OPERATION, MAINTENANCE AND MONITORING PLAN

VOLUME 1
Overview and General Requirements

Countywide Recycling and Disposal Facility
88-Acre Remediation Unit

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OPERATION, MAINTENANCE, AND MONITORING PLAN

VOLUMES OF THE PLAN

Volume 1 – Overview and General Requirements (this volume)
Volume 2 – Gas Collection and Control System
Volume 3 – Leachate Management System

INCORPORATED BY REFERENCE

Countywide/Republic Services Health and Safety Plan
Flare Operation and Maintenance Manuals
500,000 Gallon Storage Tank Manual
NPDES Permits
NSPS/Title V Permits
Incident Management System Plan
SPCC Plan
Operating Record
Final Report on U.S. EPA AOC Remedial Actions

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1.0 INTRODUCTION

The Countywide Recycling and Disposal Facility (Countywide) is a single facility operating under Ohio Environmental Protection Agency (Ohio EPA) Permit to Install (PTI) 02-14796, but is managed as two separate units: a 170-acre operational unit and an 88-acre remediation unit. These unit designations result from distinct physical differences caused by a reaction which began in or before 2006, and from an isolation break installed under United States Environmental Protection Agency (U.S. EPA) oversight. The isolation break was installed as a time-critical measure to prevent spread of the reaction from the 88 acre remediation unit to the 170 acre operational unit.

This Operation, Maintenance, and Monitoring Plan (OM&M Plan) has been developed to provide requirements specifically for the 88-acre remediation unit. It has been prepared at the request of the U.S. EPA, per their July 2, 2008 letter. The Ohio EPA may approve this OM&M Plan as an interim remedial measure under authority of the March 28, 2007 Director's Final Findings and Orders (DFFOs).

The following and attached materials comprise Volume 1 of a multi-volume OM&M Plan for the Countywide 88-acre remediation unit. The OM&M Plan consists of the following.

Volume 1 – Overview and General Requirements (this volume)
Volume 2 – Gas Collection and Control System
Volume 3 – Leachate Management System
Miscellaneous other volumes/documents/manuals incorporated by reference (see Table of Contents for this Volume 1 for list of documents).

Throughout this document, references are made to specific sections of the Ohio Revised Code (ORC) laws and the Ohio Administrative Code (OAC) rules which were in effect as of August 2009. Should the rules or rule numbering system change in the future, any reference to specific rules in this document will automatically correlate to the new rule or rule number (when applicable). In addition, references are made to specific guidance documents, manuals, and policies; it is understood that if and when these documents are updated, the current versions shall be adopted.

1.1 History and Background

Countywide is a municipal solid waste (MSW) landfill permitted by the Ohio EPA and is located at 3619 Gracemont Avenue SW, East Sparta, Ohio (in Pike Township, Stark County, Ohio). The facility is licensed by the Stark County Health Department (SCHD), and has been in operation since 1991. Countywide has been owned and operated by Republic Services of Ohio II, LLC (Republic) since March 1999. In June 2003, the Ohio EPA approved a 170-acre expansion (Cells 7-16) to the original 88-acre (Cells 1-6) waste disposal area (see **Figure 1**).

Between 1993 and 2006, Countywide received 17,000,000 cubic yards of waste; approximately 600,000 tons of which consisted of non-hazardous industrial aluminum process waste. The majority of the aluminum waste material was described as "dross" and "salt cake" which are by-products from melting recycled aluminum with a salt flux. Smaller quantities of aluminum-containing baghouse dust materials were also disposed. All of the dross and salt cake was disposed in the original 88-acre portion of the facility. Some baghouse dust is present in Cell 7 which is now part of the 170 acre operational unit.

Beginning in 2001, Countywide noted elevated temperatures in some gas wells and submitted higher operating value (HOV) requests to the Canton City Health Department (CCHD). In 2004, Countywide expanded the gas collection and control system (GCCS) in response to citizen odor complaints.

Then, in 2006, Countywide observed a rather sudden and unusual temperature increase in many gas extraction wells, forceful leachate outbreaks, accelerated settlement, and odors. Countywide also discovered changes in landfill gas composition, including a decrease in methane, and an increase in hydrogen concentrations and carbon monoxide. These were ultimately attributed to a reaction between the aluminum wastes and liquid and to the effects of the aluminum waste reaction interacting with the solid wastes which were also disposed in the landfill (see Section 1.2).

Throughout 2006, Countywide initiated numerous activities to reduce odor generation from the landfill including placement of 30 acres of temporary exposed geomembrane cap. However, odor generation was not completely abated. Subsequent agency orders, work plans, studies, etc. ensued—all aimed at eliminating the odor and, if possible, remediating the causes of the odor. A compiled list and chronology of major orders and actions is provided below:

September 6, 2006 Ohio EPA DFFOs –The Director determined the site was an air pollution nuisance, and required certain actions to control, monitor and characterize odors.

March 28, 2007 Ohio EPA DFFOs – The Director defined a "fire" as "rapid thermal decomposition of solid waste producing carbon monoxide in excess of 1,000 ppmv" and thus declared that the facility violates OAC Rule 3745-27-19(E)(3)(a), and also concluded that the facility continued to be an air pollution nuisance. The Orders required significant sampling and analyses to characterize the reaction and its byproducts and side-effects, ordered implementation of a community ambient air monitoring system, and requested a number of study reports including a Fire Suppression Plan. It also established penalties and control mechanisms for future enforcement. These DFFOs superseded the September 6, 2006 DFFOs.

October 1, 2007 Ohio EPA– Required creating a "firebreak" between Cell 8A and 8B, and ceasing filling in Cell 7 and 8A.

November 7, 2007 Ohio EPA DFFOs – Required dewatering by adding pumps to gas extraction wells to improve gas collection efficiency. Also required additional scientific studies.

December 6, 2007 Modification to November 07, 2007 DFFOs – Suspended some of the time frames and requirements in the November 7, 2007 DFFOs.

December 31, 2007 Ohio EPA DFFOs – Superseded portions of the November 07, 2007 DFFOs, and requested revised, increased dewatering including installing deeper remediation wells (RWs).

February 7, 2008 Ohio EPA DFFOs – Required changes to the community ambient air monitoring program including sampling for dioxins and furans.

April 11, 2008 U.S. EPA Administrative Settlement Agreement and Order on Consent for Removal Action AOC) – Required isolating and containing the reaction through capping and redirection of reaction gases away from Cell 7. The AOC also required on-site, real-time continuous ambient air monitoring and sampling.

June 5, 2008 Countywide Report **–** At the request of the Ohio EPA, Countywide performed an investigation and then submitted a report regarding the 2006 waste slope movement. The report concluded that a limited portion of the south slope had moved up to 20' outside the permitted waste disposal limits.

October 24, 2008 U.S. EPA Letter – Requested Countywide to submit a Work Plan for the construction of a physical separation (Isolation Break) to "achieve complete separation, full containment and isolation of the ongoing reaction affecting Cells 1-6."

November 19, 2008 U.S. EPA Letter – Approved the Work Plan for construction of an Isolation Break.

December 30, 2008 Letter – A letter from the Ohio EPA Enforcement Coordinator approved a requested reduction in certain sampling and analytical requirements per the March 28, 2007 DFFOs.

January 13, 2009 U.S. EPA Letter – Requested Countywide submit a Work Plan for placement of composite cap over Cells 1-3.

May 29, 2009 Ohio EPA DFFOs – Requires submitting a PTI modification application by June 01, 2010.

By July 2009, the temporary capping had been accomplished and the Isolation Break had been completed. See **Figure 2** for the remedial feature locations and the limits of the 88-acre remediation unit. The U.S. EPA concluded the Isolation Break had achieved a full and complete separation of waste, leachate, and gas between the 88-acre unit and the 170-acre unit (see **Appendix A**). This "bifurcation" resulted in the creation of the two non-contiguous units which were previously described.

1.2 Reaction Description

Note: ***The statements provided in this section are hypotheses, theories, and models based on extensive subsurface investigation, sampling and analyses, monitoring, and data review. These statements reflect the opinion of Countywide and its experts, and are presented only in an attempt to provide the reader some background on the unusual and unprecedented conditions within the 88-acre unit. It appears that a series of chemical reactions are occurring in the landfill. These reactions could include—but are not limited to—hydrolysis of the aluminum waste product, thermal decomposition of waste, pyrolysis of waste, and oxidation of waste. It is not known which of these mechanisms predominates. Throughout this document, the term "reaction" is used—it should be assumed that the term "reaction" includes any or all of the previously-referenced types, or other reactions that have not yet been identified. Countywide previously submitted a Fire Suppression Plan (FSP) to the Director per the March 2007 DFFOs. The Director may disagree with or elaborate on the descriptions provided by Countywide below as part of his review of the FSP.***

It is believed the conditions in the remediation unit were initiated by a reaction involving the aluminum waste and moisture in the landfill, which results in heat generation as follows.

$$2\ Al + 6\ H_2O \Rightarrow 2\ Al(OH)_3 + 3\ H_2 + \text{Heat}$$

Figure 3 illustrates a hypothetical model of the reaction's major manifestations and the interaction of the reactions with the solid waste, including:

- Elevated temperatures (up to 280° F) which require special construction materials and which produce conditions unfavorable to methanogenesis resulting in a significant decrease in methane production;
- Production of hydrogen, acetylene, volatile organic, and carbon monoxide gases;
- Generation of unique odor;
- Drying of waste which results in a steam/water vapor front moving out, up, and away from the reaction which then condenses in the leachate collection system, cooler surrounding waste mass, and gas extraction wells, resulting in extremely high leachate generation;
- Higher-than-normal pressure adjacent to the reacting waste mass; and
- Large settlement under and/or adjacent to reacting waste mass.

Each of these manifestations results in significant environmental management challenges. It is not known how long the reactions will continue or how long these conditions will exist, but it is believed the elevated temperatures and atypical gas quality will be present for many years.

1.3 Operation, Maintenance, and Monitoring (OM&M) Plan Objectives

The objectives for Volume 1 of the OM&M Plan are as follows.

1. Create a document which could be implemented by in-house Countywide personnel or by a third party to maintain effective, safe, environmental management (see Sections 2.0, 3.0, 4.0, and 5.0).

2. Provide a program for monitoring to assess: the reaction condition; issues which warrant agency notification and/or contingency measures; and conditions which may be conducive to further remedial measures (see Sections 6.0 and 7.0).

3. Develop plans to ensure worker and public safety (see Sections 8.0 and 9.0).

4. Describe the path toward achieving final closure and post closure care and the process and requirements for financial assurance to bring the unit through the OM&M phase to the point when final closure and post closure care are achieved (Sections 10.0 and 11.0).

5. Present means for communicating, reporting, and propose procedures for revising for the Plan (Sections 12.0 and 13.0).

2.0 MANAGEMENT AND RESPONSIBILITIES

2.1 Facility Management

Both the 170-acre operational unit and the 88-acre remediation unit portions of Countywide's facility are owned and operated by Republic Services of Ohio II, LLC (Republic). However, the unique physical conditions and installation of the time-critical isolation break in 2009 created the need to manage the two units somewhat separately. Republic's management approach will feature:

- Oversight shared with the 170-acre operational unit,
- Some shared, and some dedicated personnel,
- Separate document filing, and
- Separate financial accounting.

Table 1 illustrates this management structure, while **Table 2** presents contact information.

As indicated on **Table 1**, Countywide will have staff and management dedicated to the OM&M of the remediation unit. All personnel responsible for OM&M will be required to read, and be familiar with, all volumes of the OM&M Plan and to reread the plans at least annually.

2.2 Agency Authority and Responsibilities

Since the 88-acre remediation unit has been functionally split from the 170-acre operational unit, agency authority is somewhat untypical. **Table 3** presents a simplified graphic of the general inter-agency relationship and authority with respect to the 88-acre remediation unit and the 170-acre operational unit. Agency roles related to the 88-acre remediation unit are briefly summarized below.

Ohio EPA. Lead agency responsible for regulating in accordance with the facility's authorizing documents and with ORC rules adopted thereunder. Provides oversight of compliance with the requirements of this OM&M Plan.

U.S. EPA. Has authority through the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) to enhance and augment remedial effort if necessary. The U.S. EPA will also will provide technical expertise at request of Ohio EPA during OM&M and during further remedial efforts.

Stark County Health Department (SCHD). Approved by the Director to license and co-regulate the Countywide facility in accordance with the facility's authorizing documents and ORC 3734 and the rules adopted thereunder.

City of Canton Health Department. Has permitting and oversight role for Title V and New Source Performance Standards (NSPS) air permits. These permits are common to both the 88-acre remediation unit and the 170-acre operational unit.

A compilation of the permits and licenses required by these and other regulatory authorities is included in the Operating Record Index of the current facility Operating Record which is incorporated by reference to this Plan. Contact information for each of the above-listed parties is provided on **Table 2**.

3.0 MATERIALS

Many natural and synthetic materials are needed to construct, operate, and maintain a landfill. The 170-acre operational unit is active, and anticipated to be active throughout the remediation unit's OM&M period; therefore, excavation, preparation, and use of such materials will be a common and ongoing process. For informational purposes, and to represent the typical broad spectrum of materials that are either in-hand or readily available, the following sections provide typical materials which are available or necessary—other materials (not listed below) may be needed for other purposes or due to changing technology or market conditions. Therefore, any of the materials listed below may change throughout the duration of the OM&M period.

3.1.1 Soils and Aggregates

Various soil and aggregate materials are available from on-site and off-site sources. On-site material stockpiles vary in quantity throughout the year based on estimated future needs. On-site sources include clay residual soils from surface mining activities, surface mining spoil material (structural fill), and shot rock from cell construction excavation. Following is a list of on-site materials which are typically available in stockpiles. However, it is not necessary for these materials to be consistently maintained on-site given their ready availability.

- #9 Stone (imported)
- #57 Gravel (imported)
- #4 Gravel (imported)
- #3 Slag (imported)
- #4 Limestone (imported)
- #57 Slag (imported)
- Liner-quality clay (imported)
- Liner-quality clay (imported)
- Surface mine spoils (from on-site cell construction)
- Residual soil (from on-site cell construction)
- Shot rock (from on site cell construction rock blasting)
- Liner-quality clay (from on-site underclay formations and/or imported)

3.1.2 Geosynthetic Materials

Various geosynthetic materials which may be left over from previous construction projects are typically stockpiled on-site. The following materials may be available on-site for use. However, it is not necessary for these materials to be consistently maintained on-site given their ready availability.

- 40-ml LLDPE textured flexible membrane liner (FML)
- 60-mil HDPE textured FML
- 16 oz/sy non-woven geotextile
- 8 oz/sy non-woven geotextile
- 315 woven geotextile
- Geocomposite (2-sided non-woven geotextile)
- Geosynthetic clay liner (GCL)

3.1.3 Pipe Materials

An inventory of pipe and fittings will be maintained on-site. Quantities will vary based on anticipated needs. Material types and sizes at a minimum will include the following. However, it is not necessary for these materials to be consistently maintained on-site given their ready availability.

- 6" Schedule 40 PVC pipe and common fittings
- 8" Schedule 40 PVC pipe and common fittings
- 6" Schedule 80 PVC pipe and common fittings
- 8" Schedule 80 PVC pipe and common fittings
- 6" Schedule 40 CPVC pipe and common fittings
- 8" Schedule 40 CPVC pipe and common fittings
- 6" Schedule 80 CPVC pipe and common fittings
- 8" Schedule 80 CPVC pipe and common fittings
- Miscellaneous SDR 11 and SDR17 HDPE pipe and common fittings (multiple diameters) and electro-fusion couplings

3.2 Equipment

The site maintains heavy and portable equipment to perform routine operations and maintenance on the site. In addition, some specialized heavy and portable equipment is maintained on-site for use in emergency and response efforts. A summary of the Countywide and OM&M heavy and portable equipment is included on **Table 4**. However, it is not necessary for this equipment to be consistently maintained on-site given their ready availability.

Various equipment rental sources, which can also provide support to Countywide with minimal notice, are located within close proximity to the site.

4.0 OPERATION

4.1 Gas Extraction System (see Volume 2 for details)

Countywide operates and maintains a comprehensive gas collection and control system (GCCS). The GCCS has a series of active gas collection wells which are connected via a network of vacuum distribution piping to two primary flare stations where the landfill gas (LFG) is combusted. A schematic illustration of the GCCS is provided as **Figure 4.**

The GCCS provides control of odor and lateral migration of explosive gases which could potentially impact the surrounding community. Effective control has been very challenging due to the unprecedented conditions that were created by, and following, the reaction in the remediation unit (described in Section 1.2). Therefore, Countywide has adopted a stringent and unique program for operating the GCCS. **Volume 2** of this Plan presents the standard operating procedures and operation and maintenance efforts required to perform GCCS management services at Countywide.

4.2 Leachate Collection System (see Volume 3 for details)

In a typical landfill, leachate is generated by precipitation which filtrates through waste material. Additionally, at Countywide, leachate recirculation and solidification of liquid wastes occurred for a number of years—these have added to the normal precipitation load.

