPOSITION MONITORS

Technical Specifications

Operation Range

Unit	Minimum	Maximum	Comments
Envision	-22° F	140° F	Heater unit option for low temperatures

Gas Sensors

Gas Sensors	Range	Comments
CH4	0 - 100%	Infra-red cell
CO2	0 - 100%	Infra-red cell
O2	0 - 22%	Electrochemical w/ 1,000,000 O2% hours = Approximate life 5.4 years

Gas Sensor Accuracy

Range	CH4	CO2	O2
0-5%	±0.3%	±0.3%	±0.25%
5-30%	±1.0%	±1.0%	±<1% (Max O2 = 22%)
30 - 100%	±<2.0%	±<2.0%	NA
Resolution	0.01%	0.01%	0.01%
T90	<30s	<30s	<13s

Pressure Sensors

	Range		
Static	(-)5 H2O to 5" H2O	(-)130" H2O to 130" H2O	Comments
Accuracy	0.375"	+/- 2% of reading	According to sensor manufacture specs.
Resolution	0.001	0.01	
T90	<1 ms	<10 ms	
Differential			
Accuracy	0.375"	+/- 2% of reading	According to sensor manufacture specs.
Resolution	0.001	0.01	
T90	<1 ms	<10 ms	
Available			
Accuracy	NA	+/- 2% of reading	
Resolution	NA	0.01	
T90	NA	<10 ms	

Elkins Earthworks, LLC
865 W. Liberty Street, Suite 170
Medina, Ohio 44256
www.elkinsearthworks.com

North America Sales
Phone (330) 725-7766
Fax (216) 373-0084
www.sales@elkinsearthworks.com

Note: All statements about sensor accuracy and product tolerances are subject to change in the final released unit. This technical specification sheet will be updated when final product is quoted.

Technical Specifications

Pump Specifications

" H2O	Flow (cc/min)
-138	260
-56	650
-11	1010
11	1030
56	740
138	440

Battery Specifications

Battery Life	up to 1000 full charge cycles
Battery Construction	NiMH (no memory)
Charge Time	4 hours from complete discharge

Battery Life (NiMH)

Temperature (°F)	Life (hours)
77	13.8
50	13.1
32	10.5
14	6.6
-4	2.6

WARRANTY EXCLUSIONS AND DISCLAIMER. Elkins Earthworks, LLC. does not guaranty or warrant the results obtained through use of the Products. Accuracy and precision may be affected by:

1) improper or inadequate maintenance by Customer;

2) Customer or third party supplied products, software, interfacing or supplies;

3) unauthorized modification;

4) improper use or operation outside of the specifications for the Product;

5) misuse, abuse, negligence, accident;

6) or damage caused by accident, lightning or other electrical discharge, fresh or salt water immersion or spray, or exposure to environmental conditions for which the Product is not intended;

7) unauthorized maintenance or repair; normal wear and tear on consumable parts (e.g., batteries).

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Note: All statements about sensor accuracy and product tolerances are subject to change in the final released unit. This technical specification sheet will be updated when final product is quoted.

3/19/2008

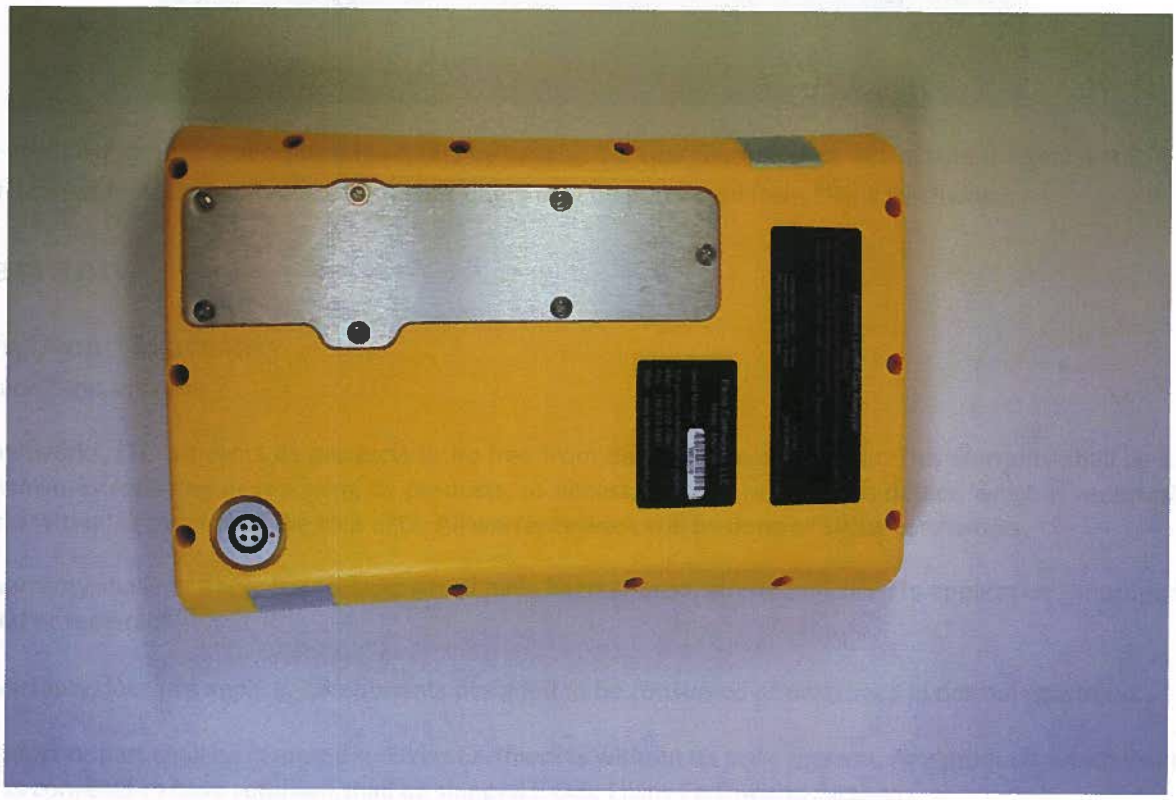
12 Envision™ Maintenance

12.1 Factory Maintenance

The Envision™ gas analyzer should be returned to the factory at a minimum once per year for inspection and factory calibration.

12.2 Field Maintenance

The Envision™ gas monitor has two internal filters. Over time these filters may clog or fowled and may need to be changed. In order to change the filters, locate the aluminum door on the back of the Envision™ gas analyzer under the protective black boot.



Remove the aluminum filter door by loosening the flathead screws and lifting the door off of the enclosure. Warning: do not remove the filter door in dusty or wet atmospheres as the internal components can get damaged.

GEM™2NAV Plus
GEM™2NAV
GEM™2000 Plus
GEM™2000

GAS ANALYZER & EXTRACTION MONITORS

OPERATION MANUAL
for
Serial Numbers 10000 and up

For further information contact:

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This manual is subject to revision without prior notice. Please periodically check our website for a newer revision.

Revision	Date	Approved by	Translated from	Comment
A	Oct-2009		N/A	*This document uses Arial, Wingdings, Wingdings 2, Wingdings 3, GI2k fonts. Printing of this document to PDF should only be done if these fonts are present. "Whitespace" has been removed from many of the graphical images and the images are otherwise "cropped" to reduce the total number of pages. These alterations of the actual screen images do not detract from the technical content presented.* 1st Release of this manual
B	Nov-2009	MC & SM	N/A	Minor Corrections / Final Proofing
B1	Nov-2009	SM	N/A	Minor corrections to images

Contents

1 Introduction

LANDTEC is the premier manufacturer of products, instruments and software for landfill gas extraction and regulatory monitoring compliance. LANDTEC has provided the landfill industry with a technologically innovative family of products for more than a decade. These products are the result of field-proven experience in design, operation and maintenance of landfills for environmental compliance.

The GEM2000, GEM2000 Plus, GEM2NAV and GEM2NAV Plus instruments designed by LANDTEC, are specifically for use on landfills to monitor landfill gas (LFG) extraction systems, flares and migration control systems. These instruments sample and analyze the Methane, Carbon Dioxide and Oxygen content of LFG. The Plus versions (GEM2000 Plus and GEM2NAV Plus) also samples and analyzes Carbon Monoxide and Hydrogen Sulfide. The NAV versions (GEM2NAV and GEM2NAV Plus) include an integral GPS (Global Positioning System). The readings are displayed and stored in the instrument and can be downloaded to a personal computer for reporting, analyzing and archiving. Since there are variations to the features of the instruments, this single manual is designed to cover all instrument versions. Throughout this manual, the term GEM2xxx is intended to refer to ANY of the GEM instruments with a serial number above 10,000. Features specific to one particular instrument will be designated within this manual to be specific for the particular instrument.