However, the unique reaction occurring in the 88-acre unit is believed to result in other, unusual mechanisms of leachate generation. Some of the reactions occurring in the landfill are exothermic, resulting in temperatures in the waste mass higher than the boiling point of water. As waste is exposed to these temperatures, steam develops, and liquid is forced out of the waste. The steam is confined by the waste mass and internal pressures develop that exceed gravitational forces, causing lateral or even upward movement. These vapor phase gases permeate the waste outside the reaction zone, and condense when they cool adding to the liquids which collect in gas extraction wells. **Figure 3** illustrates this process.

As a result, the amount of leachate being generated in the 88-acre remediation unit is much higher than normal (currently about 10 times higher). This is attributed to the reaction-induced drying of waste from the as-landfilled moisture content of 25-30%, to a dried-out moisture content of 5% (estimated based on visually examining samples retrieved from the reacted zone).

In addition to the unusually high volume of leachate, salts and ammonia are dissolving from the aluminum dross creating a leachate which is highly-corrosive, prone to precipitation and clogging, and difficult to treat.

In response to the untypical conditions described above, a multiple-component leachate collection system has been constructed at the 88-acre remediation unit. Like a typical MSW landfill, the leachate collection system has typical components consisting of an impermeable base liner, a leachate collection and drainage layer, perforated trench drains and floor sumps all constructed before waste was placed. In addition to these, Countywide has devised and installed auxiliary means for removing leachate including the following.

- ***Dual-Phase Gas Extraction Dewatering Wells*** – Remove condensation and free liquid directly from the gas extraction wells.
- ***Subcap Drains*** – A series of drains installed under the cover system collects condensed vapor phase derived liquids and leachate outbreaks expressed laterally from the waste mass.
- ***Leachate Toe Drains*** – A perforated pipe trench drain installed around the footprint perimeter at the junction of the base liner and temporary cap to collect leachate expressed at the toe of the landfill slope.

Leachate removed from these features is conveyed by a forcemain piping system to storage tanks, from which it is hauled for treatment and disposal at off-site treatment facilities. A schematic of this process is included as **Figure 5**. A detailed plan to operate and maintain the leachate collection system is presented as **Volume 3** of this OM&M Plan.

4.3 Surface Water Management System

Surface water will be managed by draining runoff to diversion swales, perimeter channels, and sedimentation ponds. **Figure 1** presents the major surface water control features. The facility operates under the National Pollution Discharge Elimination System (NPDES) regulatory requirements under Ohio EPA Permit No. 3IN00139*HD which is located in the Countywide main office library.

Existing sedimentation ponds serving the 88-acre remediation unit include Sedimentation Pond Numbers 1, 1A, 2, 3 and 9. Ponds 1/1A and 3 also service the 170-acre active landfill unit. Outlet structures include valves which can be closed to prevent outflow should the pond contain water which does not meet NPDES permit discharge standards. In addition, “snorkels” are being installed on the ends of the outlet pipes which can also be closed should the pond contain water which fails to meet NPDES permit discharge standards. Pond outlets consist of pipes with rock energy dissipaters at the outlet to control water velocity. Pond locations are shown on **Figure 1**, and the outlets are located as follows.

- Sedimentation Pond 1 – Outlet location: Lat. 40º 40’ 42”; Long. 81º 25’ 23”
- Sedimentation Pond 1A – Outlet location: Lat. 40º 40’ 42”; Long. 81º 25’ 03”
- Sedimentation Pond 2 – Outlet location: Lat. 40º 40’ 28”, Long. 81º 26’ 02”
- Sedimentation Pond 3 – Outlet location: Lat. 40º 40’ 42”; Long. 81º 25’ 55”
- Sedimentation Pond 9 – Outlet location: Lat. 40º 39” 57”; Long. 81º 25’ 39”

If any condition arises (e.g., leachate emerges under or through the temporary cap, or a spill occurs) which creates a threat to the surface water, Countywide will immediately construct a containment berm between the threat location and the potential recipient pond to intercept the liquid. If liquid is collected in this area, it shall be pumped and handled as leachate, and contact soil shall be removed and disposed in the active face of the landfill.

In the event potential leachate makes it to a sedimentation pond, measures will be taken to prevent discharge from the pond, and then dispose of it properly. Sediments will be analyzed and then managed in accordance with applicable requirements if determined to be contaminated.

Section 5.3 of this plan describes the maintenance of the surface water management system.

4.4 Cap System

A cap layer functions in a “passive” manner, and thus does not have operational requirements. However, the cap ***systems*** involve gas management, leachate management, and surface water management. Therefore, the operation for the cap system components are described in detail in **Volumes 2 and 3** of this OM&M Plan.

5.0 MAINTENANCE

Between 2006 and 2009, many remedial measures and features were installed at the 88-acre remediation unit. These features were self-initiated, or were installed at the direction of the Ohio EPA or U.S. EPA. These measures include substantial temporary capping (using exposed membrane), significant upgrades to the gas collection and control system, and significant upgrades to the leachate management system.

As-built records, drawings, permit-to-install (PTI) alterations, and engineering certifications for these features are incorporated into this OM&M Plan by reference. These features are anticipated to need repair, augmentation, extension, and/or major reconstruction in the future. For routine maintenance issues which do not fundamentally alter or extend a feature's purpose or function, maintenance records will be kept at the facility to be available for inspection by the Ohio EPA. For major replacements, extensions, or changes, Countywide will consult with the Ohio EPA and follow the applicable procedural requirements for changing, altering, or modifying the PTI.

5.1 Gas Extraction System (see Volume 2 for details)

The conditions created by the reaction result in high temperatures and impacted gas composition. The resulting high maintenance level for the gas extraction system is presented in **Volume 2** of the OM&M Plan.

5.2 Leachate Collection System (see Volume 3 for details)

As described in Section 1.2, the reaction creates unique leachate collection challenges. Maintenance for the leachate collection system is presented in **Volume 3** of the OM&M Plan.

5.3 Surface Water Management System

Surface water features require routine inspections and maintenance to comply with the site requirements. These responsibilities will be shared with the active Countywide facility since some features are shared by the landfill and the 88-acre remediation unit. Weekly inspections are required in accordance with OAC Rule 3745-27-19(E)(11)(b). A log is required by OAC 3745-27-19(E)(10), and a log required by the site titled "Weekly Surface Water Inspection." Copies of the logs are included in **Appendix B**. The following sections describe the inspection and maintenance requirements for these features.

A summary of the specific sedimentation pond, channel and ditch, pipe and culvert, and erosion components requiring documented inspection are included on **Table 5**. Sedimentation pond cleanout is required when sediment levels within the pond reach sediment storage design volume levels. **Table 6** includes the design, cleanout volume and reference information.

A summary of the specific erosion control components requiring documented inspection are included on **Table 5**. The form in **Appendix B** including a section titled "Description of Corrective Actions Taken and Other Comments" must be completed when corrective actions for these components are required.

5.4 Cap Systems

Temporary capping using exposed FML was completed in phases as follows.

- 2006 temporary FML cap (Countywide-initiated, about 30 acres)
- 2008 temporary FML cap (per U.S. EPA-approved Work Plan, about 33 acres)
- 2009 temporary FML cap (per U.S. EPA-approved Work Plan, about 8 new acres, and several acres recapping the "Bowl Area" and other areas).

The entire extent of temporary capped area is shown on **Figure 2**. As of July 2009 (completion of temporary capping per U.S. EPA-approved Work Plan), about 71 acres of the 88-acre remediation unit were under temporary cap. Additional temporary capping and/or composite capping will be done as appropriate and necessary as described in Section 7 of this OM&M Plan.

5.4.1 Temporary Cap

5.4.1.1 Inspections

Regular inspections will be performed to verify that the FML cap's integrity has been maintained. Recommended inspection frequency; procedures developed to detect damage and/or failure to prevent a compromised FML; and the recommended criteria to be used to determine when corrective actions are necessary are presented on **Table 7**. Inspections will be documented and repairs completed as soon as practical. **Appendix C** contains the field form to be used to complete the formal monthly cap inspections.

Whenever new temporary FML cap is installed or significant replacements are required, the installation will be subject to the Quality Assurance and Quality Control (QA/QC) requirements of **Appendix D.** The procedure shall consist of inspecting each FML panel, unless specific areas are deemed unsafe to access.

In addition, the Liner Integrity Program (LIP) will be maintained. This is an informal program which requires that all OM&M personnel carry survey pin flags when working on the temporary FML cap area. Any time personnel identify a hole or tear in the temporary FML, a torn penetration boot, missing boot clamp, or any other concern which could result in an odor or leachate release, the survey pin flag will be immediately placed at the problem area. The flag locations will be reported to the OM&M Manager, who will assign personnel to complete the appropriate repairs as soon as reasonably possible.

5.4.1.2 Corrective Measures

Table 8 contains the recommended corrective action procedures for the temporary cap system where required (based on inspections performed according to **Table 7** referenced above). The OM&M team will implement these procedures as necessary to maintain the temporary cap system integrity.

5.4.1.3 Routine Maintenance

Loose rocks, boulders and debris will be removed from the exposed FML cap to prevent punctures. Undercap features will be maintained in accordance with guidelines described in **Volumes 2** and **3** of this OM&M Plan.

5.4.1.4 Temporary Cap QA/QC

Temporary cap QA/QC was performed in accordance with the document titled "Quality Assurance Quality Control Plan for Installation of the Temporary FML Cap" (QA/QC Plan) dated July 2009, prepared by Cornerstone Environmental Group LLC and included as **Appendix D**. This document includes the QA/QC requirements for subgrade preparation, leachate collection and landfill gas collection components, geosynthetic materials and installation, and pipe air pressure testing procedures. Initial construction was completed in substantial conformance with this plan. The QA documentation for the 2008 and 2009 temporary cap FML installation and major repairs was completed in accordance with the QA/QC Plan, and is included in the final construction certification report (prepared for the U.S. EPA Consent Order), which is available at the facility.

Future major repairs to the FML and piping will be completed in accordance with the QA/QC Plan in **Appendix D**. QA/QC will be performed by either supervisory or QC personnel from the repair crew or third party QA personnel. All documentation will be completed in accordance with the QA/QC Plan and maintained in the OM&M document management system. Repair areas will be documented and shown when appropriate on the active as-built drawings for the temporary cap.

Repairs to soil cover and leachate collection piping (including undercap collectors and leachate toe collectors) will be performed in accordance with the original installation requirements and accepted construction practice. QA/QC will be performed by supervisory personnel from the repair crew for minor repairs, or third party QA personnel if the repairs are deemed major. All documentation will be completed in accordance with the QA/QC Plan and maintained in the OM&M document management system. Major repair areas will be documented and shown when appropriate on the active as-built drawings for the temporary cap remediation area. Documentation and as-built survey are not required for minor repairs.

5.4.2 Composite Cap

Composite cap will be installed when conditions are conducive to installation as described in Section 7 of this OM&M Plan. When the conditions for placing composite cap are met, it will be installed and maintained in accordance with the design and features contained in the facility PTI, ORC 3734 requirements and the rules adopted therein, and all applicable orders issued by the Director of the Ohio EPA..

6.0 MONITORING AND DATA ANALYSIS

The unique conditions caused by the reaction in the Countywide 88-acre remediation unit require enhanced and focused monitoring to provide the feedback necessary for successful management. Throughout the following sections, references may be made to particular equipment brands or published methods for sampling or analysis. Other equipment or methods may be substituted, as long as the same information can be obtained and monitoring objectives can be achieved.

6.1 Monitoring Objectives

The following monitoring objectives have been identified by Countywide as relevant to successfully operate and maintain the remediation unit.

1. Monitor status/progression of reaction.
2. Monitor characteristics of leachate and gas.
3. Maintain gas collection and leachate collection efficiency.
4. Track settlement and slope movement/stability of waste mass and perimeter berms.
5. Monitor exposure conditions for engineered components.
6. Determine when conditions are suitable for composite capping.
7. Assess conditions requiring notification, repair, further evaluation, or corrective action.

Note that perimeter environmental monitoring (e.g., groundwater and gas migration monitoring) is not included in this Plan since it is governed by other facility permit and compliance documents that are located or associated with the facility PTI.

6.2 Monitoring Program

Over two years of monitoring and data collection has been performed by Countywide at the facility. Analysis, interpretation, and correlation for some of this data have been performed and are presented in **Appendix E**. Based on that analysis and on the experience (both subjective and objective) gained during previous data collection, a program has been developed to meet the monitoring objectives and is presented on **Table 9**. Ohio EPA may adjust the requirements of Table 9 as necessary if analysis and interpretation of the data performed by Ohio EPA warrants such a change.

6.3 Data Collection Procedures

By the third Friday of each month, Countywide will submit a sampling schedule that outlines the anticipated schedule for the following calendar month. Data collection and analytical procedures and some discussion of data quality objectives for the program are provided below.

To assure data is being collected in a manner which satisfies the monitoring objectives and can be evaluated and interpreted appropriately, certain individuals will be assigned primary responsibility for the field data collection and analyses. The parties involved in this process are listed in Section 6.5, and are identified on the Proposed Data Collection **Table 9**, along with the applicable procedural section of this OM&M Plan.

6.3.1 Field Gas Parameter Monitoring

These measurements will be taken by a trained operator who is directly employed by Countywide or subcontracted to perform these services. Data collected in the field allows the operator to make immediate adjustments to gas wells for improving gas collection efficiency, and provides data which may indicate a potential problem within the landfill waste mass. Both objectives are further described in **Volume 2** of this OM&M Plan.

Measurements are made in the field at the wellhead sampling port using a GEM 2000 device distributed by CES Landtec or equivalent. The device is calibrated according to the manufacturer's recommendations. This instrument provides temperature, pressure/vacuum, flow, methane, oxygen, and carbon dioxide readings. The GEM 2000 has the following accuracies within the referenced ranges:

- Temperature at 14 to 167° F range with + or – 0.4% accuracy (if gas temperatures exceed 167° F, an analog temperature gauge is inserted into the sample port and the temperature is manually input into the GEM 2000 data screen);
- Methane (CH_4) at 0 to 70% range by dual wavelength infrared cell with + or – 3% accuracy;
- Carbon dioxide (CO_2) at 0 to 40% range by dual wavelength infrared cell with + or – 3% accuracy;
- Oxygen (O_2) at 0 to 40% range by electrochemical cell at + or – 1% accuracy;
- Pressure at maximum – 70 inches water column vacuum and + or – 250 mbar from calibration pressure; and
- Ambient air temperature operating range is 32 to 104 degrees F (for operating temperatures outside these ranges, equipment will be swapped throughout the day and while in the field will be either shaded or insulated to keep the internal instruments within the manufacture's recommended operating range).

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

At the end of each monitoring day, the GEM 2000 data is downloaded to a computer for data storage. The technician that collected the data will review his/her collected data to look for triggers, unusual trends, or anomalous readings that may not have been detected in the field. In addition, the Gas System Field Data Manager (see Section 6.5) typically reviews all GEM data within 48 hours of collection to look for triggers, unusual trends, or anomalous readings.

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

6.3.2 "Deadhead" Well Pressure

These measurements will be taken by a trained GEM operator who is directly employed by Countywide or subcontracted to perform these services. Results can be used in slope stability analyses to allow approximating the pore pressure that may be present in the surrounding waste mass.

For this measurement, the well valve is closed, isolating the well from vacuum. Pressure buildup in the well is observed until the pressure stabilizes or for five minutes, whichever is longer. These measurements are made with a GEM 2000 which has a maximum positive pressure detection limit of 200" water column (WC). If pressure greater than 200" WC exists, a Hayward analog pressure gage (or equivalent) capable of reading 30 psi (800" WC) is used, and the recorded pressure is manually entered into the GEM 2000 data screen.

6.3.3 Liquid Levels

These measurements will be taken by a trained field technician who is directly employed by Countywide or subcontracted to perform these services. Results will be used to determine if sufficient gas extraction well screen perforations are exposed to allow for efficient gas extraction. This objective and the criteria used to evaluate the liquid level effect on the gas extraction well performance are further described in **Volume 2** of this OM&M Plan.

Measurements are made with a Heron Water Tape Water Level Indicator distributed by Heron Instruments, Inc. or equivalent. The water tape is introduced into the well via a dedicated sample location drilled and tapped into each well head assembly. This device signals water contact with a bright LED light and a buzzer. The manufacturer claims an accuracy of 1/100th of a foot. However, this reading can be highly inaccurate, even when extreme care is taken by the technician. The probe often clings to the side of a saturated gas well casing, giving a false reading. Changes to the instrument may be made including additional weighting of the probe and/or constructing a small cage to prevent probe contact with the casing in an attempt to minimize erroneous readings. Knowledge about historical readings can be helpful to the field technician when discerning false readings. Alternatively, other liquid monitoring manufacturing equipment and technology could be utilized to improve reliability of these measurements. An operation manual for this device is included in **Volume 2** of this OM&M Plan.

6.3.4 Gas Flow at Flares

These measurements are continuously made utilizing inline flow measurement devices prior to the flare stack of each operating flare. All the flare systems at Countywide use Thermal Mass flow meters manufactured by Fluid Components International LLC (FCI), Thermal Instrument Company or equivalent. These are continuous reading insertion probe instruments which log data via a data recorder. The data recorder saves the data to a flash card in accordance with NSPS regulation.

Thermal Mass flow devices are bench-calibrated at the factory to typical landfill gas mixtures, temperatures and pipe size. Although the Countywide gas constituents are not typical, the manufacturer's representative has noted that the Countywide gas is lower in density, but higher in moisture content than the typical gas used in calibration. Therefore, these factors offset and mitigate the need to attempt to replicate the Countywide gas during calibration.

These flow meter devices use a constant temperature system which employs two sensors; one for temperature and one for flow. The flow sensor is heated to a precise temperature above the gas flowing by. The gas conducts heat off the sensor in direct proportion to the mass flow rate. Temperature corrections are automatically made.

Manuals for the flow meters are included with the flare operating manuals which are incorporated into this OM&M Plan by reference.

6.3.5 Gas Quality

Gas quality samples will be obtained from the main gas extraction header pipes that direct landfill gas to the flares (see **Figure 4**). General gas quality and general spatial distribution of gas quality can be obtained in this manner. In the event that more local or well-specific gas quality data is needed for any reason (see Volume 2, Appendix H), additional samples can be taken.

Details regarding sampling methods, analytical methods, laboratory QA/QC, and data validation are presented in **Appendix F**.

6.3.6 Leachate and LCS Pipe Temperature

Temperature measurements are taken at each leachate sideslope riser. Dedicated thermocouples are installed into each leachate collection pipe that is inserted into the leachate sump area. The thermocouples are composed of a Mineral Insulated Style AF Metal Transition Single Element, as manufactured by Watlow or equivalent. The thermocouples are Type T and have a standard Type T temperature range of -300 ^{0}F to +600 ^{0}F with an accuracy of + or – 0.05% of the reading plus 0.5 ^{0}F. See **Appendix G** for information on the thermocouples and **Figure 8** for current locations of these measurements.

The thermocouples are read by connecting the clips at the top of the leachate collection pipe to a Fluke 51 or equivalent single-input thermometer. See **Appendix H** for a manual for the thermometer. Readings will be collected by a trained designee of Countywide, and will be recorded onto the appropriate form.

6.3.7 Leachate Quality

Samples are obtained directly from the storage tank(s). The samples will be analyzed in accordance with the procedures outlined in **Appendix F**. Results will be sent to the off-site wastewater treatment plants serving the facility within seven days of receipt of data from the laboratory. See **Figure 5** for a schematic of the leachate sampling location.

6.3.8 Leachate Volume

All leachate is transported by truck to off-site treatment facilities. Daily leachate volume will be tracked on a spreadsheet noting the capacity and number of trucks leaving the facility.

6.3.9 Aerial Infrared Photography

Procedures to collect this image are as follows: The aerial Infrared (IR) survey company will use the latest lab quality Forward Looking Infrared (FLIR) Systems Series SC4000 Infrared Imaging Camera System, or equivalent. This equipment has a thermal sensitivity of 18mK signal-to-noise ratio and pictorial resolution of 76,800 at 200 frames per second. It depicts warmer areas as shades of white and colder areas as shades of black. It uses an Indium Antimonide (InSb) detector array, with the advanced ISCO309 Readout Integrated Circuit (ROIC) IR system in a spectral bandwidth of 3-5 microns. The images are digitally recorded to high speed data drives.

The images will be analyzed by Level III Master Thermographers, or equivalent, to create one grayscale digital image. The image's grayscale will show a temperature scale appropriate to show the temperature ranges detected on the landfill's surface.

A technician will collect several ground reference temperatures on the ground at the time of the flight. The reference temperatures will be collected at pre-determined points with a hand-held IR/thermal sensor, or equivalent. The reference temperatures will be used to cross check the accuracy of the aerial thermal image.

6.3.10 Settlement Survey

Surface settlement surveys are completed by using a Trimble Real Time Kinematic (RTK) global positioning satellite (GPS) surveying system, or equivalent, with electronic field data collector. Each week, a surveyor traverses the area to be surveyed (the "Survey Area") and collects the ground elevations on a nominal 50 foot grid and at major grade breaks. Recognizing the Survey Area may include areas undergoing unpredictable settlement, the survey team's safety is top priority. As such, any areas deemed unsafe for foot or truck traffic are surveyed using a Prismless Pulse Laser Total Station, or equivalent, taking direct readings off the cap surface on the same grid as the previous week.

Upon completing the survey, spot elevations are downloaded to a computer aided drafting and design (CADD) map of the landfill. The grid points are used to create a 3D surface, which is compared to the previous week's surface and to the original baseline surface to create isopachs showing the week-to-week settlement and the cumulative settlement. A hard copy of each map will be stored on-site.

Settlement surveys can be enhanced (at a closer spacing or frequency) in a particular area for a limited time duration if Countywide or Ohio EPA deems warranted.

6.3.11 Pin and Plate Surveys

Figure 7 shows proposed locations for slope pins and toe-of-slope plates. The pins are blunt-headed spikes installed under the exposed FML cap, and the plates are located on the baseliner (with a vertical extension tube, the top of which is surveyed) at the waste boundary. These points will be monitored weekly using GPS techniques, and once per month using total stationing (higher resolution than GPS).

6.3.12 Electronic Piezometer Readings

Figures 6 and 7 show existing locations for piezometers at the South Slope as well as proposed locations for piezometers on the West Berm. Some of these are open standpipe piezometers which will be monitored in accordance with the procedure presented in Section 6.3.3.

6.3.13 Soil Gas Probes

Soil gas probes located in the vicinity of the South Slope waste movement (see Figure 6)will be sampled using the procedure described in Section 6.3.1, and sampled in accordance with the procedure in 6.3.5. In addition, these probes and others located around the facility's perimeter will be monitored for explosive gas levels on a quarterly basis to meet the OAC 3745-27-12 requirements.

6.3.14 Leachate Head on Liner

Maintaining no more than one foot of leachate head on the liner is a design standard outlined in the OAC. This is measured by transducers which are mounted on the body of the pumps located in the landfill sumps. A detailed description of this process is provided in **Volume 3** of this OM&M Plan. Records of leachate head in the sumps are kept on site and available for inspection by the Ohio EPA or SCHD.

6.4 Quality Control and Quality Assurance for Monitoring Activities

See the previously-referenced **Appendix F** for monitoring QA/QC and data validation procedures for laboratory sampling and analyses. All field instrumentation will be calibrated in accordance with the manufacturer's recommendations.

6.5 Data Evaluation and Interpretation

All data will be evaluated and interpreted using graphs, tables, and/or plan-view drawings. Changes to this data evaluation or presentation may be suggested by the involved regulatory agencies or by Countywide, and be made by mutual agreement at any time. Each presentation described below will be included in the Progress Reports described in Section 12. The presentations have not yet been final-designed, however, the format will similar to that used in the previous years of data evaluation. All figures described below will be produced at the same scale to facilitate comparing and contrasting different parameters and the areas impacted.

Collected data will be transmitted to the appropriate parties for interpretation, evaluation, and compilation into presentation graphics. The parties involved in this process are listed below, and are identified with the descriptions of each graphic.

- **OM&M Manager** – Responsible for the entire data evaluation and interpretation program. The OM&M Manager duties are assumed directly by the Division Manager (see **Table 1**) or shall be designated by the Division Manager.
- **Gas System Field Data Manager** – Manages the database of field (GEM) measured parameters. This will be a third-party overseen by the OM&M Manager.
- **Gas System Lab Data Manager** – Manages the database of lab measured parameters. This will be a third-party overseen by the OM&M Manager.
- **Leachate System Field Data Manager** – Tracks the leachate volume and monitors leachate head levels and functionality of leachate collection system. This will be Countywide personnel designated by the OM&M Manager.
- **Leachate System Lab Data Manager** – Manages the database of lab measured parameters. This will be a third-party overseen by the OM&M Manager.

- **Slope Stability Consultant** – Third-party consultant responsible for monitoring data related to the landfill and perimeter berm's stability.

See Section 1.2 and the accompanying notes regarding the use of the term "reaction" and hypotheses regarding its nature.

6.5.1 Monitor Status/Progression of Reaction

Progress Report Figure 1 – Methane to Carbon Dioxide Ratio Map (Gas System Field Data Manager). The untypical reactions occurring in the remediation unit curtail methane generation before temperatures are elevated noticeably. Therefore, it has been found that the methane to carbon dioxide ratio (as determined by field GEM meters) is a good leading edge indicator for areas which have been, or are about-to-be, affected by elevated temperature and/or untypical settlement. This map will employ color shading to present areas with normal ratios and impacted ratios. Methane to carbon dioxide ratios greater than 1.0 are generally considered to be areas which are unaffected by the reaction.

Progress Report Figure 2 – Incremental Settlement Map (Slope Stability Consultant). This map presents the settlement amount occurring in a given time frame (e.g., one month) in the entire 88-acre remediation unit. Shading and outlining are used to identify areas experiencing untypical settlement (assumed to be an indicator to identify reaction size and location). Settlement rates for a given time period will be normalized to the waste thickness at each point, and expressed as an annualized rate (% of waste thickness) of settlement. Currently, a settlement rate greater than 10% of the waste height per year is considered to be near the locus of an active reaction, and a 2% rate of the waste height per year is considered greater than typical for a mature municipal waste landfill and warrants observation. Therefore, this figure will include a line representing the boundary of points representing these settlement rates and shading to represent transitional rates in between these values.

Progress Report Figure 3 – Wellhead Temperature Zone Map (Gas System Field Data Manager). This map uses color shading to present the gas wellhead temperature distribution obtained by a field GEM meter. If the reaction intensifies or diminishes, or the area impacted by the reaction enlarges or decreases, the area and color shades will correspondingly increase or decrease in size.

Progress Report Figure 4 – Carbon Monoxide Distribution Map. (Gas System Field Data Manager). Carbon monoxide values for every gas extraction well will be obtained by lab analyses and presented on a drawing. This figure will use color shading and isopach boundaries to delineate concentrations. Areas with very high concentrations may help indicate the reaction's location and movement. Since this data will only be collected annually, an updated Figure 4 will not be available for every progress meeting.

Progress Report Graph 1 – Wellhead Temperature vs. Time Graph (Gas System Field Data Manager). Minimum, maximum, and average wellhead temperature data is available back through 2005. This data will be plotted to allow comparison to previous months and short-term and long-term trending. This provides a global indicator of the heat build-up or decrease within the waste mass.

Progress Report Graph 2 –Settlement Volume vs. Time Graph (Slope Stability Consultant). Settlement volume is calculated by using the vertical settlement amount multiplied by the area (typically about 50'x50') represented by the settlement point. The settlement volume will be plotted for a given time period (month, quarter, year, etc.). Increasing settlement volume (relative to previous periods) suggests more waste is being thermally degraded.

Progress Report Graph 3 – Leachate Volume vs. Time Graph (Leachate System Field Data Manager). As discussed in Section 4.2, the unusually high leachate volume from the 88-acre site results from the heat drying of waste material from high as-placed moisture content, to low, dried moisture content. Therefore, increasing leachate volume may correlate to increasing total reaction and heat production activity.

Progress Report Graph 4 – Hydrogen Gas Volume vs. Time Graph (Gas System Lab Data Manager). The main potential source for elevated hydrogen in the landfill gas is from the hydrolysis of aluminum waste material. Therefore, decreased hydrogen gas volume may suggest the hydrolysis reaction is decreasing. Since little to no hydrogen should be coming from the non-88-acre portion of the facility, this is a useful unique identifier for reaction-related gas.

6.5.2 Monitor General Characteristics of Leachate and Gas

Progress Report Graph 5 – Leachate Total Dissolved Solids (TDS) vs. Time Graph (Leachate System Lab Data Manager). TDS is a useful indicator of dissolved salts and metals amounts in the leachate, and a good indicator of leachate treatability.

Progress Report Graph 6 – Leachate Chemical Oxygen Demand (COD) vs. Time Graph (Leachate System Lab Data Manager). COD is a common wastewater treatment parameter which indicates the trend for the amount of organic constituents over time.

Progress Report Table 1 – Leachate Constituent Summary (Leachate System Lab Data Manager). This table will present leachate concentration values for selected leachate constituents for leachate removed from the 88-acre leachate collection system and stored at the 500,000 gallon leachate storage tank.

Progress Report Graph 7 – Gas Total Volatile Organic Compound (VOC) vs. Time Graph (Gas System Lab Data Manager). The reaction creates higher-than-normal VOCs in the landfill gas. Higher levels of VOCs suggest an active pyrolysis process, so VOC levels may be expected to decrease as the reactions subside.

Progress Report Graph 8 – Gas Total Dioxin/Furan vs. Time Graph (Gas System Field Data Manager). There is insufficient dioxin/furan data available from “normal” landfills to be able to know whether or not this is a useful indicator parameter. However, Countywide has a significant amount of data available to which future levels may be compared.

6.5.3 Maintain High Level of Gas Collection and Leachate Collection Efficiency

Progress Report Graph 9 – Total Landfill Gas Flow vs. Time Graph (Gas System Field Data Manager). Gas flow from each flare station and a total gas flow from all flares at the facility will be presented on a graph. The total amount of gas collected depends on a number of factors including the number of gas extraction wells installed in the 170-acre operational unit. However, this data may provide useful information regarding the collection efficiency of the gas extraction system.

Progress Report Table 2 – Liquid Levels and % Perforations Exposed Table (Gas System Field Data Manager). Routinely examining this table will allow identifying gas extraction wells which should be assessed for potentially adding dewatering pumps (see Section 2.6 of Volume 2 for criteria).

Progress Report Graph 10 – Leachate Volume/Hydrogen Volume/Cumulative Settlement vs. Time Composite Graph (Gas System Field Data Manager). This graph will present these three parameters on one presentation. If leachate volume decrease occurs at a similar pattern as hydrogen and settlement volume, one may suggest the decreased leachate volume is attributable to a decreasing dross reaction as opposed to an inefficient leachate collection and removal system. This data will be evaluated along with the results of leachate cleanout information and sump head levels to assess the function of the leachate collection system.

Progress Report Figure 5 – “Deadhead” Gas Well Pressure Distribution Map (Slope Stability Consultant). Wellhead pressures will be presented on a map using color shading and/or contouring. Areas with elevated pressure should be assessed for possibly installing additional gas extraction wells and/or more aggressive dewatering.

6.5.4 Track Slope Movement/Stability of Waste Mass and Perimeter Berms

Progress Report Graph 11-13 – South Slope Pin Movement (northing, easting, and elevation change (Slope Stability Consultant). These graphs will show movements for individual pins over a period of time for all three spatial dimensions at a scale that facilitates review and is acceptable to the Ohio EPA. Change rates for the pin movement slope may indicate conditions are changing. The pin displacement rate can be calculated from these graphs and compared to trigger values (see Section 9.2).

Progress Report Graph 14-16 - West Slope Pin Movement (northing, easting, and elevation change) (Slope Stability Consultant). See above.

Progress Report Graph 17-19 - North Slope Pin Movement (northing, easting, and elevation change) (Slope Stability Consultant). See above.

Progress Report Table 3 – Piezometer Readings from West Structural Fill Berm (Slope Stability Consultant). A table will be created to record electronic piezometer readings which have been converted into a static water table elevation or water elevations in traditional open-casing piezometers. For each piezometer, a water table elevation will be established which correlates to a calculated factor of safety of 1.5 and 1.2 for the berm. Further discussion of the trigger values and how they were determined is included in **Appendix M**.

6.5.5 Monitor Exposure Conditions for Engineered Components

Progress Report Graph 20 – Leachate Sump Temperature vs. Time Graph (Leachate System Field Data Manager). This graph indicates the average temperature to which the base liner is exposed.

Progress Report Graph 21 – Leachate Collection System (LCS) Temperature vs. Time Graph (Leachate System Field Data Manager). This graph provides temperature data on local base liner conditions at selected locations. The duration of liner exposure to certain temperatures may allow assessment of the possible liner condition at the location of the temperature reading.

6.5.6 Determine When Conditions Suitable for Composite Capping

Progress Report Figure 2 – Incremental Settlement Map. Previously described. This map will help identify the active settlement zones as a screen for areas not ready to receive composite cap. See Section 7.2 for discussion of criteria associated with this map.

Progress Report Figure 3 – Wellhead Temperature Zone Map. Previously described. See Section 7.2 for discussion of criteria associated with this map.

Progress Report Figure 6 – Aerial Infrared Map (Gas System Field Data Manager). This map will allow identification of areas of elevated subcap temperatures within temporary exposed FML capped zones. See Section 7.2 for discussion of criteria associated with this map.

6.5.7 Assess Conditions Requiring Notification, Repair, Further Evaluation, or Remediation

One key objective of the OM&M Plan is to be able to identify conditions warranting further investigation, which may indicate a problem or imminent problem or need immediate remediation or emergency action. "Trigger values" were established which, if exceeded, will require some course of action. Each trigger value can be discerned on-the-spot in the field or interpreted off the above-referenced graphs, figures, or tables. Section 9.2 presents the parameters of concern and associated trigger values.

6.6 Data Storage

Data that is used to generate the reports required in Section 6.5 will be stored in an electronic format in the existing Locus web-based database or alternative web-based database(s) in a manner which facilitates the combination, selection, export, and use in data mapping and data analysis software. The Ohio EPA will be given access to the database site upon request.