The GEM instruments are shipped in a protective hard case with a foam interior that offers additional protection, transportation convenience and component hardware storage. When properly sealed, the hard case is watertight. The hard case is equipped with a pressure relief valve (located under the handle on the case) that is normally kept closed. If there is a change in elevation, the hard case may not open until the pressure relief valve is opened to equalize internal pressure. When shipping an instrument to LANDTEC for calibration or service, always ship it in the hard case to protect unit from damage. It is a good idea to also call and generate a Service or Repair Authorization (RA) prior to sending the instrument. This ensures proper routing of your instrument once it arrives at LANDTEC. The RA also will detail a list of reasons as to why the instrument is being returned for service. If an RA does not exist when the instrument arrives it can delay service of your instrument.

Carefully unpack the contents of the instrument package, inspect and inventory them. The following items should be contained in your package:

- The GEM2000, GEM2000 Plus, GEM2NAV or GEM2NAV Plus instrument (Plus instruments have a Silver Keyboard and the numbers 1, 3, 5, 7, and 9 will be white on a blue background with a red highlight.)
- Operation Manual
- Registration/Warranty Card
- Soft carrying case with replaceable protective window and carrying strap
- Clear ¼" vinyl sampling hose assembly (5 ft.) with external water trap filter assembly
- Blue ¼" polyurethane pressure sampling hose (5 ft.)
- Spare internal particulate filter element
- Polypropylene male connector (hose barb) connects to blue & clear tubing
- Spare o-rings for the male connectors
- Spare external water trap filter element
- 100-240 volt battery charger
- Software on CD-ROM
- USB communications cable
- Temperature probe (optional)
- Hard carrying case

Complete the Registration/Warranty Card and return it to LANDTEC. The model and serial numbers are located on the back of the instrument.

Immediately notify shipping company if the instrument or accessories are damaged due to shipping. Please keep all packaging material and take pictures to document the damage. Next, contact LANDTEC immediately so that a claim can be established with the shipping company.

For questions regarding instrument operation and procedures, please contact LANDTEC at the regional office of your choice. General Operational Features

1.1 Physical Characteristics of the GEM2xxx instruments

1	Exhaust Port
2	Temperature / Gas Pod / Communications Socket (Connector “A”)
3	Power Socket (Connector “B”)
4	Particulate Filter Housing (on back of instrument)
5	Sample Inlet,Static or System Pressure Port
6	Impact Pressure Port

①	① key
②	② key, up arrow, '^' cursor key, scroll up
③	③ key
④	④ key, left arrow, '<' cursor key, scroll left
⑤	⑤ key
⑥	⑥ key, right arrow, '>' cursor key, scroll right
⑦	⑦ key
⑧	⑧ key, down arrow, 'v' cursor key, scroll down
⑨	⑨ key
⓪	⓪ key, (zero) key, Backlight operation, Keyboard Lock (press and hold for 2 second to activate keyboard lock, press again to deactivate the lock)
	Pump Operation, Pump On/Off, Backspace Key (press and hold for 1 second to backspace)
↵	Enter/Store key
⑩	Red Power Button, On-Off (Press and Hold for 2-3 seconds for normal On-Off function, Press and Hold for 15 seconds to forcibly turn off the instrument)

1.2 Storage

Do not keep the instrument in the trunk of a car or shed because it may be exposed to temperature extremes.

After use or before storing the instrument it should be purged with clean nitrogen or air. Purging with nitrogen may prolong the oxygen sensor's life. When not in use, instruments and accessories should be kept clean, dry and warm inside of their hard case.

The instrument batteries should be discharged and fully charged at least once every four weeks regardless of indicated charge state. The discharge function may be carried out with the use of the Data Logging Function in GA mode of operation.

1.3 Battery/Charging

The Battery Charger IS NOT covered by the unit UL certification. Warning - To reduce the risk of ignition of a flammable or explosive atmosphere, charge batteries only in an area known to be non-hazardous" or equivalent.

The battery used in the GEM2xxx instrument is an encapsulated six cell, Nickel Metal Hydride pack. This type of battery is not as susceptible to "memory effects" as Nickel Cadmium batteries, although it is not recommended that the unit be given short-term charges. When the flashing LED indicates "Trickle Charge" the charging is completed and the unit should be disconnected from the charger.

The battery charger indicates when the unit is charging, charged or if there is a fault. A full charge should take approximately 2 hours.

1.4 Instrument Certification

The GEM2xxx is UL/Sira certified for use in hazardous locations. Specifically certified as to intrinsic safety for use in hazardous locations Class I, Zone 1, AEx ib d IIA T1 (Ta=32°F to +104°F).

When the GEM2xxx instrument is in the hazardous area it shall only be externally attached via connector A to devices that are marked with the UL File Number E203142

For the certification to remain intact it is vital the instructions in this manual are followed closely and repairs of this equipment be carried out in accordance with the applicable code of practice by an approved repair facility. See section 7.2 for a list of authorized repair locations.

It is the responsibility of the operator to determine the protection concept and classification required for a particular application.

1.5 Safety Information

The GEM2xxx instruments are normally used for measuring gases from landfill sites. Inhalation of any gas may be harmful to health and in some cases may be fatal. It is the responsibility of the user to ensure that they are adequately trained in the safety aspects of the gases being used and that appropriate procedures be followed. In particular, where hazardous gases are being monitored or used the gas exhausted from the analyzer must be piped to an area where it is safe to discharge the gas. Hazardous gas can also be expelled from the instrument when purging with clean air.

1.6 Turning the Instrument On/Off

When switching the instrument on, a long beep will sound, followed by the LANDTEC logo being displayed and the self-test will commence. Whenever a key is pressed the unit will emit a short 'beep' as an acknowledgement. This function cannot be turned off.

When switching the instrument off, the On/Off button must be held down for approximately 2-3 seconds, at which point a clean air purge will be carried out. If for any reason the instrument 'locks-up' and will not switch off, press and hold the On/Off button for 15 seconds. This will force the instrument to switch off.

1.7 Warm-up Self Test

When switched on, the instrument will briefly display the LANDTEC logo and perform a predetermined self-test sequence taking approximately 30 seconds, during this time many of the instrument's functions are tested, including:

- General operation
- Pump function
- Gas flow measurement
- Calibration
- Backlight function
- Solenoid function

During the self-test, the following information is also displayed:

- Software version
- Serial Number
- Calibration due date
- Date format
- Operating language
- Communication Baud rate

Depending upon your version of GEM2xxx instrument you may see additional items listed from the self-test as well.

1.8 Warning and Error Display

During the self-test, if any operational parameters are out of specification or the pre-programmed recommended calibration/service date has passed errors or warnings may be displayed. Only three errors/warnings can be displayed at any time. To ascertain if more errors occurred, use the '∧' and '∨' key to scroll up/down the list, to exit from this screen press the "Enter/Store" key '↵'.

1.8.1 WARNING Displayed

All warnings displayed will be prefixed by the word "**WARNING**' followed by a relevant description. Two types of warnings may be displayed.

1. General warnings that may not have an effect on the instrument's function and those where the self-test has detected a function that is outside the usual programmed operating criteria (e.g. Battery charge low, memory nearly full, etc.).
2. Specific warnings of operational parameters that can affect the performance of the instrument (e.g. O_2 Cell out of calibration, CH_4 out of calibration, CO_2 out of calibration, etc.).

The most likely reason for the errors is either an incorrect user calibration, or sensor failure. If an incorrect user calibration has caused the warning, it should be correctable by way of returning the instrument to factory settings, zeroing or carrying out a user calibration as necessary for the relevant function.

1.8.2 ERROR Displayed

All errors displayed will be prefixed by the word '**ERROR**' followed by a number and description. The errors detected by the self-test are usually caused by a user calibration being out of specification or possibly memory corruption. This will have an effect on the functionality of the instrument and should be corrected before use (e.g. 01 - User cal data, CH_4 reading or channel out of specification, 02 - User cal data, CO_2 reading out of specification).

If any other Warnings or Errors are displayed, contact a LANDTEC Authorized Service Facility for further information.

1.9 Service Information Screen

Upon self-test completion, the instrument will display service information including when the next manufacturers service is due, what type of service agreement the instrument is under (if applicable), and when the last factory gas check was performed. To exit from this screen press the "Enter/Store" key '↵'.

1.10 Technician ID Screen

The Technician ID screen is displayed after the Service Information screen. It is not necessary to input a Technician ID but it is suggested to do so for record purposes. Up to four characters can be entered to identify the technician performing the readings. This technician ID will be appended to all readings that are taken until the instrument is turned off. To change the Technician ID simply turn the instrument off and back on again. The Technician ID can be input through a virtual key board shown on the instruments display. Letters or numbers can be selected by using the '∧' and '∨' keys to scroll up/down and the '<' and '>' to scroll left and right. Pressing the "Enter/Store" key '↵' will select the highlighted character. Once the Technician ID is selected, or to bypass selecting any characters press the '①' button.

1.11 Gas Reading Screen

After inputting or bypassing the Technician ID, the instrument will go into the Gas Reading screen, also considered the normal operation screen. All operations are carried out from this starting point. The following information is displayed in various boxed sections at this time:

- Current programmed time and date
- Current selected ID code
- Pump status
- Pump run time
- Three main constituent gases – CH_4, CO_2, O_2 (in %)
- Two minor gases – CO & H_2S and indication of H_2 (GEM2xxx Plus instruments only)
- Balance gas
- Last read time/date (if previous data is in memory)
- Technician ID
- External devices (displays pod type or temperature probe readings when attached)
- % LEL CH_4 (if selected through LSGAM)
- Barometric pressure reading.
- Current relative pressure reading (GA mode only)
- Gas Pod or Temperature Probe reading (if connected)
- Battery Charge graph (5 segment, flashes at 20% remaining)
- Memory Usage graph (5 segment, flashes at 5% remaining)

Other options:

① Menu	Allows access to all instrument user functions.
③ Next ID / GPS Screen /	Allows the next ID to be selected (if IDs are available). (GPS Screen is for GEM2NAV Models when ID's are not used)
⑤ Measure Flow	For GEM mode only.
⑦ Previous Reading	Allows the previous reading of the selected ID to be viewed (if data is available).
↵ Store Reading	Stores the current displayed reading. (GA mode only)

1.11.1 Keypad Lock

After the instrument enters into the Gas Reading Screen, and from this point forward, the keypad can be locked by pressing and holding the backlight key for approximately 2 seconds. A message will display at the bottom of the display instructing you that to release the lock you will need to press and hold the backlight button.

1.12 Optional Gas Pods

Optional Gas Pods are available for use with the instruments. These pods are available for a variety different gases. For certain gases, more than one PPM range may be available; consult with a sale representative for the Gas Pod that would best meet your specific needs. Connection to the instrument is made via the communications socket and exhaust port. The detected PPM level is displayed in the upper right area of the gas read screen and is saved in the same manner as the other gas readings. The Gas Pods are not classified as intrinsically safe they should not be attached or detached from the instrument in hazardous areas.

Gas Type	Range (PPM)	Resolution (PPM)
H_2S	0-50	0.1
	0-200	1.0
	0-5000	35
CO	0-1000	1.0
SO_2	0-20	0.1
	0-100	1.0
H_2	0-1000	1.0
HCN	0-100	1.0

Gas Pods are intended for use as an inexpensive detection means and not for regulatory reporting purposes. If a Gas Pod, indicates the presence of the pod's selected gas, further testing should be performed with regulatory approved instrumentation. LANDTEC recommends that field calibration be performed using the relevant gas and concentration, prior to sampling with a Gas Pod. If calibrated properly, the accuracy of these Gas Pods are typically 5-10% Full Scale. Certain gases used to calibrate gas pods may be dangerous or fatal to your health. Be familiar with material safety data sheets (MSDS) prior to using any gas.

1.13 Memory

The instrument's memory is volatile. It is maintained by a battery back-up system, which will maintain the memory while the battery is being charged.

The memory is **not** to be used as a permanent storage medium and any data should be downloaded to a computer with permanent storage as soon as possible. An Instrument should never be stored for prolonged periods with valuable data in its memory.

When using the instrument please cover the communications and charging sockets with their "dust plugs". Although unlikely, sudden shocks, high levels of electromagnetic interference or static discharge may cause memory corruption or loss. Additionally the use of cell phones or other high powered devices near the instrument may cause radio frequency interference and may cause memory corruption or loss. If this occurs, the instrument may need to be Cold Started and the calibration reset to factory settings before further use. **NOTE: Cold Starting will erase all data in the instrument including resetting the following to default values:**

- Time and Date
- Language Settings
- Screen Contrast Setting
- Mode of Operation
- Field Calibration

1.13.1 Cold Start

THIS FUNCTION SHOULD BE USED ONLY AS A LAST RESORT.
(For Gas Calibration Error Messages, confirm that Factory Settings and User Calibration are done).

A Cold Start should only be carried out to correct an instrument if no other course of action has proved successful. This function **WILL ERASE** the instrument memory entirely. After a cold start is performed the user will need to reset the instrument to factory settings, perform a field calibration, reset the internal time/date to the default settings, and load device IDs into the instrument. Please note that the time/date and device IDs may only be updated through the communication software. They cannot be updated manually.

To carry out a cold start, turn the instrument on, before the instrument enters into the self-test screen press and continue to hold the '↵' key until a pass code entry screen is displayed. At this point the '↵' key may be released. Enter the pass-code **12345** and press '↵' to confirm.

After the pass-code entry has been accepted, the instrument serial number will be displayed along with the hours in use, pump run time and service dates. There are four options from this screen;

1 - Cold Start
2 - Recover readings
3 - Print readings
0 - Exit

ONLY select option '**1**' if a Cold Start is to be carried out. Press key '**1**' to confirm this operation or press key '**0**' to continue with normal operation. If you select '**1**' to confirm the cold start a message will be displayed confirming the cold start operation and all memory will be cleared. The instrument will continue to the technician ID screen.

1.13.2 Recover Readings

THIS FUNCTION SHOULD BE USED ONLY AS A LAST RESORT.

Recover readings is a low level memory function that should only be used as a last resort if all your readings were inadvertently deleted and you know how many readings you had. This function moves the memory buffer and can cause instrument corruption. Contact LANDTEC before attempting to recover readings. After using this function, it is recommended that you download data from the GEM and then perform a cold start to ensure all memory is cleared and returned to an initialized state.

1.13.3 Print Readings

This function is performed as a technical support diagnostic tool and can assist LANDTEC personnel in troubleshooting certain types of problems.

1.14 Radio Frequency (RF) Interference

The gas sensors, especially the Methane sensor, are sensitive to RF interference.

Any device that transmits radio waves can cause your gas readings to fluctuate. Cell phones are the most common cause of the problem. You should never use your cell phone while you are taking gas readings.

2 The LANDTEC System Gas Analyzer Manager (LSGAM) Software

Beginning with GEM2xxx serial number 10000 and above, LSGAM is the only software that will communicate with the instrument.

6 Troubleshooting

Problem	Corrective Action/Reason
Unit does not turn on or operation is erratic	Battery charge is too low-recharge batteries. Unit is too hot - cool down unit and try again. Contact Factory Service.
"Flow Fail" is displayed and an audible alarm is heard	The inlet is blocked. Remove blockage and retry. The particulate filter or water trap filter needs replacing.
Readings taken are not what was expected	Unit may be out of calibration. Calibrate unit with known gas concentration. Water trap or particulate filters are clogged. Replace filter(s).
Readings swing up or down wildly as they are being taken	Cell phones and other sources of RF interference can affect Methane readings. Don't use your cell phone while taking readings.
Unit displays***** or >>>>>	These symbols are substituted when the measured reading is out of range of the instruments capabilities in some fields or when a value needs to be entered manually such as temperature.
Oxygen reading is high on all wells	Check that the water trap housing is screwed on tight. Check or replace O-rings on the water trap and instrument inlet. Check the wellhead inset for cracks, replace O-ring on insert. Field calibrate Oxygen channel.
Unit will not download readings or an error occurs while downloading.	Verify that the communications software is the right version for the instrument being used. Check that the proper serial port is selected in the software. Contact Factory Service.
Methane and Carbon Dioxide readings drift	Perform a field calibration and check well again. Verify cal gas is flowing when regulator is turned on. Verify all connections are tight and filters are not clogged. Contact Factory Service.
Oxygen readings drift	Perform a field calibration - zero and span. Contact Factory Service.
Black screen displayed when unit turned On	Charge unit over night and try again. Unit too hot - cool down and try again. Try adjusting contrast level. Contact Factory Service.
Nothing happens when the Gas Pod is installed	Remove and re-seat the Gas Pod. Contact Factory Service.
Temperature does not update when temperature probe is installed	Check the probe fitting is fully seated. Check the probe plug is screwed together tightly. Contact Factory Service.