All data, including that which is not used to generate reports required by Section 6.5 (e.g. well-specific gas quality data generated under the March 2007 DFFOs), will be archived periodically and retained by the database vendor and provided to Countywide (and the Ohio EPA upon request) on DVD or alternative hard data storage media.

Data storage will be annually re-evaluated to determine if the current data storage tools are sufficient or require modification. No data will be eliminated without prior approval from the Ohio EPA.

7.0 FUTURE CAPPING

7.1 Criteria for Timing of Additional Temporary Cap

Currently, about 18 acres of the Cell 1-3 area are covered by intermediate soil cover as there is no evidence of impacts or odors from the reaction or its interaction with solid wastes in this area. Composite cap will be placed on this area if and when the conditions described in Section 7.2 are satisfied.

However, if conditions in this area change so that it becomes a source of odor or fugitive emissions (that cannot be resolved by normal maintenance or operation of the GCCS system), or if unusual settlement or cracking appears, or atypical and uncontrollable leachate outbreaks occur, additional temporary FML cap will be placed within three months or sooner if practical, unless the director has approved an extension.

In addition, if there are indications that the effects of reaction and its interaction with solid wastes are moving into this area or portions of this area, consideration shall be given to placing additional temporary FML cap. These indications include:

- Methane/carbon dioxide ratio less than 1.0 (Progress Report Figure 1)
- Incremental settlement rate greater than 2% per year (Progress Report Figure 2)
- Maximum welhead temperatures greater than 150 deg. F. (Progress Report Figure 3)
- Maximum carbon monoxide greater than 100 ppmv (Progress Report Figure 4)

If/when any of these conditions occur, Countywide will prepare an assessment for consideration by the Ohio EPA, which may require additional FML temporary cap and undercap drains and gas collectors.

7.2 Criteria for Timing of Composite Cap

If all of the following criteria are met for a period of one year, Ohio EPA will consider an area acceptable for placement of composite cap (meeting the requirements of OAC 3745-27-08 and PTI):

- Incremental settlement rate less than or equal to 2% per year (Progress Report Figure 2)
- Maximum welhead temperatures less than or equal to 150 deg. F. (Progress Report Figure 3)
- Average wellhead temperature in the area less than 131 deg. F, and no evidence of increasing average temperature in the area (Progress Report Figure 3)
- Exposed temporary FML cap temperature less than 100 deg. F (as determined from infrared aerial imaging taken in pre-dawn hours)
- The area to be capped is contiguous to the permitted limits of waste placement or areas that had been previously covered with composite cap
- The area to be capped excludes a 100-foot wide buffer in which the first four above-listed conditions are met
- There are no physical signs or manifestations of an actively occurring subsurface oxidation event, fire, pyrolysis, or aluminum process waste reaction within the area proposed to receive composite cap.

The minimum area that would be considered for placement of composite cap is 10 acres. Countywide will provide notification to the Ohio EPA, along with a demonstration that the conditions are satisfied prior to capping. Countywide can proceed with capping if no comment on the demonstration is received from Ohio EPA within 30 days. The composite cap shall be constructed in accordance with the approved PTI Closure/Post-Closure Plan and ORC 3734 and rules adopted thereunder.

Alternatively, Countywide may make a request to place composite cap if most, but not all of the above-referenced conditions are satisfied. In this case, Countywide will prepare a petition to cap an area, along with the information referenced previously, and any other information that may support the request. Countywide will not proceed with capping unless approval of the request from Ohio EPA is obtained.

7.3 South Slope Relocation

Between June 2006 and September 2006, a slow, limited movement of waste occurred in the South Slope of the 88-acre remediation unit. To stabilize the apparent movement, Countywide placed about 60,000 cubic yards of earthen material at the toe (buttress) and on top of the area to stabilize it. See **Figure 2** for this location. Later, an investigation determined some waste material (about 1,500 cubic yards) had moved approximately 20 feet outside the permitted solid waste boundary. This area, including the buttress material and displaced waste material, is currently covered by temporary FML cap and managed by subcap drainage features.

Countywide understands Ohio EPA would like the displaced waste to be placed back into the landfill's permitted footprint as soon as safety considerations allow. As such, Countywide will prepare and submit a Work Plan for safely relocating the waste, and will schedule the relocation for the winter months (to minimize odor impacts on the community) of 2009-2010.

To minimize the risk of igniting a subsurface oxidation (SSO) event during the excavation and relocation process, the 2009-2010 Work Plan will be developed to require that temperatures in the thermistor/thermocouples in borings SS-1, -3, -5, and -7 (shown on **Figure 6)** be less than 180° F; all gas extraction well temperatures in the vicinity (bounded by site coordinates N 23,500 to 23,800 and E 42,700 to 43,500) be less than 200° F; and gas pressures (positive and negative) in the area be within reasonable values (greater than -2 inches and less than 20 inches water column) to prevent either slope destabilization or rapid introduction of oxygen during excavation. If these conditions are not met, the project will be postponed and evaluation will be performed in each following September to determine if conditions are suitable to relocate the upcoming winter.

If these conditions are not achieved by September of 2014, Countywide will develop an alternative work plan that will allow the relocation to occur no later than the winter of 2014-2015.

8.0 HEALTH AND SAFETY PLANS

Health and safety (H&S) for all workers and the public is always a primary concern for Countywide. Compliance with all OM&M H&S specific plans, Republic standard operating procedures (SOPs), Occupational Safety and Health Administration (OSHA), U.S. EPA and Ohio EPA applicable regulations will be adhered to at all times.

The “88-Acre Operation, Maintenance & Monitoring Health and Safety Plan” (HASP) was developed to address the specific H&S concerns to be followed when performing work under the OM&M Plan. The HASP also includes task specific Job Safety Analyses (JSAs) which list the hazards and controls for specific work activities. The OM&M HASP and task specific JSAs are included as **Appendix I**.

Approval of this OM&M Plan by the Ohio EPA does not imply review or approval of any HASP or measures to be used at the site.

9.0 CONTINGENCY PLANS

9.1 Existing Incident Management System Plan

The Countywide Incident Management System Plan (IMSP) prepared by Arcadis and dated January 2009 will be implemented in the event of emergency situations such as fire, explosion, flood, hazardous substance release, slope failure or other incident which could threaten human health and safety or the environment. A current copy of the IMSP is available in the OM&M offices, and is incorporated into this OM&M Plan by reference. It is required the IMSP be updated annually.

Approval of this OM&M Plan by the Ohio EPA does not imply review or approval of the IMSP to be used at the site.

9.2 Triggering Events

The IMSP covers events which will require rapid response and may involve assisting and/or notifying public or public first responder entities. However, certain values for certain parameters may indicate significant changing conditions or imminent threats that need to be assessed or be addressed quickly. As such, this section proposes "trigger" values which would require notification of the Ohio EPA and require certain actions by Countywide. Such events would not rise to a level which would require the IMSP to be followed, but would require investigation by Countywide and possible preparation for implementing contingency procedures. Any exceedance of a trigger value (if confirmed) would initiate these actions.

Trigger values, issues which may be associated with the value, and proposed courses of action for each trigger value are presented on **Table 10**.

9.3 Odor Events

This section establishes a plan to investigate odor complaints in a timely manner; document odor investigations; and complete necessary actions to mitigate the odor as quickly and safely as possible.

9.3.1 Odor Complaint Logging System

An odor monitoring system has been established to document community odor complaints received, and record investigation details, and track the response implemented by the OM&M team.

9.3.1.1 Complaint Sources

Odor complaints are received in a number of ways including:

- Direct call in or e-mail from complainant(s),
- Calls referred to the site from local officials such as Mayors, City Council members, County commissioners, other governmental officials, fire departments, etc.,
- Calls and letters from City, County, Regional, or State or Federal regulatory officials,
- Reports from officials who have investigated complaints, and/or
- Reports from assigned personnel who investigate complaints.

9.3.1.2 Investigation and Response by OM&M Team

All odor complaints will be investigated as promptly as possible. The goal of the investigation will be to determine if odor originates from the 88-acre remediation unit and, if so, to determine the specific source and cause of the odor, and then remediate the odor cause.

All complaints will be investigated using a subjective odor ranking (a scale of 0-4) which is used by the community and the Ohio EPA and an objective odor ranking. Objective odor ranking is performed with a Nasal Ranger Field Olfactometer (Nasal Ranger) or equivalent. Information on the Nasal Ranger device is included in **Appendix J**. Countywide will ensure that several site personnel are trained in the proper use of the Nasal Ranger.

The community will continue to register complaints through a dedicated cell phone number which has been previously distributed and publicized. Countywide will continue to make this (or any future new) number known to the community through several proven mechanisms.

Odor complaints and complaint investigations will be documented on the "Investigated Complaint Form" contained in **Appendix K.** If the complaint is received during normal landfill operation hours, it will be investigated as soon as possible. If the complaint is received outside normal landfill operation hours with an associated complainant-assigned subjective level of 0-3, it will be investigated as soon as practical on the next business day. If the complaint is received outside normal landfill operation hours with an associated complainant-assigned subjective level of 4, it will be investigated within 4 hours of receipt of the complaint..

The OM&M team shall investigate to determine what conditions are causing or significantly contributing to the odor. The OM&M team will determine what type of odor control corrective action or actions need to be taken, and will initiate and expeditiously complete the corrective actions.

All odor monitoring data and records shall be kept on file at the Countywide offices for 5 years, and shall be available for inspection by SCHD and Ohio EPA representative(s) including the City of Canton Health Department.

A portable odor neutralizer trailer will be available for use in localized areas if an unexpected need arises. Neutralizer specifications and directions for using the portable trailer are included in **Appendix L**. An inventory of neutralizer product will be maintained on-site for the portable neutralizer systems.

10.0 FINAL CLOSURE AND POST-CLOSURE

With the completion of the Isolation Break, the 88-Acre unit is considered a non-contiguous unit which can be closed separately from the 170-acre operational unit (OAC 3745-27-11(C)(2)). In addition, the March 28, 2007 DFFOs requires closing the 88-acre unit.

However, the currently-approved Closure Plan and Post-Closure Plan contained in the June 2, 2003 Permit to Install (PTI) is no longer valid due to splitting the site into two non-contiguous units and due to the special closure requirements for the 88-acre remediation unit. Therefore, a new Closure Plan and Post-Closure Plan will be submitted as part of a new PTI Modification permit application.

Composite cap will be installed as soon as practical after the criteria of Section 7.2 are satisfied. Post-Closure care activities will commence following termination of the March 28, 2007 DFFOs and certified closure of ***both*** the 88-acre and the 170-acre non-contiguous units, regardless of which unit is certified closed first.

11.0 FINANCIAL ASSURANCE

The Ohio EPA requires that financial assurance be obtained and renewed as necessary for Closure, Post Closure, and Corrective Measures per OAC 3745-27-15, -16, and -18. The circumstances regarding the 88-acre remediation unit require a prolonged OM&M period and a phased capping program, preceding the certified Final Closure.

Therefore, in addition to the Closure and Post-Closure care financial assurance provided with the facility's PTI application, additional financial assurance will be provided. This additional financial assurance will be for OM&M costs incurred during the implementation of the OM&M Plan, and include a contingency amount for unforeseen costs.

The OM&M and contingency financial assurance cost estimates will be based on the Ohio EPA financial assurance cost estimate worksheets (guidance document 675) and augmented by all additional costs that would be necessary for Ohio EPA to operate and maintain the remediation unit until the unit is certified closed. The costs will be based on third party contractors conducting the work at prevailing wages, and will be adjusted for inflation and changing circumstances at the facility. The cost estimate will include the cost for temporary re-capping of the entire remediation unit, the costs for moving the south slope area back into the limits of waste placement and the typical 5% to 10% contingency amount.

The financial assurance instrument and supporting cost estimate will be submitted under separate cover from this OM&M Plan, and will be reviewed annually for potential adjustments.

12.0 PROGRESS REPORTS AND MEETINGS

12.1 Content of Progress Reports

Section 1 – Monthly (or Quarterly) Summary Narrative

Section 2 – New Construction

Section 3 – Major Non-routine Maintenance, Repairs, or Events

Section 4 – New Trigger Events (see Section 9.2 of this Plan)

Section 5 – Investigation Results from Previous Trigger Events

Section 6 – Trend Graphs and Drawings

- Graph 1 – Wellhead Temperature vs. Time Graph
- Graph 2 –Settlement Volume vs. Time Graph
- Graph 3 – Leachate Volume vs. Time Graph.
- Graph 4 – Hydrogen Gas Volume vs. Time Graph
- Graph 5 – Leachate TDS vs. Time Graph (quarterly)
- Graph 6 – Leachate COD vs. Time Graph (quarterly)
- Graph 7 – Gas Total VOC vs. Time Graph (quarterly)
- Graph 8 – Gas Total Dioxin/Furan vs. Time Graph (quarterly)
- Graph 9 – Total Landfill Gas Flow vs. Time Graph
- Graph 10 – Leachate Volume/Hydrogen Volume/Cumulative Settlement vs. Time Composite
- Graph 11-13 – South Slope Pin Movement
- Graph 14-16 – West Slope Pin Movement
- Graph 17-19 – North Slope Pin Movement
- Graph 20 – Leachate Sump Temperature vs. Time Graph
- Graph 21 – LCS Temperature vs. Time Graph
- Table 1 – Leachate Constituent Summary (quarterly)
- Table 2 – Liquid Levels and % Perforations Exposed Table
- Table 3 – Piezometer Readings from West Structural Fill Berm
- Figure 1 – Methane to Carbon Dioxide Ratio Map
- Figure 2 – Incremental Settlement Map
- Figure 3 – Wellhead Temperature Zone Map
- Figure 4 – Carbon Monoxide Distribution Map
- Figure 5 – “Deadhead” Gas Well Pressure Distribution Map
- Figure 6 – Aerial Infrared Map (quarterly)

Section 7 – Review of Potential Need to Extend Temporary FML Cap

Section 8 – Petitions to Perform Work (e.g. additional capping)

Section 9 – Proposed OM&M Plan Revisions

Section 10 – Odor Summary/Complaints

12.2 Frequency of Progress Reports

Progress reports will be submitted monthly for one year after approval of this OM&M Plan, and then decreased to a frequency approved by the Ohio EPA in consultation with U.S. EPA.

Progress reports will be stored on an FTP site or otherwise made readily available to the regulatory agencies, and will be transmitted via email to parties directly involved in overseeing the project including representatives from:

- Ohio EPA
- U.S. EPA Region V
- Stark County Health Department
- City of Canton Health Department

12.3 Meetings

Meetings will be held at the Countywide facility following a Progress Report submittal at the request of the Ohio EPA. Meetings will usually be held at the facility, and will include a site tour and a progress review. However, at the Ohio EPA's request, a meeting could be held at an alternate location or skipped altogether.

13.0 PLAN REVISIONS AND DOCUMENTATION

This OM&M Plan is intended to be a “living” document. As described in the specific sections of this OM&M Plan, most operation and maintenance activities are self-implementing with infrequent need for authorizations or changes. Forms used to operate and maintain the facility may be revised by Countywide, as long as the information required by this OM&M Plan is recorded. For changes to, or to remove information from forms or records, follow the procedures outlined in the following paragraphs.

Over the life of this work, site features will change; gas wells will need to be replaced and piping rerouted; air delivery lines and liquid transmission lines will need to be added or moved; etc. Such changes will be reflected in revised as-built drawings, which will be kept up-to-date at the facility and submitted annually to regulatory agencies upon request. For routine maintenance issues which do not fundamentally alter or extend a feature’s purpose or function, maintenance records will be kept at the facility to be available for inspection by the Ohio EPA.

Countywide-initiated changes to procedures or requirements will be submitted to the Ohio EPA for review. The proposed changes will be considered effective if no comment is received within 30 days. OM&M Plan revisions to be submitted for agency review include, but may not be limited to: revisions to data collection, fundamental process changes, proposed decreases in certain maintenance tasks, etc. Revisions will be issue-focused and submitted in a way which allows identifying revisions (i.e., a revision block on a drawing, colored paper or forms in the binders, revision date in corner, etc.). Likewise, the Ohio EPA may request or require changes to the OM&M Plan. Such changes may be discussed at the Progress Report meetings discussed in Section 12.3 or at a special meeting requested by the Ohio EPA. Up-to-date binders will be kept at the facility, and updates can be submitted annually to regulatory agencies upon request.

Note that modifications to the OM&M Plan <u>do not</u> constitute PTI permit alterations or modifications. For major replacements, extensions, or changes, Countywide will consult with the Ohio EPA and then, if necessary, submit a PTI alteration application, and provide an engineering certification upon completion of the work.

After one year of experience with the OM&M procedures, a procedural review document will be submitted. Countywide and the Ohio EPA will collaborate to determine if changes to any procedures, frequencies, or reporting would be beneficial to the future OM&M, and, if so, will submit proposed changes for Ohio EPA consideration for approval.