7 Service & Maintenance

7.1 Factory Service

LANDTEC Facilities are the ONLY authorized service centers for the GEM™ Family of instruments. LANDTEC offers a several service plans to facilitate your bi-annual Factory Servicing of the instrument. Please contact your LANDTEC representative for more information on the service plan that best fits your specific needs. Factory Service includes but is not limited to the following;

General operations
The main functions of the gas analyzers operation are checked to ensure that they are within specification.

Barometric pressure reading
The barometric pressure reading is checked to ensure it is within specification. This is carried out by way of comparing the atmospheric reading against a known standard. If necessary, reprogramming is quoted.

Static and differential pressure readings
The static and differential pressure transducers are checked to ensure they are within specifications. This is carried out by comparing instrument readings to a known standard, applying a known pressure and noting both readings. If necessary, reprogramming will be quoted.

Pump functionality (flow and vacuum)
All flow and vacuum functions of the internal pump are checked to ensure the operation is within specification.

Water ingress/blockage
The internal filters are checked for cleanliness and moisture ingress to ensure they are not contaminated.

Flow fail setting
The flow fail function is checked to ensure proper operation within the specified limits.

Gas pod and Temperature probe connectivity reading
The connectivity of the gas analyzer is checked to ensure correct operation and reading performance with accessories.

Computer controlled gas check
Inward and outward gas checks are carried out by way of connecting the gas analyzer to a custom built computer controlled 'gas checking rig' and proprietary software. At the inward stage, two sets of readings are taken - one using the customer's calibration settings and a second set using factory calibration settings. During this process a range of gases are used that span the reading range of the gas analyzer.

Structural and aesthetics check
The instrument is checked for cracks, scratches and broken or missing pieces.

7.2 Factory Service Facilities

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LANDTEC South America
LANDTEC Produtos e Servicos Ambientais Ltda.
Rua Pedroso de Carmargo, 237 - Chácara
Santo Antonio - SP/SP CEP 0417-010
Brazil
Phone: +55(11) 5181-6591
Web: www.landtecbrazil.com.br

7.3 User Maintenance

This instrument is designed to be low maintenance and rugged. However, field calibrations are recommended prior to use or when the ambient operating temperature of the instrument changes more than +/- 20 degrees Fahrenheit. See section 2.18 for further information on field calibrations. Additionally, it may be necessary to change the user accessible filters and o-rings from time to time.

There are two user accessible filters, the particulate filter is located in the back of the instrument, see section 1.1 for location, and the water trap filter which is part of the included hose kit. There are four user changeable o-rings, one on the particulate filter cover, one on the outside of the water trap filter housing, one on the inside of the water trap filter housing, and one on the ends of each male quick connect fitting included on the hose kits.

Note: The o-rings on the male quick connect fittings should be routinely checked as dust and dirt from the various wells they connect to can be abrasive. A damaged or leaky o-ring may allow air intrusion into your gas sample. This intrusion of air may not be noticed when calibrating the instrument because the calibration does not occur under vacuum.

Technical Specifications

7.4 Physical

Weight	4.4 lbs.
Size	L 2.48" x W 7.48'' x D 9.92".
Case material	Anti-static ABS.
Keys	Membrane panel.
Display	Liquid Crystal Display 40 x 16 characters. Fiber optic woven backlight for low light conditions.
Filters	User replaceable integral fiber filter at inlet port and external PTFE water trap filter.

7.5 General

Certifications	UL Certified to Class 1, Zone 1, AEx Ib d IIa T1
Temperature measurement	With optional probe 14°F to 167°F.
Temperature accuracy	±0.4ºF (± probe accuracy).
Visual and audible alarm	User selectable CO_2, CH_4 and O_2 Min/Max levels via LSGAM CS software.
Communications	RS232 protocol via download lead with variable baud rate.
Relative pressure	±250 mbar from calibration pressure

7.6 Power supply

Battery type	Rechargeable Nickel Metal Hydride battery pack containing six 4AH cells. **Not user replaceable**. Lithium Manganese battery for data retention.
Battery life	Typical use 10 hours from fully charged condition.
Battery charger	Separate intelligent 2A battery charger powered from AC voltage supply (110-230V).
Charge time	Approximately 2 hours from complete discharge.
Alternative power	Can be powered externally for fixed-in-place applications only. Contact LANDTEC for further information.
Battery lifetime	Up to 1,000 charge/discharge cycles.

7.7 Gas Ranges

Detection principle	CO_2 and CH_4 by dual wavelength infrared cell with reference channel. O_2 (and CO & H_2S in Plus) by internal electrochemical cell. The gas sample is not dried or adjusted for Gas Humidity and therefore is on a wet basis.
Oxygen cell lifetime	Approximately 18 months in air.
Typical Accuracy 0 - Full Scale	**Gas** **0-5% volume** **5-15% volume** **15%-FS** **CH_4** ±0.3% ±1% ±3% **CO_2** ±0.3% ±1% ±3% **O_2** ±1% ±1% ±1% **CO & H_2S in Plus Instruments** ±10%FS from 0-Full Scale
Response time, T90	CH_4 ≤20 seconds CO_2 ≤20 seconds O_2 ≤20 seconds

Range	CH_4 0-100% reading. CO_2 0-100% reading. O_2 0-25% CO (in Plus Instruments) 0-2000ppm H_2S (in Plus Instruments) 0-500ppm

7.8 Pump

Typical flow	300 cc/min.
Flow fail point	Adjustable, approximately 50 – 250 cc/min.
Flow with 200 mbar vacuum	250 cc/min approximately.
Vacuum	100 inches H_20.

7.9 Operating Conditions

Operating temp range	32°F to 104°F.
Relative humidity	0-95% non-condensing.
Atmospheric pressure range	700-1200 mbar. Displayed in Inches of Mercury (5.9 – 35.4"Hg). Not corrected for sea level.
Atmospheric pressure accuracy	±5 mbar approximately.
Case seal	IP65.

7.10 Optional Gas Pods

Typical Accuracy (Subject to User calibration).	**Gas** **0-Full Scale** CO ±10% FS H_2S ±10% FS SO_2 ±10% FS H_2 ±10% FS HCN ±10% FS
Response time, T90	CO ≤60 seconds H_2S ≤60 seconds SO_2 ≤60 seconds H_2 ≤60 seconds HCN ≤60 seconds
Range	CO 0-500ppm H_2S 0-50 or 0-200ppm SO_2 0-20 or 0-100ppm H_2 0-1000ppm HCN 0-100ppm

7.11 Regulatory Compliance Labels and Statements

The device has the following safety and non-hazardous parameters:

Terminal Nos	Ui	Ii
Connector A:	6V	
Connector B	14 V	100 mA
or	11 V	2.25 A

Underwriters Laboratories Inc. (UL) has not tested the performance or reliability of the Global Positioning System (GPS) hardware, GPS operating software or other GPS-related aspects of this product. UL has only tested for the explosion, fire, shock and casualty hazards required by the applicable hazardous locations standards. UL certification does not cover the performance or reliability of the GPS hardware, GPS

operating software or other GPS-related aspects of this product.

UL MAKES NO REPRESENTATIONS, WARRANTIES OR CERTIFICATIONS WHATSOEVER REGARDING THE PERFORMANCE OR RELIABILITY OF ANY GPS RELATED FUNCTIONS OF THIS PRODUCT

APPENDIX F

CALIBRATION CERTIFICATES
MAGNETROL THERMATEL MODEL TA2 MASS FLOW METER

5300 Belmont Road
Downers Grove, Illinois 60515-4499
Phone: 630-969-4000
Fax: 630-969-9489
info@magnetrol.com

CALIBRATION CERTIFICATE

Model TA2 Thermal Dispersion Mass Flow Transmitter

Customer	SENECA MEADOWS LANDFILL
Reference	10829
Model	TA2-00B1-830
Probe	TER-A110-375
Date	January 12, 2010
Serial Number	10829-01-002