TABLES

Table 1 – Management Structure

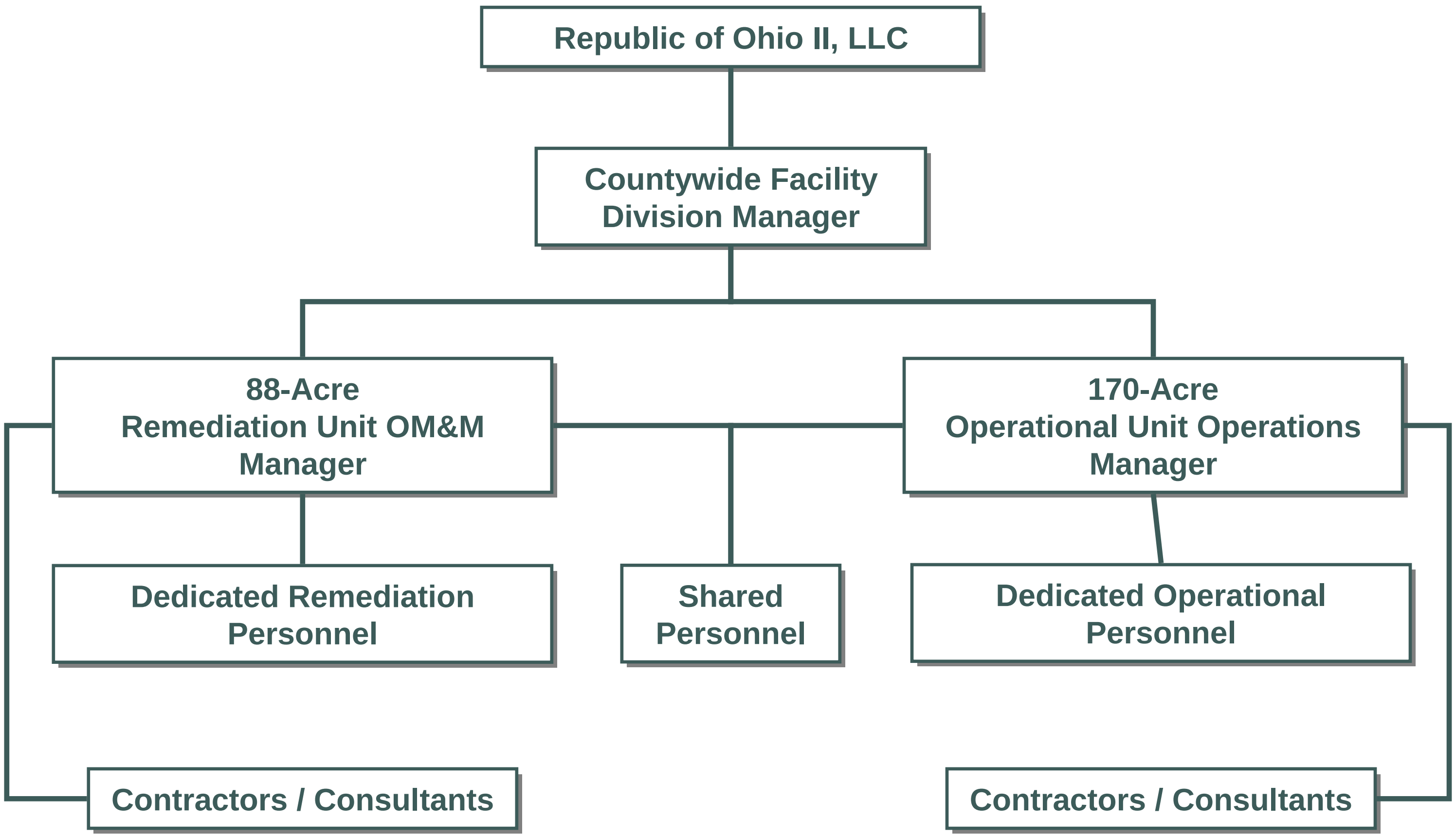


Table 2 – Contacts

Company	Name	Phone Number
Republic Services	Jim Teter	(480) 627-2743
Republic Services	Craig Almanza	(480) 748-3146
Countywide RDF	Michael Darnell	(502) 803-6573
U.S. EPA	Paul Ruesch	(312) 617-7212
Ohio EPA	Lynn Sowers	(330) 963-1200
Stark Co. Health Dept.	Kirk Norris	(330) 493-9904
Canton City Health Dept.	Bud Keim	(330) 489-3385

Table 3 – Agency Authority

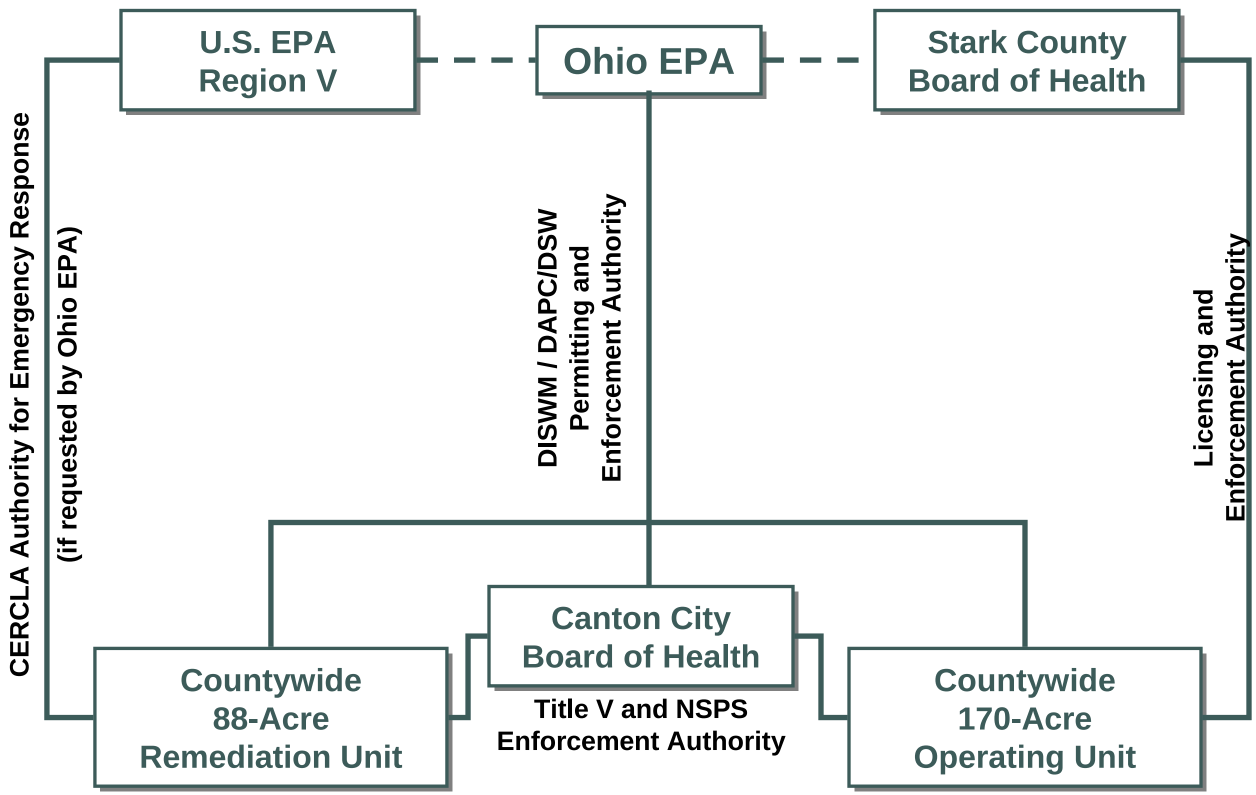


Table 4 – Equipment List

Equipment Type	Typical On-site Inventory
Pickup Trucks/SUVs	7
Bulldozers	3
Trash Compactors	3
Smooth Drum Roller	1
Excavators/Backhoes	2
Off-Road Dump Trucks	3
Front-End Loaders	1
Motor Graders	2
Service Truck	1
Lube truck	1
Street Sweeper	1
Light Plants	1
Generators	5
Water Truck	1
Vacuum Truck	1
Utility Vehicle	1
Large Water Pumps	3
Air Compressor	1
Tractor	1
Brush Hog	1
Blade	1
Lawn tractor	1
Geomembrane Extrusion Welder	1
Vacuum Box Test Apparatus	1
Gem Monitors	3
4-Gas meters	3
Photoionization Detector	1
Ammonia Detector	1

Note: This list is provided for informational purposes only. Equivalent equipment may be provided and equipment my be present in the numbers given, or may not be, based on the needs at any particular time.

Table 5 – Surface Water Inspection Criteria

Sedimentation Ponds	Frequency
Structural Integrity of Berms	Weekly
Vegetation	Weekly
Primary Spillway(s)	Weekly
Emergency Spillway(s)	Weekly
Water Quality	Weekly
Sediment Volume	Weekly
Discharges	Weekly
Ditches/Channels	
Vegetated	Weekly
Riprap	Weekly
Freeboard	Weekly
Scour	Weekly
Water Quality	Weekly
Clogging	Weekly
Pipe/Culverts	
Structural Integrity	Weekly
Crushing	Weekly
Adequate Cover	Weekly
Water Quality	Weekly
Clogging	Weekly
Head/Endwalls	Weekly
Erosion Control	
Permanent Controls	Weekly
Temporary Controls	Weekly
Hillsides	Weekly
Vegetation	Weekly
Stability	Weekly
Checkdams	Weekly
Roadways	Weekly

Table 6 – Sediment Pond Design / Cleanout

Sedimentation Pond #	Design Drainage Area (acres)	Sediment Storage Design Volume (cubic feet)	Sediment Storage Design Elevation	Sediment Storage Design Depth (feet)	Design Reference	Comment
1	24.4	313,227	1,063.0	3.0	Not Available. Drainage area from 1993 PTI Application	Sediment depth based on typical design from Pond 1A. Sediment elevation and volume based on as-built drawings. Pond 1 to be replaced by pond 1-1A.
1A	36.5	473,148	1,072.5	3.0	1993 PTI Application and as-built drawings	Sediment elevation and volume based on as-built drawings which show pond bottom 0.5' lower than design. Pond 1A to be replaced by pond 1-1A
2	72.1	657,801	959.91	1.9	July 2008 PTI Alteration Request	Pond reconstructed in 2008 per PTI Alteration design volumes
3	44.0	293,544	1,033.8	3.0	2001 PTI Application	Basin construction was raised 4.8 feet from design while maintaining design volumes. Sediment storage elevation reflects shifted construction.
9	75.5	605,448	1,022.8	1.8 above north floor	2008 PTI Application – Approved by Ohio EPA Division of Surface Water Management	Basin design adjusted slightly by DEI from PTI design to balance earthwork while maintaining required storage volume

Table 7 – Inspections for the Temporary Cap System (see Note 1)

Item or Conditions to Be Inspected (see Note 2)	Approximate Inspection Frequency	Inspection Procedure	Criteria for Acceptance
Cracks/Separation in the soil directly under the FML	Monthly	Visual observation for cracks, separation, etc. evidenced by distortion or strain in FML	No cracks, separation, etc. observed
Non-uniform waste decomposition(differential settlement of cap subgrade)	Monthly or after significant rain event (>0.5"/day)	Visual observation for stormwater ponding, recent discontinuities in surface	No damage to cap, no damage to engineered components, no ponding.
Rips, tears, or punctures of the FML cap	Monthly	Visual observation for rips, tears, punctures, or stress of the FML	No rips, tears, punctures, or stress observed
FML boots connected to LFG wells or other penetrations	Weekly	Visual observation of stressed or damaged FML boots, welds, seals, etc.	No stress or damage observed
Areas of elevated surface temperatures and, heat affected portions of FML cap	Monthly	Visual observation of FML cap for evidence of elevated surface temperature and heat affected portions of the FML	No visual impact observed
Liquids (leachate) below the FML cap	Weekly	Visual observation for bulging of the FML near the toe of slopes and listening for bubbling liquids	No bulging or noise observed
Liquids (leachate) above the FML cap	Weekly	Visual observation for liquids or staining due to leaks in the FML	No liquids or staining verified as attributable to leachate observed
LFG below the FML cap	Weekly	Visual observation to confirm the absence of gas build-up under the geomembrane cover	No gas build-up observed
Outside Slope Elevation Survey	Monthly	GPS survey of outside slopes on max. 50'x50' grid.	No unusual bulging or combination of lateral and horizontal movement.

Notes:

1. Inspection and Maintenance procedures for subcap gas collectors are presented in Volume 2 and for subcap drains are presented in Volume 3.
2. All personnel who have responsibility for the remediation unit will be trained and expected to look for and report any of these items as they conduct their routine activities.

Table 8 – List of Corrective Procedures for the Temporary Cap System

Description of Compromise	Procedures to be Followed to Correct the Compromise	Target Time for Correction*
Cracks/Separation in the soil directly under the FML	Determine the nature and extent of the crack upon discovery, and evaluate safety, extent, and if repair is required. If safe and required to maintain FML integrity, cut open FML, fill in cracks with more soil, and repair FML. Document repairs in accordance with QA/QC Plan. If repair is not required, continue to monitor until repair is required.	1 week
Non-uniform waste decomposition	Fill the area to promote sheet flow or install a stormwater pump in the low area to remove the water. Repair impacted cap or engineered components.	Upon discovery
Rips, tears, or punctures of the FML cap	Extrusion weld FML repair patch (or bead for small holes) as soon as practical upon discovery. Remove, adjust or protect temporary FML cap from objects causing stress point concentrations. Document repairs in accordance with QA/QC Plan.	1 day
Stormwater management components impaired	Fill the area to promote sheet flow or install a stormwater pump in the low area to remove the water. Re-grade and install new temporary cap or readjust features above the cap as necessary so stormwater management system will function to drain stormwater to intended locations.	1 month
Failure of FML boots at LFG wells or other penetrations	Repair the FML boot, patch, weld, or seal. Document repairs in accordance with QA/QC Plan.	1 week
Aged, brittle, heat affected portions of FML cap	Replace or overcap aged, brittle, or heat affected sections. Document repairs in accordance with QA/QC Plan.	3 months
Liquids (leachate) below the FML cap	Cut the FML, add a port and valve if deemed appropriate and then pump out/collect the liquids, and dispose properly. Evaluate subcap drainage piping, and install additional subcap drainage piping or repair existing as necessary. Repair FML and document in accordance with QA/QC Plan.	1 month
LFG Build-up under the FML Cap	Increase vacuum to subcap LFG collectors in the area of the floating FML. Install surface vacuum point (bubblesucker) if necessary.	1 day
Liquids (leachate) above the FML cap	Upon discovery, collect and remove liquid as soon as possible. Construct barriers to block liquid from entering storm water collection channels if necessary. Once liquid is under control, repair FML to prevent additional leachate outbreaks. Document repairs in accordance with QA/QC Plan.	1 day

* Upon discovery shall mean as quickly as can be reasonably expected given weather and/or access conditions and material availability. If an immediate threat to human health, safety, odor release, loss of stability, or the environment exists, these target times would not apply; rather immediate and if necessary temporary repairs must be made as soon as possible. Ohio EPA may modify these timelines for a particular issue.

Table 9 – Proposed Data Collection

Proposed Data Collection	Location	Frequency	Collection Procedure	Data Collection Oversight (see Note 1)
Gas Extraction Well Field Parameters (wellhead temperature, oxygen, pressure, methane, carbon dioxide)	Gas extraction features (gas extraction wells, subcap collectors, leachate risers, etc.), see Vol. 2, Fig. 2-2	Weekly	6.3.1	OM&M Lead Tech.
"Deadhead" Well Pressure	Accessible vertical gas extraction wells, see Vol. 2, Fig. 2-2	Quarterly	6.3.2	OM&M Lead Tech.
Liquid Levels	Accessible vertical gas extraction wells, see Vol. 2, Fig. 2-2	Monthly	6.3.3	OM&M Lead Tech.
Gas Flow Volume Measurements	Operating Flare(s), see Fig. 4	Continuous	6.3.4	OM&M Lead Tech
Gas Quality (D-1946 analyses for carbon monoxide)	Accessible vertical gas extraction wells, see Vol. 2, Fig. 2-2	Annually	6.3.5.	OM&M Lead Tech.
Gas Quality (D-1946 analyses for methane, hydrogen, carbon monoxide, oxygen)	Select header sampling ports, see Fig. 4	Monthly	6.3.5.	OM&M Lead Tech.
Gas Quality (TO-15 for volatile organics and TO-9 for dioxins and furans)	Select header sampling ports, see Fig. 4	Quarterly	6.3.5. 6.3.5.	OM&M Lead Tech.
Leachate Temperature	Each leachate cell sump, see Fig. 8	Monthly	6.3.6	OM&M Lead Tech.
Leachate Collection System (LCS) Pipe Temperature	Selected accessible LCS Pipes, see Fig. 8	Monthly	6.3.6	OM&M Lead Tech.
Leachate Quality (leachate "indicator" parameters, App. I parameters, and dioxins and furans)	Each leachate storage tank serving remediation unit, see Fig. 5	Quarterly	6.3.7	Leach. Sys. Data Mgr.
Leachate Volume	Each leachate storage tank serving remediation unit, see Fig. 5	Continuous	6.3.8	Leach. Sys. Data Mgr.
Aerial Infrared Photograph	Entire remediation unit	Quarterly	6.3.9	Licensed Surveyor
Settlement Survey	Entire remediation unit	Monthly	6.3.10	Licensed Surveyor
Slope Pin and Plate Surveys	Selected monitoring lines, see Fig. 7	Weekly	6.3.11	Licensed Surveyor
Piezometer Readings	South Slope and West Berm piezometers, see Figs. 6 and 7	Monthly	6.3.12	OM&M Lead Tech.
South Slope Gas Probe Field Parameters	South Slope gas probes, see Fig. 6	Monthly	6.3.1	OM&M Lead Tech.
South Slope Gas Probe Carbon Monoxide	South Slope gas probes, see Fig. 6	Annually	6.3.5.1	OM&M Lead Tech.