Calibration Type	
Gas type	Digester Gas 65% CH4, 35% CO2

Advanced Configuration		
STP Conditions		
Temperature	60.0	F
Pressure	1 atm	

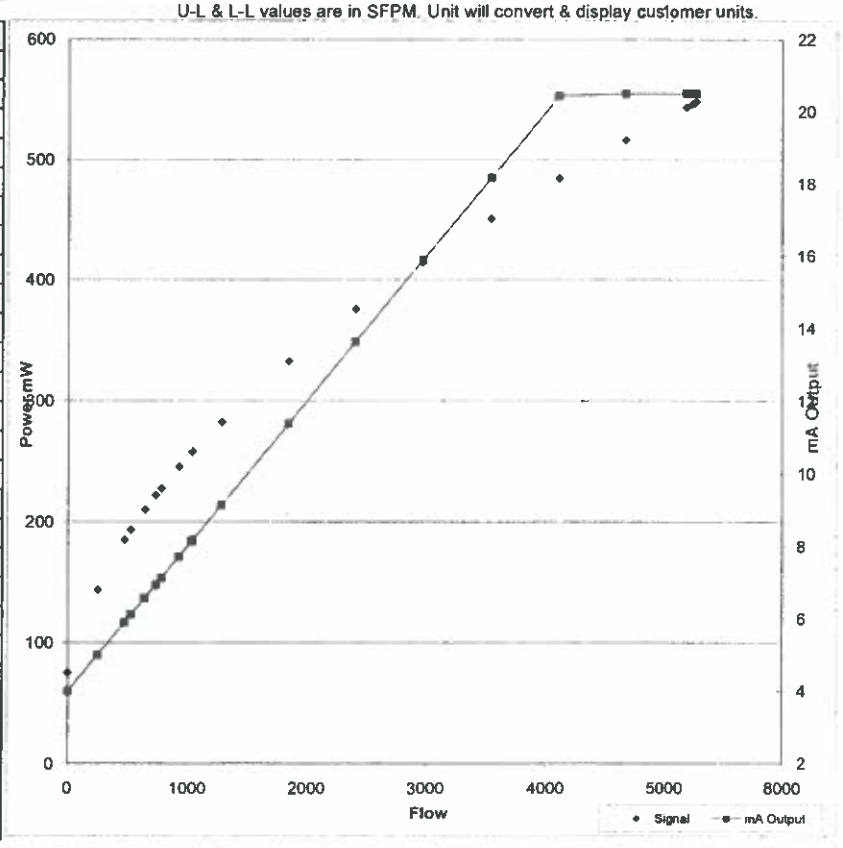
I/O Configuration		
Controlled by..	4mA	20mA
SCFM	0.00	4000.00

System Configuration		
	Units	Value
Volumetric Flow	SCFM	
Mass Flow	lbs/hr	
Temperature	F	
Density	lbs/ft3	
Line Size	24.25" ID	
Area	sq ft	3.207383

Factory Configuration					
Probe Parameters		Gas Paramaters		Control Parameters	
CA	29.356396	Density lbs/ft3	0.068071	C-Ratio	8
CB	15.278739	TCC-A	1.025300	Set Pt.	3
CC	2.088418	TCC-B	0.002436	Slope	0.001211
R_0	1347619.0	Gas Coeff Ag	0.000000	PPF	0
F_0	-3383.680	Gas Coeff Bg	0.864221		
U-L	1223.0	Gas Coeff Cg	-0.528298		
L-L	39.144	Gas Coeff Dg	0.000000		
ZFS - Gas	75.455	Gas Coeff Eg	0.000000		
ZFS - Air	77.251				

Factory Configuration values are entered using password "2200".
U-L & L-L values are in SFPM. Unit will convert & display customer units.

Instrument Setup			
Data Pt.	Units	4-20 mA	Signal
	SCFM	output	mW
1	0.00	4.00	75.45
2	247.17	4.99	143.77
3	471.59	5.89	185.53
4	524.62	6.10	193.78
5	640.70	6.56	210.47
6	731.71	6.93	222.50
7	778.27	7.11	228.37
8	925.90	7.70	245.89
9	1034.55	8.14	257.92
10	1039.21	8.16	258.42
11	1282.60	9.13	283.22
12	t845.82	t1.38	333.02
13	2407.64	13.63	375.95
14	2972.82	15.89	414.76
15	3542.60	18.17	450.78
16	4109.52	20.44	484.35
17	4112.97	20.45	484.55
18	4675.51	20.50	516.15
19	5185.80	20.50	543.87
20	5233.08	20.50	546.17
21	5249.07	20.50	547.02
22	5267.95	20.50	548.01
23	5267.95	20.50	548.01
24	5267.95	20.50	548.01
25	5267.95	20.50	548.01



Calibrated By

Checked By

January 12, 2010
Date

All calibrations NIST Traceable using an uncertainty in flow measurement of ± 0.3% of Mass Flow reading or better.

54-355 Apr-09

MISC. INFO:	

6300 Balmont Road
Downers Grove, Illinois 60515-4499
Phone: 630-969-4000
Fax: 630-969-9488
info@magnetrol.com

CALIBRATION CERTIFICATE

Model TA2 Thermal Dispersion Mass Flow Transmitter

Customer	SENECA MEADOWS LANDFILL
Reference	10829
Model	TA2-00B1-630
Probe	TER-A110-375
Date	January 12, 2010
Serial Number	10829-01-001

Calibration Type	
Gas type	Digaster Gas 65% CH4, 35% CO2

Advanced Configuration		
STP Conditions		
Temperature	80.0	F
Pressure	1 atm	

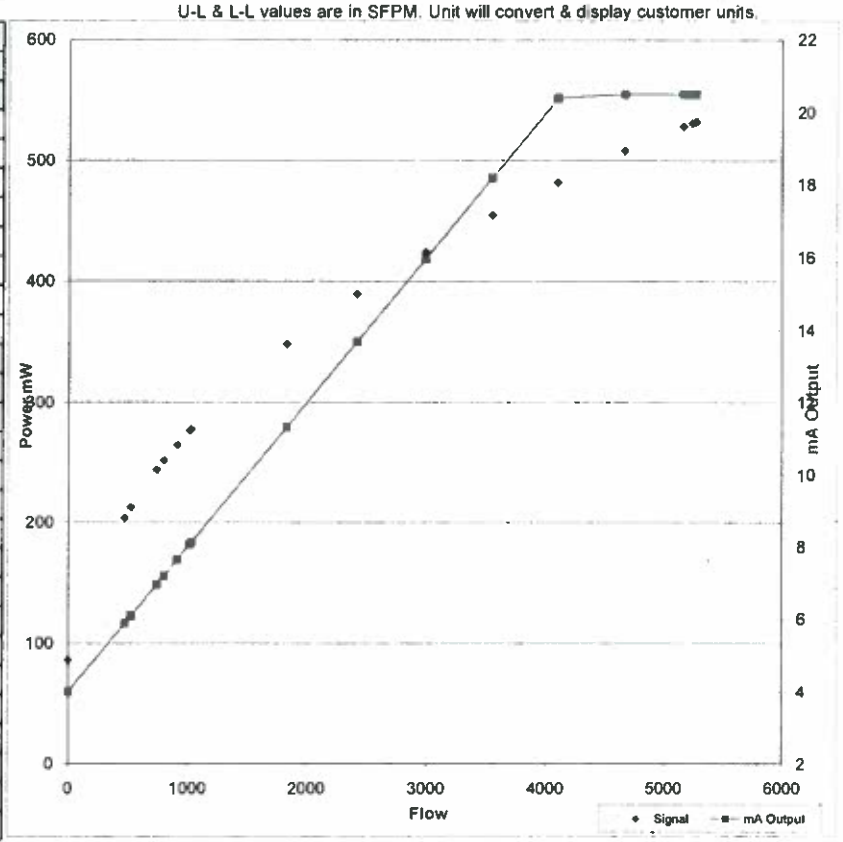
I/O Configuration		
Controlled by..	4mA	20mA
SCFM	0.00	4000.00

System Configuration		
	Units	Value
Volumetric Flow	SCFM	
Mass Flow	lbs/hr	
Temperature	F	
Density	lbs/ft3	
Line Size	24.25" ID	
Area	sq ft	3.207383

Factory Configuration					
Probe Parameters		Gas Parameters		Control Parameters	
CA	-26.517381	Density lbs/ft3	0.068071	C-Ratio	8
CB	40.363540	TCC-A	1.025300	Set Pt.	3.28
CC	2.790825	TCC-B	0.002436	Slope	0.001229
R_0	1347759.0	Gas Coeff Ag	0.000000	PPF	0
F_0	-2817.045	Gas Coeff Bg	0.842436		
U-L	1223.0	Gas Coeff Cg	0.676731		
L-L	60.835	Gas Coeff Dg	-14.240641		
ZFS - Gas	86.359	Gas Coeff Eg	53.345346		
ZFS - Air	89.636				

Factory Configuration values are entered using password "2200".
U-L & L-L values are in SFPM. Unit will convert & display customer units.

Instrument Setup			
Data Pt.	Units	4-20 mA	Signal
	SCFM	output	mW
1	0.00	4.00	86.36
2	469.53	5.88	203.79
3	521.65	6.09	212.60
4	737.23	6.95	244.00
5	797.83	7.19	251.73
6	907.78	7.63	264.87
7	1014.71	8.06	276.72
8	1025.76	8.10	277.90
9	1829.89	11.32	348.72
10	2421.59	13.69	389.66
11	2988.05	15.95	424.02
12	2990.59	15.96	424.18
13	3545.82	18.18	454.57
14	4095.80	20.38	482.04
15	4100.93	20.40	482.28
16	4667.01	20.50	507.89
17	5165.64	20.50	528.15
18	5240.15	20.50	530.99
19	5265.41	20.50	531.94
20	5273.47	20.50	532.25
21	5273.47	20.50	532.25
22	5273.47	20.50	532.25
23	5273.47	20.50	532.25
24	5273.47	20.50	532.25
25	5273.47	20.50	532.25



Calibrated By

Checked By

January 12, 2010
Date

All calibrations NIST Traceable using an uncertainty in flow measurement of ± 0.3% of Mass Flow reading or better.

54-355 Apr-09

MISC. INFO:	

Magnetrol®

MAGNETROL REGISTERED TO ISO 9001 Your Assurance of Quality and Service

Checklist for QA Documentation Required with Shipment

PRODUCTION NO.: T-010829

CUSTOMER: SENECA MEADOWS INC

P.O. NUMBER: E1621

PREPARED BY:Patrick Jennings **DATE: 11/20/2009**

TYPE OF DOCUMENTATION	FORM NO.	MAGNETROL ORDER ITEM NUMBER
		1
10 Flow Points with Certificate		2

NOTES: 1 Copies Documentation with Shipment

__ Copies Documentation to:

Partial:

Completed : KHurley

Magnetrol®

5300 Belmont Road • Downers Grove, Illinois 60515-4499 • 630-969-4000 • Fax 630-969-9489
145 Jardin Drive, Units 1 & 2 • Concord, Ontario Canada L4K 1X7 • 905-738-9600 • Fax 905-738-1306

www.magnetrol.com

APPENDIX G

CALIBRATION CERTIFICATES – LANDTEC GEM 2000 UNITS

Quality Control Check List

Model No.:	GEM-2K+	Serial No.:	8424
RA No.:	26039		
Technician:	dfletcher	Date:	3/15/2010
Repair Tech :	jlujan	Time:	1:25 PM

Options
- Software Version: ☑
- Key 3 Cold Start: ☐
- Key 8 Options: ☐
- Service Date: ☑

Display
- Function: ☑
- Contrast Adjustment: ☑
- Company Name: ☑
- 'Ex' Warning Screen: ☐

Time/Date
- Current Time: ☐
- Current Date: ☑
- Date Format: ☑

Display
- Cal Cert Figure Check: ☑
- Baro. Press. Reading: ☑
- Temp Reading: ☑
- Gas Pod Registers: ☑
- Flow Pod Registers: ☐
- CH4 Zero: ☑
- Raw Values CH4 CO2: ☑

Gas Check
- O2 Air: ☑
- O2 5%: ☑
- O2 0%: ☑
- 0.5% CH4/CO2: ☑
- 5.0% CH4/CO2: ☑
- 15.0% CH4/CO2: ☑
- 60.0/40.0% CH4/CO2: ☑
- (GEM Only) Balance%: ☑

Transducer Check (GEM Only)
- Differential Leak Test: ☑
- Static Leak Test: ☑
- Differential Press. Test: ☑
- Static Pressure Test: ☑
- Side To Side: ☐

Memory Comms.
- Store Readings: ☑
- Reading View: ☑
- Down Load: ☑
- Memory Clear: ☑

MK II Batt. & Charger
- MKII Charging: ☐
- MKII Off Current: ☐
- MKII On Current: ☐
- MKII Display: ☐
- Battery Voltage Correct: ☐

- Completed? ☑
- N/A ☐

Physical Condition
- Case: ☑
- Membrane: ☑
- Case Fittings: ☑
- Case Back Fitting: ☑
- Lemo Plug: ☑
- Carrying Strap: ☐
- Inlet Filter: ☑
- Housings Secure: ☑

Labels
- Unit Label: ☑
- Serial Number: ☑
- Battery Warning: ☐
- GI (UK): ☐
- Void Labels: ☑
- 'CE' Label: ☑
- Case Screen Printing: ☐

Flow
- Vacuum: ☑
- Flow > 300cc: ☑
- 200cc Check: ☐
- Flow fail Occurs: ☑
- Affect on Baro. Press: ☐

- Calibration Certificate: ☑

Western Region/Corporate Offices
850 South Via Lata, Suite 112, Colton, California 92324
Telephone: (909) 783-3636 Fax: (909) 825-0591
WWW.CES-LANDTEC.COM

LANDTEC

CERTIFICATE OF CALIBRATION

Certificate Number: GM08424_4/3062 **Calibration Date:** February 22, 2010
Serial Number: GM08424 **Product Type:** GEM - 2K+

Calibration checked at: 86.4 °F to 87.7 °F

Primary Gas Channels:

Methane (CH4)		Carbon Dioxide (CO2)	
Certified Gas (%)	**Reading (%)**	**Certified Gas (%)**	**Reading (%)**
50.02	49.2	49.98	49.9
15.00	14.8	15.00	14.4
5.00	4.9	5.00	4.8

Oxygen (O2)		Barometric Pressure	
Certified Gas (%)	**Reading (%)**	**Certified (mb / "/hg)**	**Reading (mb / "/hg)**
21.00	21.1	984 / 29.05	982 / 29.00

Additional Cells			
Gas	Volume		Accuracy
	Certified Gas (ppm)	Gas Reading (ppm)	
H_2	1000.0	LOW	±10%
CO	500.0	521	±10%
H_2S	100.0	106	±10%

Typical Accuracy	0-Full Scale		
Gas	Volume		
	0-5%	5-15%	15%-FS
CH_4	±0.3%	±1%	±3%
CO_2	±0.3%	±1%	±3%
O_2	±1%	±1%	±1%

LANDTEC

CERTIFICATE OF CALIBRATION

Certificate Number:	GM08424_4/3062	**Calibration Date:**	February 22, 2010
Serial Number:	GM08424	**Product Type:**	GEM - 2K+

This certificate of calibration applies solely to the unit whose serial number appears on this certificate, and is not valid for any other unit.

Prepared for:

SENECA MEADOWS,INC
1786 SALCMAN ROAD
WATERLOO NY 13165

Calibration Procedures used:

ISP 17 – Calibration Chamber
ISP 18 – Incoming Inspection Procedure
ISP 19 – Outgoing Inspection Procedure
ISP 13 – Calibration and Validation Methods
ISP 12 – Handling of customer equipment
ISP 10 – Contract review

The gases used to prepare this calibration are traceable to a certified standard prepared by weights traceable to the National Institute of Standards and Technology (NIST), or by using NIST standard reference materials where available.

Approved by:

Name: DAVID FLETCHER

Signature: David Fletcher

Job Title: Service Technician

CERTIFICATE OF CALIBRATION

Certificate Number: GM07990_4/3852 **Calibration Date:** September 9, 2010
Serial Number: GM07990 **Product Type:** GEM - 2000

Calibration checked at: 74.0 °F to 91.1 °F

Primary Gas Channels:

Methane (CH4)		Carbon Dioxide (CO2)	
Certified Gas (%)	**Reading (%)**	**Certified Gas (%)**	**Reading (%)**
50.02	49.3	49.98	50.3
15.00	15.0	15.00	14.4
5.00	5.1	5.00	4.7

Oxygen (O2)		Barometric Pressure	
Certified Gas (%)	**Reading (%)**	**Certified (mb / "/hg)**	**Reading (mb / "/hg)**
21.00	21.0	975 / 28.80	977 / 28.85

Typical Accuracy	0-Full Scale		
Gas	**Volume**		
	0-5%	**5-15%**	**15%-FS**
CH_4	±0.3%	±1%	±3%
CO_2	±0.3%	±1%	±3%
O_2	±1%	±1%	±1%

Method of Test: The analyser is calibrated in a temperature controlled chamber using reference gases.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95%. The uncertainty evaluation has been carried out in accordance with NIST requirements.

Landtec North America Instrument Services Facility 850 South Via Lata, Suite 112, Colton CA, 92324

CERTIFICATE OF CALIBRATION

Certificate Number:	GM07990_4/3852	**Calibration Date:**	September 9, 2010
Serial Number:	GM07990	**Product Type:**	GEM - 2000

This certificate of calibration applies solely to the unit whose serial number appears on this certificate, and is not valid for any other unit.