Note 1: All data collection will be the responsibility of the OM&M Manager.

OM&M Manager – Responsible for the entire data collection program. The OM&M Manager duties are assumed directly by the Division Manager (see **Table 1**) or shall be designated by the Division Manager.

OM&M Lead Technician – Countywide personnel designated by the OM&M Manager as the manager of the technicians involved in the well field tuning and sampling program.

Licensed Surveyor – Third-party consultant.

Leachate System Data Manager – Countywide personnel designated by the OM&M Manager as the compiler of leachate volume and quality data.

Table 10 – Trigger Levels

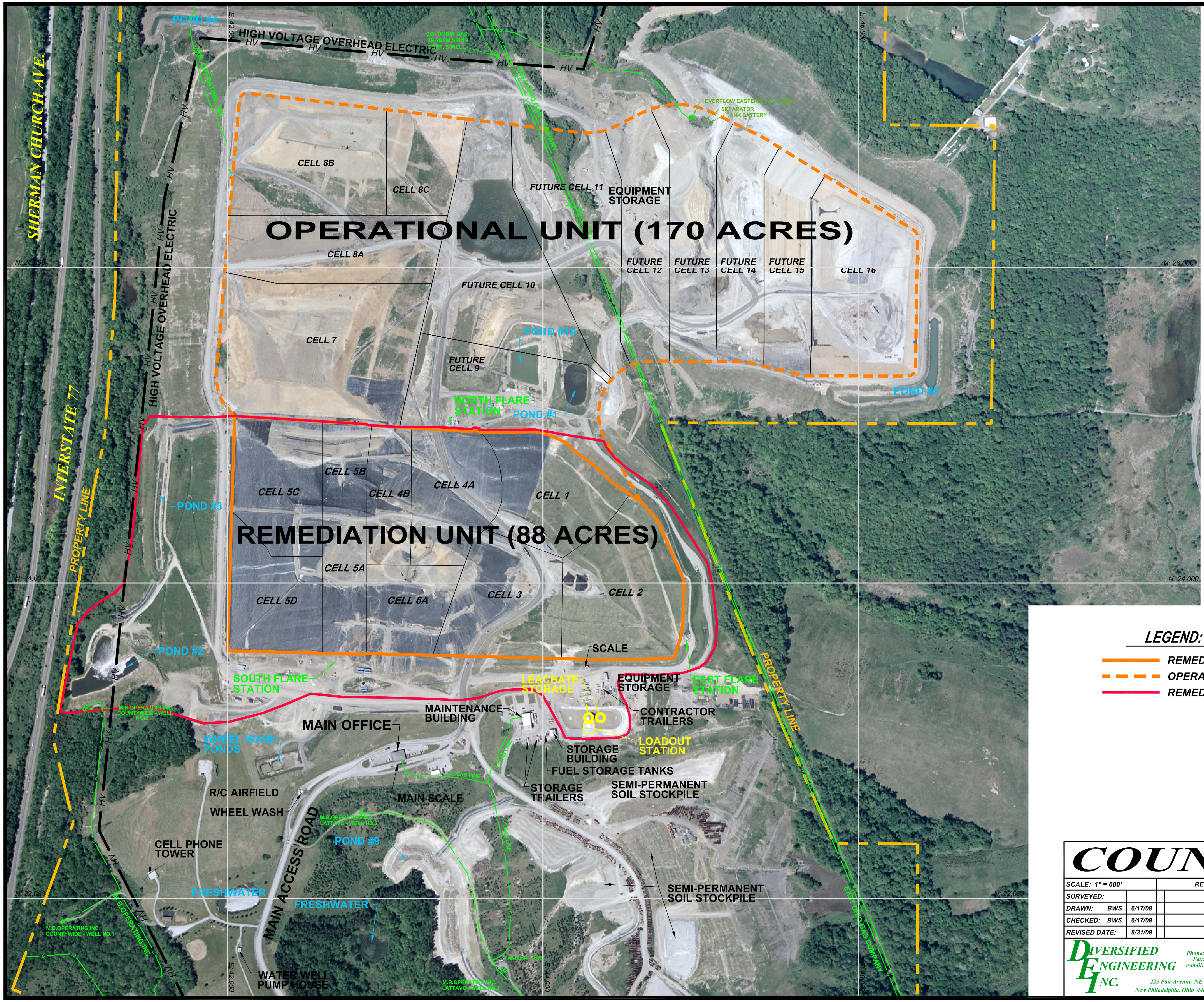
Parameter	Trigger Value	Possible Issue to be Evaluated	Course of Action (Note 1)
Gas Extraction Wellhead Temperature	>210° F	Subsurface oxidation	Vol. 2, Appendix E
Gas Extraction Wellhead Oxygen	>1.5% (after wellhead tuning adjustment)	Subsurface oxidation	Vol. 2, Appendix C
Gas System Header Total Dioxin and Furan	>10,000 pg/m^3	Subsurface oxidation	Vol. 2, Appendix F
Gas System Well Carbon Monoxide (Note 2)	>100 ppm	Subsurface oxidation	Assess as necessary and/or as requested
Gas System Header Carbon Monoxide	>25% increase over previous reading	Subsurface oxidation	Vol. 2, Appendix F
Leachate Temperature in Sump (Note 2)	>150° F	Engineered Components	Assess as necessary and/or as requested
LCS Temperature in Collection Pipe (Note 2)	>150° F	Engineered Components	Assess as necessary and/or as requested
Infrared or Temperature Gun on Temporary Cap (Note 2)	>150°	Subsurface oxidation or cap system integrity	Assess as necessary and/or as requested
Waste Slope Movement	Pin or plate > 0.05'/day horiz. Pin or plate raises vertically above orig, survey elev.	Slope instability	Monitor, prepare stockpile for buttress
Excessive Settlement (Note 2)	>annualized rate of 2% waste height/year	Subsurface oxidation	Increase survey frequency to weekly in immediate area, inspect adjacent engineered components
Deadhead Well Pressure (Note 2)	>200" water column	Slope stability, gas collection efficiency	Assess surrounding wells and need for pressure relief if widespread
Water Level in West Berm Piezometers	Higher than predetermined trigger which causes F.S<1.5	Slope stability	Install Inclinometers
Water Level in West Berm Piezometers	Higher than predetermined trigger which causes F.S<1.2	Slope stability	Install Buttress and/or remove water
Inclinometer Deflections	Increase in deflection rate.	Slope stability	Install Buttress and/or remove water

Notes:

1: Ohio EPA shall be notified when any trigger is exceeded.

2. This parameter shall only be considered a trigger if it occurs in a location where it had not been exceeded in the previous event.

FIGURES



LEGEND:

- REMEDIATION UNIT LIMIT OF WASTE (88 ACRES)
- OPERATIONAL UNIT LIMIT OF WASTE (170 ACRES)
- REMEDIATION AREA OM&M LIMITS

Scale: 1 in . = 600 ft.

0' 600' 1200' 1800'

Graphic Scale

COUNTYWIDE RDF

SCALE: 1" = 600'			REVISIONS
SURVEYED:			
DRAWN:	BWS	6/17/09	
CHECKED:	BWS	6/17/09	
REVISED DATE:		8/31/09	

PROJECT: CWRDF

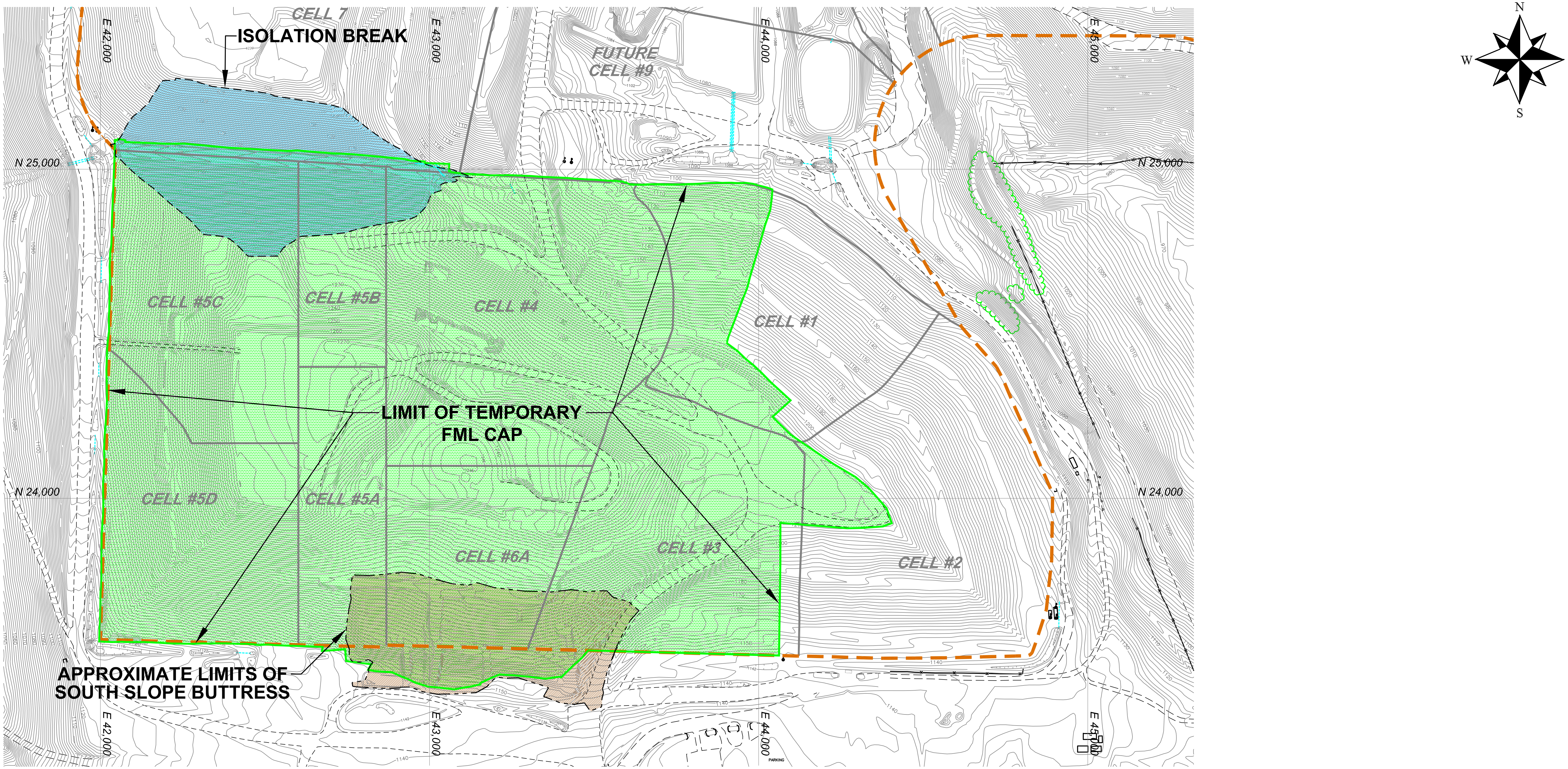
SHEET TITLE: FACILITY LAYOUT

FILE ID: Bifurcation Facility Layout (Exhibit B) 12-02-08 (REVISED 08-31-09)

FIGURE 1

DIVERSIFIED ENGINEERING INC.
225 Fair Avenue, NE
New Philadelphia, Ohio 44663
Phone: (330) 364-1631
Fax: (330) 364-4031
e-mail: dei@dei-eng.com

\\Alpha\alpha-data\Data\LANDFILLS\Countywide Landfill\Isolation Break\Cell 5-7 Break\DEI Air Break DWG's\Bifurcation Facility Layout (Exhibit B) 12-02-08 (REVISED 08-31-09).dwg, 8/31/2009 8:13:55 AM



Scale: 1 in . = 300 ft.

0' 300' 600' 900'

Graphic Scale

LEGEND:

- LIMIT OF TEMPORARY FML CAP
- LIMIT OF ISOLATION BREAK
- APPROXIMATE LIMITS OF SOUTH SLOPE BUTTRESS

COUNTYWIDE RDF

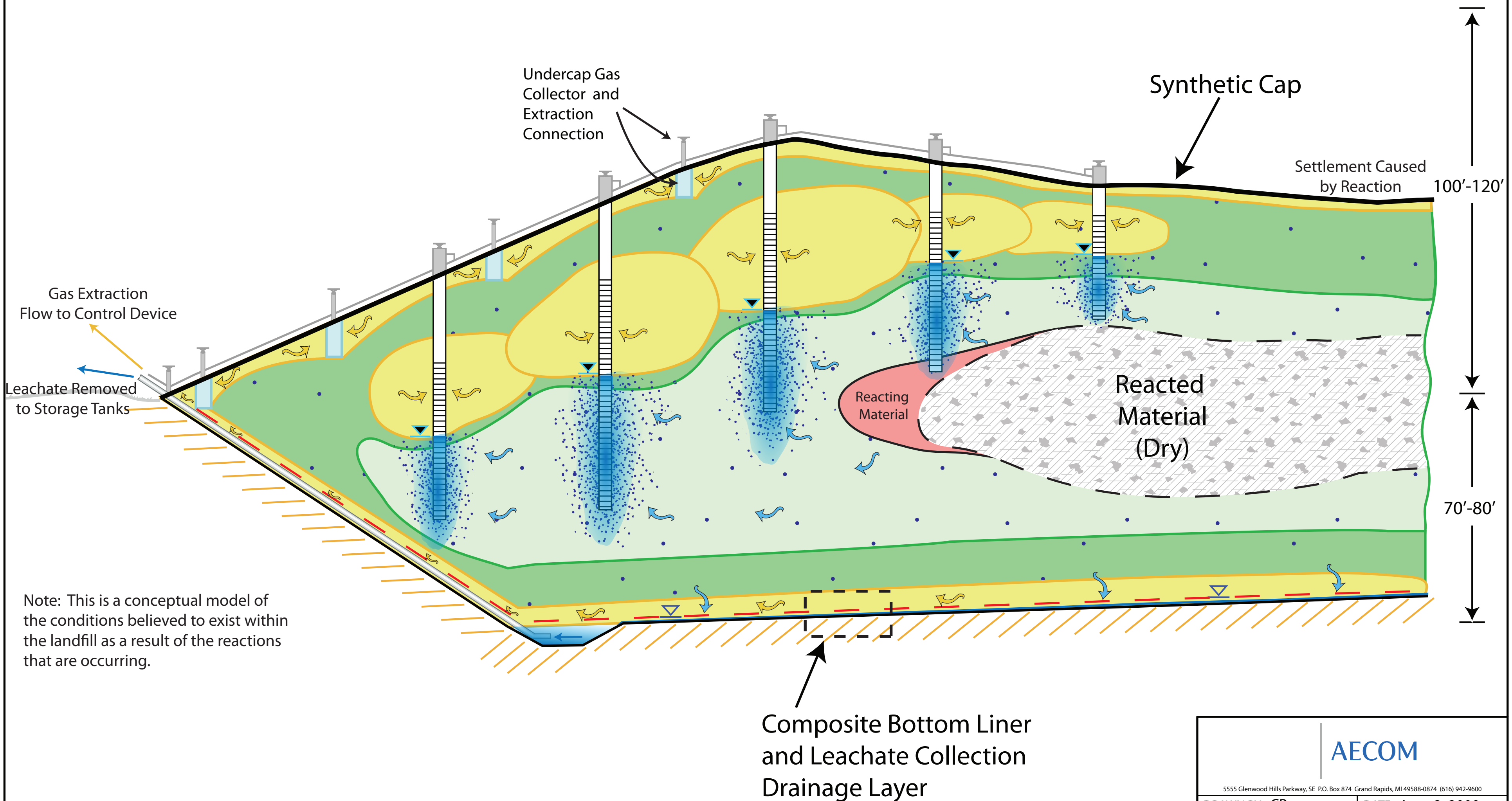
SCALE: 1" = 300'		REVISIONS	PROJECT: CWRDF
SURVEYED:			
DRAWN: BWS	6/17/09		
CHECKED: BWS	6/17/09		SHEET TITLE: REMEDIATION FEATURES
REVISED DATE:			

DIVERSIFIED ENGINEERING INC.
225 Fair Avenue, NE
New Philadelphia, Ohio 44663
Phone: (330) 364-1631
Fax: (330) 364-4031
e-mail: dei@dis-eng.com

FILE ID: OM-M Plan-Remediation Features 06-17-09

FIGURE 2

\\Alpha\alpha-data\Data\LANDFILLS\Countywide Landfill\Miscellaneous Drawings\OM-M Plan-Remediation Features 06-17-09.dwg, 6/17/2009 4:23:23 PM



Note: This is a conceptual model of the conditions believed to exist within the landfill as a result of the reactions that are occurring.