Prepared for:

Seneca Meadows Inc.
1786 Salcman Road
Waterloo, NY 13165

Calibration Procedures used:

ISP 17 – Calibration Chamber
ISP 18 – Incoming Inspection Procedure
ISP 19 – Outgoing Inspection Procedure
ISP 13 – Calibration and Validation Methods
ISP 12 – Handling of customer equipment
ISP 10 – Contract review

The gases used to prepare this calibration are traceable to a certified standard prepared by weights traceable to the National Institute of Standards and Technology (NIST), or by using NIST standard reference materials where available.

LANDTEC North America is an ISO 9001 and ISO/IEC 17025 accredited company.

Approved by:

Name: Javier Lujan

Signature:

Job Title: Service Technician

Quality Control Check List

Model No.:	GEM-2000	**Serial No.:**	7990
RA No.:	27841		
Technician:	jlujan	**Date:**	9/10/2010
Repair Tech :	mlujan	**Time:**	9:12 AM

Options

- Software Version: ☑
- Key 3 Cold Start: ☐
- Key 8 Options: ☐
- Service Date: ☑

Display

- Function: ☑
- Contrast Adjustment: ☑
- Company Name: ☑
- 'Ex' Warning Screen: ☐

Time/Date

- Current Time: ☐
- Current Date: ☑
- Date Format: ☑

Display

- Cal Cert Figure Check: ☑
- Baro. Press. Reading: ☑
- Temp Reading: ☑
- Gas Pod Registers: ☑
- Flow Pod Registers: ☐
- CH4 Zero: ☑
- Raw Values CH4 CO2: ☑

Gas Check

- O2 Air: ☑
- O2 5%: ☑
- O2 0%: ☑
- 0.5% CH4/CO2: ☑
- 5.0% CH4/CO2: ☑
- 15.0% CH4/CO2: ☑
- 60.0/40.0% CH4/CO2: ☑
- (GEM Only) Balance%: ☑

Transducer Check (GEM Only)

- Differential Leak Test: ☑
- Static Leak Test: ☑
- Differential Press. Test: ☑
- Static Pressure Test: ☑
- Side To Side: ☐

Memory Comms.

- Store Readings: ☑
- Reading View: ☑
- Down Load: ☑
- Memory Clear: ☑

MK II Batt. & Charger

- MKII Charging: ☐
- MKII Off Current: ☐
- MKII On Current: ☐
- MKII Display: ☐
- Battery Voltage Correct: ☐

- Completed? ☑
- N/A ☐

Physical Condition

- Case: ☑
- Membrane: ☑
- Case Fittings: ☑
- Case Back Fitting: ☑
- Lemo Plug: ☑
- Carrying Strap: ☐
- Inlet Filter: ☑
- Housings Secure: ☑

Labels

- Unit Label: ☑
- Serial Number: ☑
- Battery Warning: ☐
- GI (UK): ☐
- Void Labels: ☑
- 'CE' Label: ☑
- Case Screen Printing: ☐

Flow

- Vacuum: ☑
- Flow > 300cc: ☑
- 200cc Check: ☐
- Flow fail Occurs: ☑
- Affect on Baro. Press: ☐

- Calibration Certificate: ☑

Western Region/Corporate Offices
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Telephone: (909) 783-3636 Fax: (909) 825-0591
WWW.CES-LANDTEC.COM

APPENDIX H

CALIBRATION CERTIFICATES – ENVISION GAS ANALYZER UNITS

1104 Envision
Testing and Calibration Report

Elkins Earthworks, LLC

Meter ID: 1007001 **Job No:** 0000006899 **Date:** Sep 17, 2010

Firmware Version: 000001.03

TESTS PERFORMED:

Communications Testing:
PDA ☒
Bluetooth ☒

Firmware Testing:
Test / Update Firmware Version ☒

Battery Testing:
Battery Charger Check ☒
Battery Life Check ☒

Thermistor Testing:
Thermistor Room Temperature Check ☒

Pressure Sensor Testing:
Available Port Pressure Testing / Calibration ☒
Impact Port Pressure Testing / Calibration ☒
Static Port Pressure Testing / Calibration ☒

Gas Sensor Testing:
O2 Sensor Testing / Calibration ☒
CO2 Sensor Testing / Calibration ☒
CH4 Sensor Testing / Calibration ☒

Heater Testing:
Heater ON / OFF Check ☒

CALIBRATION DATA:

Pressure Sensors:

	Certified Low Pressure (WC)	Low Pressure Reading (WC)	Certified High Pressure (WC)	High Pressure Reading (WC)
Available 100 inWC	0.0	**0.0**	100.4	**100.2**
Differential 25 inWC	0.00	**0.03**	23.99	**23.98**
Applied 100 inWC	0.00	**-0.03**	100.30	**100.12**
Applied 5 inWC	-4.61	**-4.61**	4.44	**4.44**

Gas Sensors:

	Zero Reading (100% N2 Applied)	Certified Gas Applied	Gas Reading
O2 Sensor	**0.00% O2**	20.9% O2	**21.10% O2**
CO2 Sensor	**0.00 % CO2**	35.00 % CO2	**35.02 % CO2**
CH4 Sensor	**0.00 % CH4**	50.00 % CH4	**50.07 % CH4**

This Device **PASSED** Testing and Calibration.

Calibrated By (Initials): **RK - 100923**

1104 Envision
Testing and Calibration Report

Elkins Earthworks, LLC

Meter ID: 1007009 **Job No:** 0000006899 **Date:** Sep 17, 2010

Firmware Version: 000001.03

TESTS PERFORMED:

Communications Testing:
PDA ☒
Bluetooth ☒

Firmware Testing:
Test / Update Firmware Version ☒

Battery Testing:
Battery Charger Check ☒
Battery Life Check ☒

Thermistor Testing:
Thermistor Room Temperature Check ☒

Pressure Sensor Testing:
Available Port Pressure Testing / Calibration ☒
Impact Port Pressure Testing / Calibration ☒
Static Port Pressure Testing / Calibration ☒

Gas Sensor Testing:
O2 Sensor Testing / Calibration ☒
CO2 Sensor Testing / Calibration ☒
CH4 Sensor Testing / Calibration ☒

Heater Testing:
Heater ON / OFF Check ☒

CALIBRATION DATA:

Pressure Sensors:

	Certified Low Pressure (WC)	Low Pressure Reading (WC)	Certified High Pressure (WC)	High Pressure Reading (WC)
Available 100 inWC	0.0	**0.0**	101.5	**101.3**
Differential 25 inWC	0.00	**0.02**	24.30	**24.26**
Applied 100 inWC	0.00	**-0.09**	99.60	**99.40**
Applied 5 inWC	-4.38	**-4.41**	4.56	**4.53**

Gas Sensors:

	Zero Reading (100% N2 Applied)	Certified Gas Applied	Gas Reading
O2 Sensor	**0.00% O2**	20.9% O2	**21.17% O2**
CO2 Sensor	**0.00 % CO2**	35.00 % CO2	**35.30 % CO2**
CH4 Sensor	**0.00 % CH4**	50.00 % CH4	**50.37 % CH4**

This Device **PASSED** Testing and Calibration.

Calibrated By (Initials): **RK - 100923**

APPENDIX I

COMPLAINT MANAGEMENT STANDARD OPERATING PROCEDURE

SENECA MEADOWS, INC.
COMPLAINT MANAGEMENT SOP

PURPOSE:

In 1999, SMI entered into a Host Community Benefits Agreement with the Town of Seneca Falls, and was also granted a License To Construct And Operate A Landfill Under Chapter 58 Of The Code Of Seneca Falls, New York. According to these documents, Seneca Meadows will provide a 24 hour, local telephone number for the purpose of receiving citizen complaints regarding landfill operations; including but not limited to: odors, litter, dust, noise, truck traffic, hours of operation, air contamination, and water quality. SMI will also publish the availability of the number quarterly in local newspapers, and will post it in public areas (state, county, town and village offices, libraries, meeting halls) within the Town and will publish the number in the telephone directory white pages, identified as a complaint hot line to insure that Town residents are aware of it.

SMI is also committed to maintaining a complaint log, and providing a monthly summary report to the Town of Seneca Falls with the following information:

1. Complaint calls received by SMI (including the date and time of complaint; name, address, and phone number of caller; location of incident; description and duration of incident; and other supporting details);

2. Details of the investigation and its findings; and,

3. Actions taken (if any) to mitigate the incident.

The complainant will also receive a copy of the complaint log, relating to his or her complaint, as soon as practicable after the investigation of the reported incident.

All complainants must supply certain information in order for Seneca Meadows to conduct a proper investigation. That information is as follows: name of complainant, address and phone number of complainant, location of incident, and dates and times of incident. Should a complainant neglect or refuse to provide the information necessary to conduct a proper investigation, Seneca Meadows will not be obligated to pursue the investigation.