KEY

Vacuum

Partial Vacuum/ Lower Positive Pressure

Positive Pressure

Free Water

Water in Material Pore Spaces (increasing dot density implies increase in saturation)

Transient Borehole Water Elevation

Leachate Collection System Liquid Elevation

Top of Leachate Collection System

Moisture/Vapor Migration

Gas Movement

Gas Extraction Well

Non-perforated

Perforated

AECOM

5555 Glenwood Hills Parkway, SE P.O. Box 874 Grand Rapids, MI 49588-0874 (616) 942-9600

DRAWN BY: CP | DATE: June 3, 2009

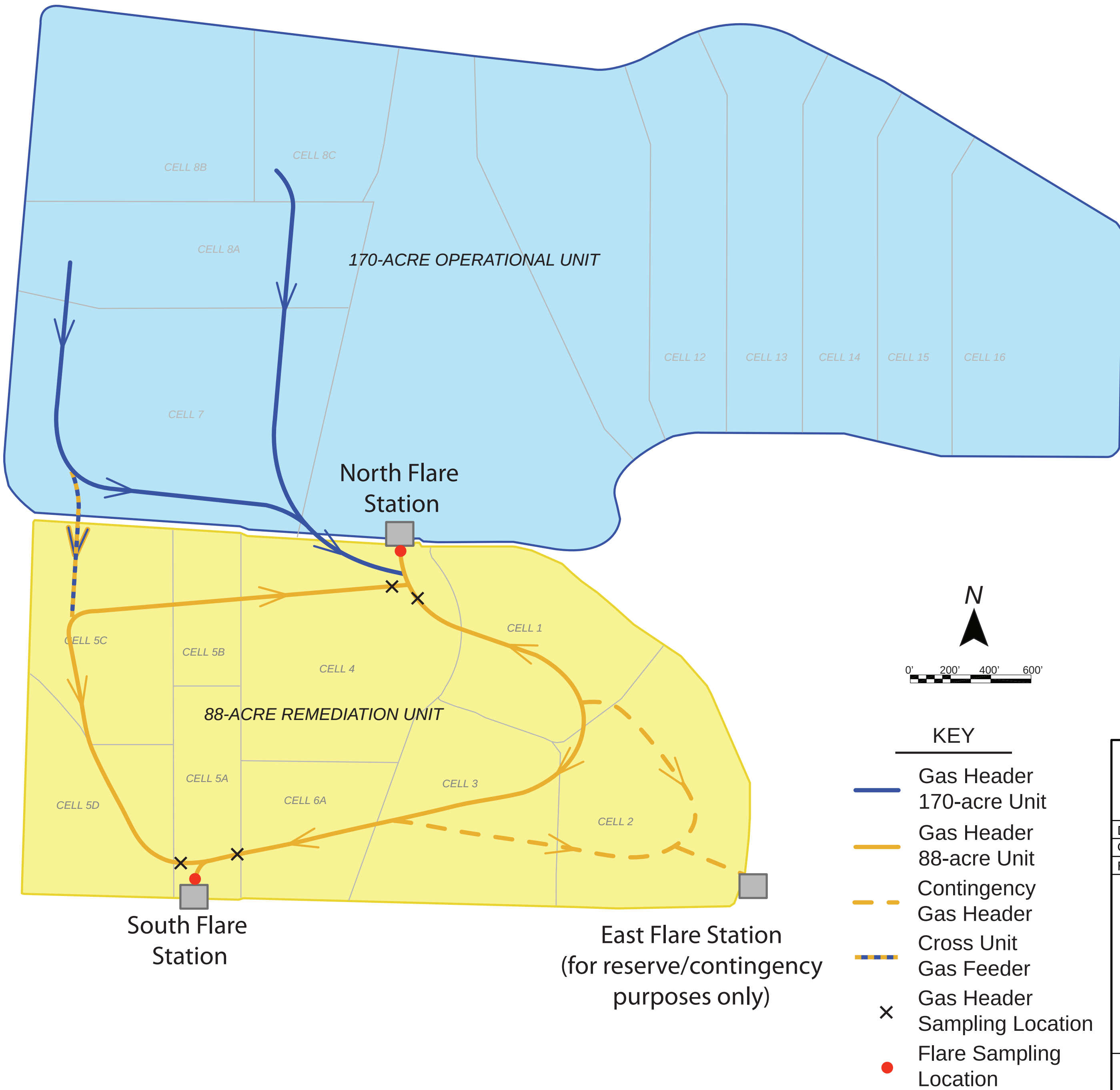
CHECKED BY: | EDITED BY:

FILE NAME: CWFIG3.pdf

Figure 3

Reaction Schematic

PROJECT NUMBER 103345 | SCALE: Not to Scale



AECOM

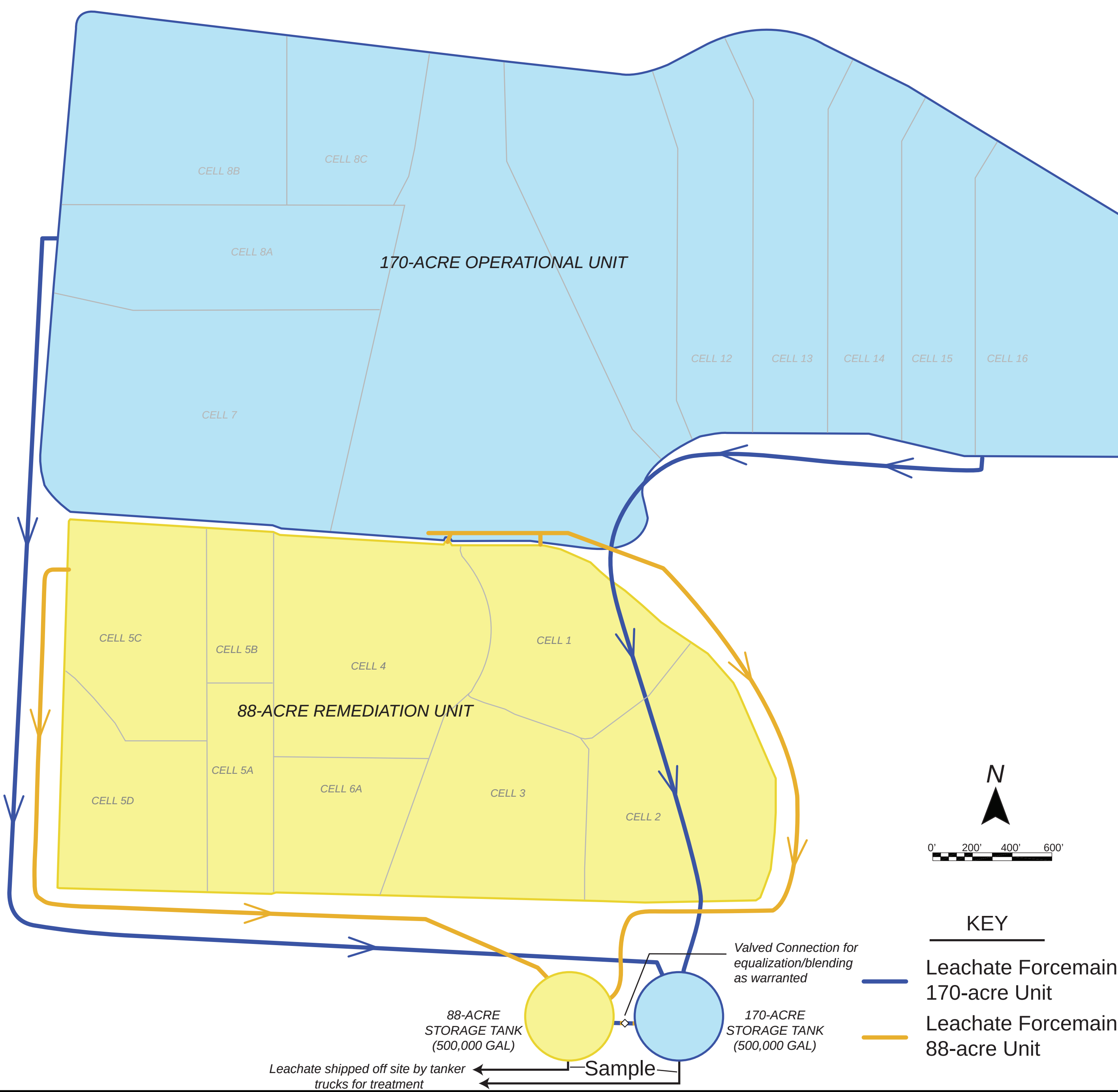
5555 Glenwood Hills Parkway, SE P.O. Box 874 Grand Rapids, MI 49588-0874 (616) 942-9600

DRAWN BY: Colin Plank	DATE: June 12, 2009
CHECKED BY:	EDITED BY:
FILE NAME: CWFIG4.pdf	

Figure 4

Gas Management Schematic

PROJECT NUMBER 103345	SCALE: As shown



AECOM

5555 Glenwood Hills Parkway, SE P.O. Box 874 Grand Rapids, MI 49588-0874 (616) 942-9600

DRAWN BY: Colin Plank	DATE: June 12, 2009
CHECKED BY:	EDITED BY:
FILE NAME: CWFIG5.pdf	

Figure 5

Leachate Management Schematic

PROJECT NUMBER	103345	SCALE:	As shown

LEGEND

SGP-5	SOUTH SLOPE GAS PROBES
SS-1	SOUTH SLOPE BORE LOCATIONS
	EXISTING ROADS

COUNTYWIDE RDF

SCALE: 1" = 30', CTR=2'

REVISIONS

DRAWN:	LDB	05-08-08
CHECKED:	CCV	05-08-08
REVISED DATE:		07-21-09

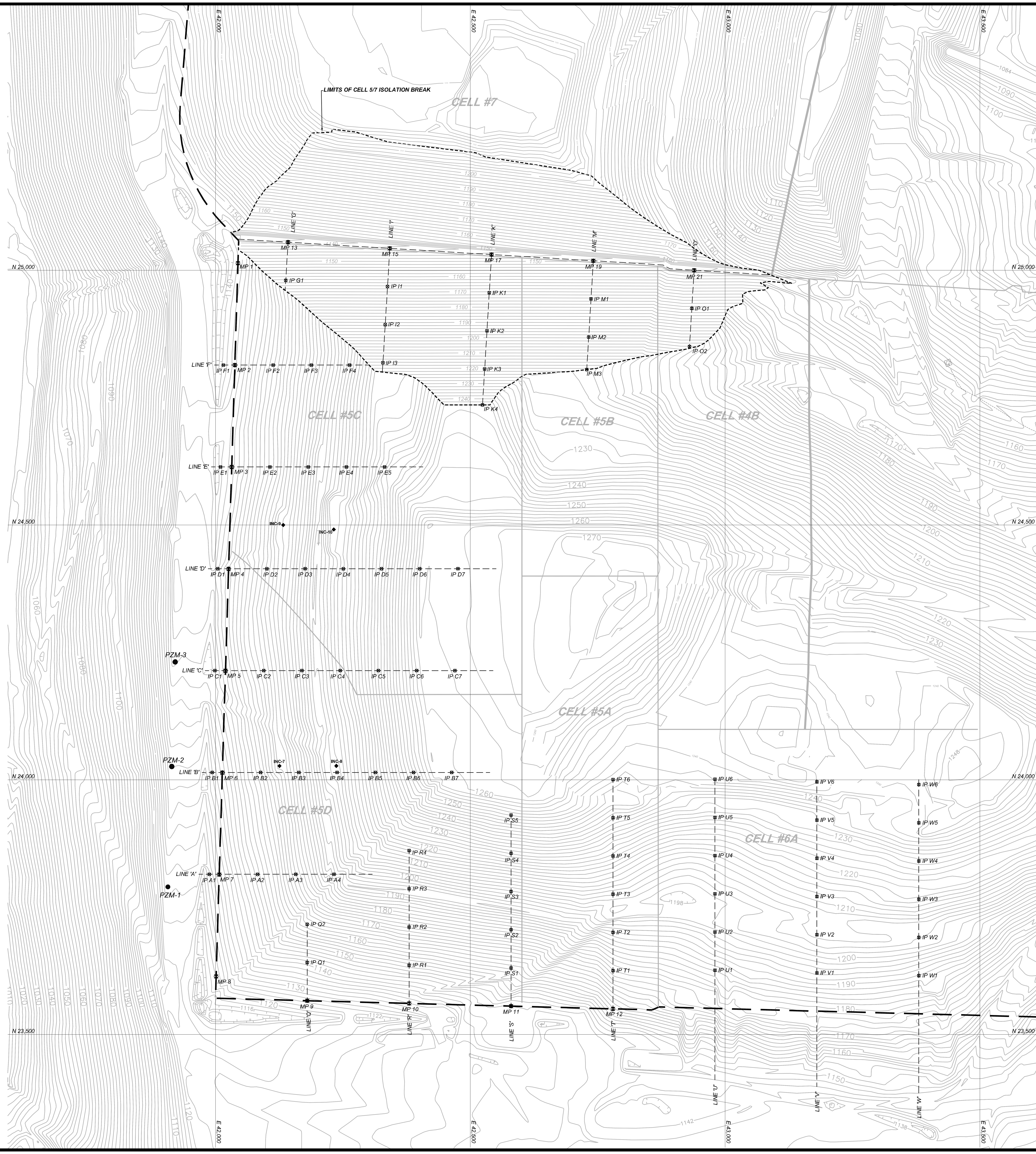
PROJECT:
SOUTH SLOPE INVESTIGATION

SHEET TITLE:
SOUTH SLOPE BORINGS

DIVERSIFIED ENGINEERING INC.
Phone: (330) 364-1631
Fax: (330) 364-4031
e-mail: dei@dei-eng.com
225 Fair Avenue, NE
New Philadelphia, Ohio 44663

FILE ID:
South Slope Investigation Sections (revised 7-21-09)

FIGURE 6



LABELING CONVENTION

IP B1 IP = IRON PIN

MP 6 MP = MONITORING PLATE

N E S W

Scale: 1 in. = 100 ft.

0' 100' 200' 300'

Graphic Scale

COUNTYWIDE RDF

SCALE: 1" = 100'		REVISIONS
SURVEYED:		
DRAWN: LDB	6/17/09	
CHECKED:		
REVISED DATE:	07/21/09	

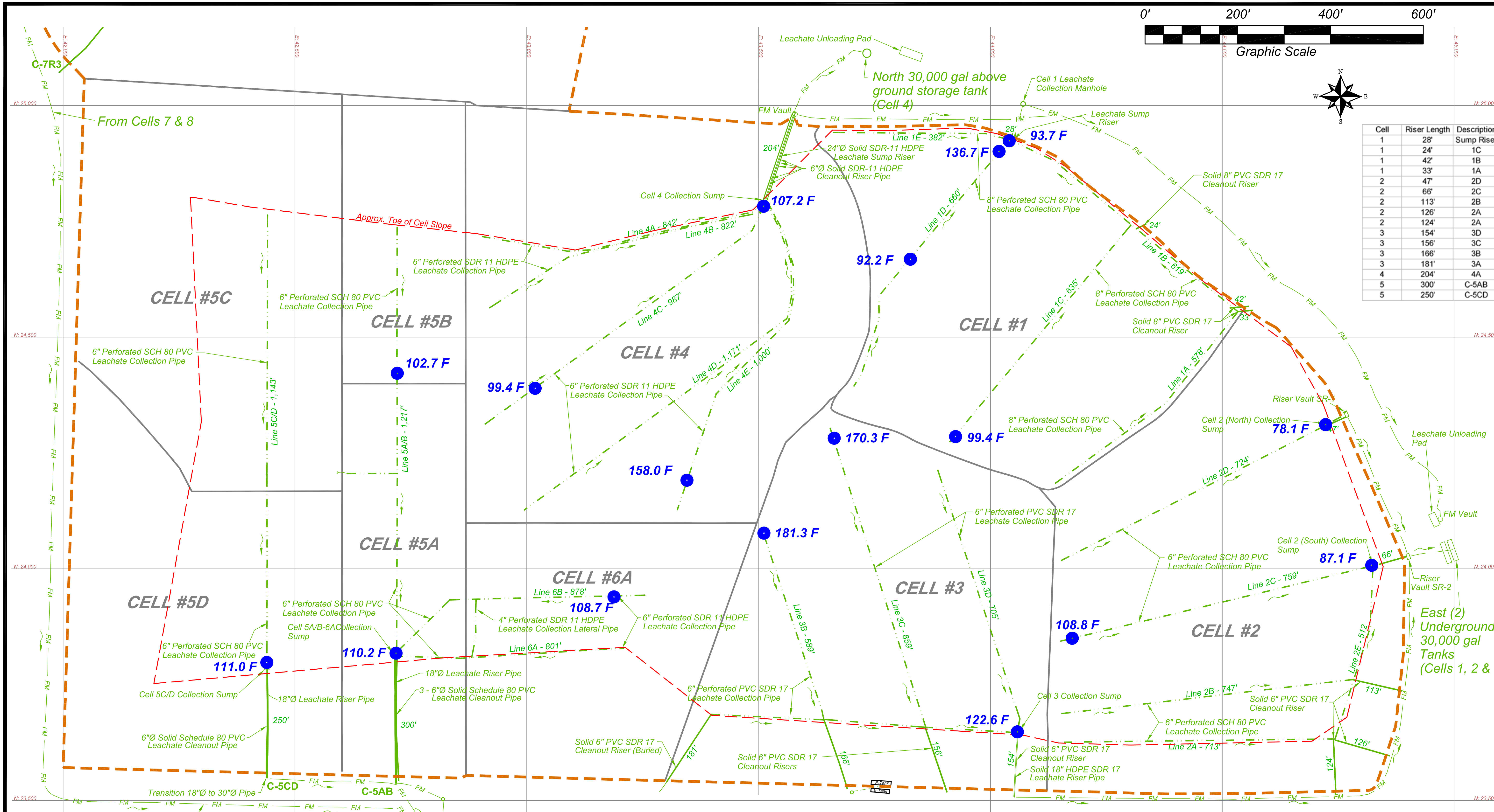
PROJECT:
88 REMEDIATION UNIT SLOPE PINS AND MONITORING PLATES LOCATIONS

SHEET TITLE:
SLOPE MONITORING

DIVERSIFIED ENGINEERING INC.
225 Fair Avenue, NE
New Philadelphia, Ohio 44663
Phone:(330) 364-1631
Fax:(330) 364-4031
e-mail: dei@dei-eng.com

FILE ID:
CW-West Slope Monitoring (Isolation Break) 06-17-09

FIGURE 7



Cell	Riser Length	Description
1	28'	Sump Riser
1	24'	1C
1	42'	1B
1	33'	1A
2	47'	2D
2	66'	2C
2	113'	2B
2	126'	2A
2	124'	2A
3	154'	3D
3	156'	3C
3	166'	3B
3	181'	3A
4	204'	4A
5	300'	C-5AB
5	250'	C-5CD

Leachate Unloading Pad

(4) 22,000 gal Temporary "Frac Tank" (South Slope Infiltration Water)

(2) 22,000 gal Temporary "Frac Tank" (Cells 5A/B, 5C/D, 6A)

South 30,000 gal above ground storage tank (Cell 7 & 8A)

107.5 F — TEMP. MEASURED ON JUNE 14, 2007 ON THERMOCOUPLES ADVANCED WITH A PVC PUSH-POLE.

IN EARLY JUNE 2007, NEW THERMOCOUPLES WERE ADDED TO PIPES 1C, 3C, AND 4E.