PROCEDURE & RESPONSIBILITIES FOR MANAGING COMPLAINTS:

In order to investigate and address complaints effectively, SMI distinguishes between odor complaints and non-odor complaints; and has developed separate investigation forms for each. The investigation form for odor complaints is entitled, the ODOR INVESTIGATION CHECKLIST, and the form for non-odor complaints is termed, the GENERAL COMPLAINT TRACKING FORM.

Receptionist

During SMI office hours, the receptionist will direct all incoming complaints to the Community Relations Coordinator. Should the Community Relations Coordinator not be available to take a call, the Receptionist will record the complainant's information on the ODOR INVESTIGATION CHECKLIST, or the GENERAL COMPLAINT TRACKING FORM; depending upon the type of complaint. The Receptionist will then promptly distribute the form to the Landfill Operations Manager, with copies to the Community Relations Coordinator, Engineering Manager and persons identified by the Engineering Manager.

Each working day the Receptionist will check the after-hours answering machine for complaint calls. If a complaint message was left on the machine, the Receptionist will record the complainant's information on the ODOR INVESTIGATION CHECKLIST, or the GENERAL COMPLAINT TRACKING FORM; depending upon the type of complaint. The Receptionist will then promptly distribute the form to the Landfill Operations Manager with copies to the Community Relations Coordinator, Engineering Manager and persons identified by the Engineering Manager.

Community Relations Coordinator

In addition to any complaint reports received from the receptionist, each weekday the Community Relations Coordinator receives a complaint listing (via e-mail) from Total Recall (SMI's complaint answering service). This listing contains complaint calls received by Total

Recall within the previous 24 hour period (listings received Monday reflect all calls received over the weekend).

If there are no complaint calls on the listing, the Community Relations Coordinator will file the listing. If complaint calls are noted on the listing, the Community Relations Coordinator will notify the Landfill Operations Manager. The Community Relations Coordinator will then complete a portion of the ODOR INVESTIGATION CHECKLIST, or the GENERAL COMPLAINT TRACKING FORM (both attached); depending on the type of complaint.

The Community Relations Coordinator will then give the appropriate form to the Landfill Operations Manager. If the Community Relations Coordinator is unavailable to perform these tasks on any given day, the Engineering Manager or his designee will assume this responsibility.

Landfill Operations Manager/Designated Personnel

Odor Complaints:

When the Landfill Operations Manager receives the original ODOR INVESTIGATION CHECKLIST, he will conduct an investigation of the incident. This investigation will involve the necessary steps to address the issues from the ODOR INVESTIGATION CHECKLIST.

The Landfill Operations Manager will then conduct an investigation of the complaint, and determine what measure(s), if any, should be implemented to mitigate the incident using the information gleaned from the investigation. If required, the Landfill Operations Manager, or his designee, will then direct personnel and equipment to mitigate the problem, and complete the ODOR INVESTIGATION CHECKLIST form. The completed checklist will then be reviewed by the Engineering Manager, and returned to the Community Relations Coordinator.

General Complaints:

When the Landfill Operations Manager receives the original GENERAL COMPLAINT TRACKING FORM he, or his designee, will investigate the incident. This investigation will include, but not be limited to, an investigation of the following:

- Nature of the incident; and,

- Source of the incident.

The Landfill Operations Manager, or his designee, will determine what measure(s), if any, should be implemented to mitigate the incident using the information gleaned from the investigation. If required, the Landfill Operations Manager, or his designee, will then direct personnel and equipment to mitigate the problem and will complete the GENERAL COMPLAINT TRACKING FORM. The completed form will be returned to the Community Relations Coordinator upon completion, or completion of mitigation efforts.

Note: Complaints that are called in well after the time of the incident, may be difficult or impossible for SMI to investigate and/or mitigate (if required). Under these circumstances, SMI will attempt to investigate the matter, based on available information, and implement a reasonable mitigation measure if warranted.

Community Relations Coordinator

When the Community Relations Coordinator has received the completed form, a copy of the completed form will be provided to the Engineering Administrative Assistant. The Administrative Assistant will mail a copy of the appropriate form to each complainant, and at the end of each month will prepare a summary report, which will include all ODOR INVESTIGATION CHECKLIST forms and GENERAL COMPLAINT TRACKING FORMS, for submission to the Town of Seneca Falls, in accordance with the Host Community Benefits Agreement and the License To Construct And Operate A Landfill Under Chapter 58 Of The Code Of Seneca Falls, New York. A copy of these submissions will be filed at the Seneca Meadows site, and a copy of the ODOR INVESTIGATION CHECKLIST forms will be submitted to the New York State Department of Environmental Conservation.

APPENDIX J

ESTIMATED EX ANTE GHG EMISSION REDUCTIONS

CARBON CREDIT EVALUATION
SENECA MEADOWS, INC.

Year	Stage 1		Stage 2		Stage 3	
	Estimated Range of Credits	Median	Estimated Range of Credits	Median	Estimated Range of Credits	Median
2009						
2010	47,239 - 234,582	140,910	4,251 - 21,112	12,682		
2011	45,387 - 212,258	128,823	55,103 - 272,452	163,777		
2012	43,607 - 192,059	117,833	103,960 - 499,873	301,916		
2013	41,897 - 173,782	107,840	99,884 - 452,304	276,094	50,815 - 252,338	151,576
2014					87,357 - 419,682	253,519
2015					83,931 - 379,744	231,837
2016					80,640 - 343,606	212,123
2017						
2018						
2019						
2020						
2021						
2022						
2023						
2024						
2025						
2026						

Notes:

All values expressed as metric tons of carbon dioxide equivalents (metric tons CO_2eq)

CARBON CREDIT EVALUATION
SENECA MEADOWS, INC.

Year	Stage 4		Stage 5		Stage 6	
	Estimated Range of Credits	Median	Estimated Range of Credits	Median	Estimated Range of Credits	Median
2009						
2010						
2011						
2012						
2013						
2014	12,308 - 61,118	36,713				
2015	50,445 - 247,085	148,765				
2016	48,467 - 223,572	136,020	12,259 - 60,878	36,569		
2017	46,567 - 202,296	124,432	62,507 - 306,994	184,751		
2018			110,784 - 529,689	320,237	40,682 - 202,021	121,352
2019			116,586 - 529,665	323,125	77,226 - 372,192	224,709
2020					74,198 - 336,773	205,486
2021					71,289 - 304,725	188,007
2022						
2023						
2024						
2025						
2026						

Notes:

All values expressed as metric tons of carbon dioxide equivalents (metric tons CO_2eq)

CARBON CREDIT EVALUATION
SENECA MEADOWS, INC.

	Stage 7		Stage 8		Stage 9	
Year	**Estimated Range of Credits**	**Median**	**Estimated Range of Credits**	**Median**	**Estimated Range of Credits**	**Median**
2009						
2010						
2011						
2012						
2013						
2014						
2015						
2016						
2017						
2018						
2019	16,905 - 83,950	50,428				
2020	66,959 - 327,813	197,386				
2021	115,050 - 548,468	331,759				
2022	143,927 - 662,076	403,002	17,391 - 86,360	51,875		
2023			64,215 - 314,052	189,134	3,389 - 16,830	10,109
2024			61,697 - 284,166	172,932	54,092 - 267,673	160,883
2025			59,278 - 257,124	158,201	96,453 - 463,090	279,772
2026					92,671 - 419,021	255,846

Notes: **Totals**

All values expressed as metric tons of carbon dioxide equivalents (metric tons CO_2eq)

CARBON CREDIT EVALUATION
SENECA MEADOWS, INC.

Year	Total	
	Estimated Range of Credits	Median
2009		
2010	51,490 - 255,694	153,592
2011	100,489 - 484,710	292,600
2012	147,567 - 691,932	419,750
2013	192,596 - 878,424	535,510
2014	99,664 - 480,799	290,232
2015	134,377 - 626,829	380,603
2016	141,367 - 628,056	384,712
2017	109,074 - 509,291	309,182
2018	151,466 - 731,711	441,589
2019	210,718 - 985,807	598,262
2020	141,157 - 664,585	402,871
2021	186,339 - 853,193	519,766
2022	161,318 - 748,437	454,877
2023	67,604 - 330,882	199,243
2024	115,790 - 551,840	333,815
2025	155,731 - 720,215	437,973
2026	92,671 - 419,021	255,846
	2,259,419 - 10,561,427	**6,410,423**

Notes:

All values expressed as metric tons of carbon dioxide equivalents (metric tons CO_2eq)

APPENDIX K

PROJECT CONTACT INFORMATION

PROJECT CONTACT LIST

SENECA MEADOWS, INC.
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