LEGEND NOTES:

1.) Leachate collection system features in Cells 1, 2, 3, 4, 5A, 5B, 5C, 5D & 6A were complied from Bair, Goodie and Associates, Inc. "Leachate Management System" record drawings.

2.) Lengths shown for leachate collection pipes are slope corrected.

COUNTYWIDE LANDFILL

SCALE: 1" = 200'
DRAWN: MRB 06-20-07
CHECKED:
REVISED DATE:
REVISIONS: 07-17-09

PROJECT: OPERATION, MAINTENANCE, AND MONITORING PLAN

FIGURE TITLE: LEACHATE SYSTEM TEMPERATURE MONITORING SYSTEM

FILE ID: Leachate Collection System Schematic 04-17-07

FIG. 8

36133 Schoolcraft Road Livonia Michigan 48150 (734) 779-2800

APPENDIX A

Letter from U.S. EPA Regarding Isolation Break

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

REPLY TO THE ATTENTION OF:

LM-8J

June 19, 2009

Republic Services of Ohio II, LLC
c/o Michael Beaudoin
3619 Gracemont Street S.W.
East Sparta, OH 44626

Re: Isolation Break - Countywide RDF, East Sparta, Ohio (Site ID# B5FC)

Dear Mr. Beaudoin:

Thank you for your cooperation in the construction of the isolation break between Cells 4B/5B/5C and Cell 7 at the Countywide Landfill. The United States Environmental Protection Agency (U.S. EPA) appreciates your attention to this effort as well as the resources dedicated to the project over the past several months to complete it on schedule and with no accidents.

The goal of this project was to isolate and contain the reaction impacting Cells 1-6 to within the 88 acre remediation area. U.S. EPA and/or our designated contractor were present on site to conduct oversight through the duration of the project. It was documented that all waste was excavated down to the bottom liner atop the berm separating Cells 4B/5B/5C from Cell 7, achieving a total separation of the waste contained in these respective cells. Further, the U.S. EPA documented that the bottom of the isolation break was constructed in a manner that would effect total separation of leachate and gas between Cells 4B/5B/5C and Cell 7. U.S. EPA documented the integrity of the bottom liner as well as all repairs made prior to construction of the roadway separating the Cells.

During this excavation, there was no evidence found of reaction, pyrolysis or fire in the waste or bottom liner separating the Cells. Approximately 70 cubic yards of secondary aluminum wastes (mostly reacted baghouse dust found in supersacks) were uncovered along the Cell 5 side slope and were disposed of within the 'bowl area' of the 88 acres.

Daily reports were completed in coordination with the construction quality assurance contractor and submitted each day throughout the project. Monthly progress reports where submitted on time throughout the duration of the project.

(over)

Thank you very much for your cooperation on the isolation break project. Please feel free to contact me at (312) 886-7898 should you have any questions about this letter.

Sincerely,

Paul Ruesch

Paul Ruesch
Environmental Engineer

cc: Kurt Princic, OEPA, Twinsburg, OH

APPENDIX B

Surface Water Inspection Log

Municipal Solid Waste Landfill Facility Daily Log of Operations - Form 4

- Weekly Sedimentation Pond and Discharge Structure Inspection - OAC Rule 3745-27-19(E)(11)(b)

{Log Required by OAC 3745-27-19(E)(10)}

Facility Name: ______________________ Today's Date: ______________

List Weather Conditions on this Day: ______________________

For any problems identified, locate and number on site map and explain. Document all corrective actions after deficiencies are corrected. Place an (X) on the line next to all aspects of facility operations which have been inspected today. Mark "N/A" if not applicable.

Sedimentation Ponds

____ Structural Integrity of Berms
____ Vegetation
____ Primary Spillway(s)
____ Emergency Spillway(s)
____ Water Quality
____ Sediment Volume
____ Discharges

Ditches/Channels

____ Vegetated
____ Riprap
____ Freeboard
____ Scour
____ Water Quality
____ Clogging

Erosion Control

____ Permanent Controls
____ Temporary Controls
____ Hillsides
____ Vegetation
____ Stability
____ Checkdams
____ Roadways

Pipes/Culverts

____ Structural Integrity
____ Crushing
____ Adequate Cover
____ Water Quality
____ Clogging
____ Head/Endwalls

Description of Water Quality Samples Taken

Description of Corrective Actions Taken and Other Comments

Signature of Person Completing Form *Print Name of Person Completing Form* *Date*

This form should be retained on file for three years for inspection by the local health department, Ohio EPA, or an authorized representative. Failure to provide accurate daily operations information may be considered a violation of Ohio Revised Code § 2921.13.

Date: 1-Jun-09

Weekly Surface Water Inspection

Landfill Inspection

Active Cell	16	
Ponding	Yes	**No**
Erosion	Yes	**No**
Leachate Outbreaks	Yes	**No**
Corrective Action		N/A

Surface Water Inspection

Active Ponds	1, 1A , 2, 3, 9	
Erosion	Yes	**No**
Clogging	Yes	**No**
Failure	Yes	**No**
Water Quality Samples Taken	No	
Weather Cond.(yes only):	See Attached	
Corrective Action:		

Annual Sediment Pond Elevations

Pond 1	1,126	Clean out @
Pond 1A	1,079	Clean out @
Pond 2	960	Clean out @
Pond 3	1037	Clean out @
Pond 9	1021	Clean out @

Signature : James R Steigerwald

APPENDIX C

Monthly Temporary Cap Inspection Form

MONTHLY TEMPORARY FML CAP INTEGRITY INSPECTION COUNTYWIDE RDF	
Completed By:	**Company Name:**
Title:	
Date:	

Item or Conditions to Be Inspected	**Inspection Procedure**	**Identified Location (i.e. Use GPS coordinates**	**Conditions Found/Comments*** (Attach figures or photos as necessary to define findings)
Cracks/Separation in the underlying soil subgrade	Visual observation for cracks, separation, etc. evident under the FML		
Non-uniform waste decomposition (differential settlement of cap subgrade)	Visual observation for stormwater ponding		
Rips, tears, or punctures of the FML cap	Visual observation for rips, tears, punctures, or stress of the FML		
FML boots connected to LFG wells or other penetrations	Visual observation of stressed or damaged FML boots, welds, seals, etc.		
Areas of elevated surface temperatures and, heat affected portions of FML cap	Visual observation of FML cap for evidence of elevated surface temperature and heat affected portions of the FML		
Liquids (leachate) below the FML cap	Visual observation for bulging of the FML near the toe of slopes and listening for bubbling liquids		

MONTHLY TEMPORARY FML CAP INTEGRITY INSPECTION

COUNTYWIDE RDF

Item or Conditions to Be Inspected	**Inspection Procedure**	**Identified Location (i.e. Use GPS coordinates**	**Conditions Found/Comments*** (Attach figures or photos as necessary to define findings)
Liquids (leachate) above the FML cap	Visual observation for liquids or staining due to leaks in the FML		
LFG below the FML cap	Visual observation to confirm the absence of gas build-up under the geomembrane cover		
Outside Slope Elevation Survey	GPS survey of outside slopes on max. 50'x50' grid.		

APPENDIX D

Quality Assurance Quality Control Plan For Installation of the Temporary FML Cap (QA/QC Plan) Dated July 2009

COUNTYWIDE RECYCLING AND DISPOSAL FACILITY

QUALITY ASSURANCE
QUALITY CONTROL PLAN FOR INSTALLATION OF THE TEMPORARY FML CAP

EAST SPARTA, OHIO

Prepared for
Republic Services, Inc.
July 2009

Prepared by

CORNERSTONE
Environmental Group, LLC
39395 W. Twelve Mile Road
Farmington Hills, Michigan 48331

Project 70187

Quality Assurance / Quality Control Plan
Countywide Landfill
East Sparta, Ohio

The material and data in this report were prepared under the supervision and direction of the undersigned.

Cornerstone Environmental Group, LLC

____
James Walker, P.E.
Project Manager

____
Matt Boudreau, E.I.T.
Project Engineer

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TABLE OF CONTENTS (Continued)

1 GENERAL

1.1 Scope

This Quality Assurance\Quality Control Plan (QA\QC Plan) addresses the quality assurance of the installation of soil, geosynthetic, trenching, and pipe materials associated with temporary FML capping activities taking place at Countywide Recycling and Disposal facility (CWRDF).

1.2 Parties

The parties discussed in this section are associated with the ownership, design, supply, manufacture, transportation, installation, and quality assurance. The definitions, responsibilities, qualifications, and submittals of these parties are outlined in the following subsections.

1.2.1 Project Coordinator

The Project Coordinator is the official representative of the Owner. In this plan, the term Project Coordinator is defined as the firm who coordinates construction and quality assurance activities for the project. The Project Coordinator shall serve as communications coordinator for the project, initiating the resolution, pre-construction and construction meetings. As communications coordinator, the Project Coordinator shall serve as a liaison between all parties involved in the project to ensure that communications are maintained. The Project Coordinator shall also be responsible for resolution of quality assurance issues that arise during construction. The Project Coordinator may appoint a designee for actions required by this Plan as appropriate.

1.2.2 Designer

The Designer is the individual and/or firm who is responsible for performing the engineering design and preparing the associated project plans and specifications for the lining system. The Designer is responsible for approving design and specification changes and making design clarifications necessitated during construction. Upon the request of the Project Coordinator, the Designer shall attend the resolution and pre-construction meetings. The Designer shall be a qualified engineer, certified or licensed as required.

1.2.3 Manufacturer

The Manufacturers are the companies that produces any of the various geosynthetic components outlined in this QA\QC Plan. Each geosynthetic Manufacturer shall provide certification documents that their products meet the minimum standards outlined in the project specifications or this QA\QC Plan. In the case of a geocomposite, the Manufacturer is the firm that combines the components into the final product.

1.2.4 Earthwork Contractor

The Earthwork Contractor(s) is the company that performs the subsurface preparations, trenching, road construction, and/or installation of the soil components associated with the temporary cap construction. The Earthwork Superintendent is the individual responsible for the Earthwork Contractor's field crew. The Earthwork Superintendent represents the Earthwork Contractor at all site meetings and acts as the Earthwork Contractor's spokesman on the project. The Owner may be the Earthwork Contractor.

1.2.5 Geosynthetic Installer

The Geosynthetic Installer (Installer) is the company that installs the geosynthetic components of the temporary cap system. The Geosynthetic Superintendent is the individual responsible for the Installer's field crew. The Geosynthetic Superintendent shall represent the Installer at all site meetings and act as the Installer's spokesman on the project. The Master Seamer shall be an experienced seamer on the Installer's field crew who shall provide direct supervision over less experienced seamers.

1.2.6 Quality Assurance Consultant

1.2.6.1 Definitions

The Quality Assurance Consultant (QAC) is the firm which observes and documents all activities related to the quality assurance of the installation of the different components of the temporary FML cap system.

In this QA\QC Plan, the term Quality Assurance Engineer (QAE) refers to the person employed by the QAC who is in charge of the quality assurance work. In some cases, two individuals may share the duties of the QAE: a Quality Assurance Certifying Engineer and a Quality Assurance Manager. Although not located at the site, the Quality Assurance Certifying Engineer shall visit the site often enough to be familiar with the details of the project.

The personnel of the QAC also include Quality Assurance Monitors (QA Monitors) who are located at the site for construction observation and documentation.

1.2.6.2 Responsibilities

The QAC is responsible for observing and documenting activities related to the quality assurance of the production and installation of the temporary FML cap components. The QAC is responsible for implementation of the QA\QC Plan as well as reviewing work products of the Quality Assurance Laboratory. The QAC is also responsible for issuing a final Construction Certification Report, sealed by a licensed Professional Engineer, as outlined in Section 2.5 of this QA\QC Plan.

The specific duties of the Geosynthetic QAC personnel are as follows:

1. The QAE:
    a. Reviews all applicable project plans and specifications.
    b. Reviews other site-specific documentation as required (i.e., previous reports).
    c. Develops site-specific addenda for quality assurance with the assistance of the Project Coordinator as necessary.
    d. Administers the QA\QC Plan, including assigning and managing quality assurance personnel, reviews field reports, and provides engineering review of all quality assurance related issues.
    e. Familiarizes himself with all applicable changes to project plans and specifications as issued by the Designer and identifying those that will require additional approvals or concurrence from the Ohio EPA.
    f. Familiarizes QA Monitors with the project and the QA\QC Plan.
    g. Assigns QA Monitors to observe and document all activities requiring monitoring.
    h. Participates in meetings or conferences to resolve outstanding QA\QC issues.
    i. Reviews Manufacturer and Installer certifications and documentation and makes appropriate recommendations.
    j. Manages the preparation of the record drawings.
    k. Reviews the QA Monitors' daily reports.
    k. Reviews the calibration certification of the on-site testing equipment (including, but not limited to tensiometer and air pressure gauges, as required and provides copy of calibrations to Site QA/QC Manager.
    o. Prepares a summary of the soils geosynthetic quantities installed.
    l. Notes on-site activities that could result in damage to the installed soil components.
    m. Reports to the Project Coordinator, relevant observations reported by the QA Monitors.
    n. Prepares a summary of the component quantities installed (pipe, drainage aggregate, etc.).
    o. Reviews the results of laboratory tests and makes appropriate recommendations.

p. Recommends the approval of the final acceptance to the Project Coordinator.
q. Designates a QA Monitor to represent the QAE when absent from the site while operations are ongoing.
r. Reports unapproved deviations from the QA\QC Plan to the Project Coordinator.
s. Maintains qualifications of all personnel and equipment.
t. Prepares or oversees preparation of the Construction Certification Report.

2. The QA Monitor:
   a. Monitors, logs, photographs and/or documents installation operations. Photographs shall be taken routinely and in critical areas of the installation sequence. The QAE shall assign the following duties to the QA Monitor(s):
   b. Monitors and documents the following operations for temporary cap components:
      i. Sampling and conformance testing;
      ii. Consistency of materials being placed;
      iii. Deployment operations;
      iv. Condition of the temporary FML cap components as placed;
      v. Visual observation, by walkover, of the finished components;
      vi. Field testing of the finished components; and
      vii. Repair operations, if and when necessary.
   c. Oversees marking, packaging and shipping of all laboratory test samples.
   d. Monitors and documents the FML seaming operations, including:
      i. Trial seams
      ii. Seam preparation
      iii. Seaming
      iv. Nondestructive seam testing
      v. Sampling for destructive seam testing
      vi. Field tensiometer testing
      vii. Laboratory sample marking
      viii. Oversees the marking, packaging and shipping of all laboratory test samples
      ix. Repair operations
      x. Measurements of installed quantities
   d. Documents any on-site activities that could result in damage to the constructed components. Any problems noted shall be reported as soon as possible to the QAE.
   e. Maintains field files of all logs and reports.

Any differences of the QAC's interpretation of the project plans and specifications from the Earthwork Contractor's and Geosynthetic Installers interpretation shall be assessed by the QAC through discussion with the Earthwork Contractor and Geosynthetic Installers.

If such assessment indicates any actual or suspected work deficiencies, the QAC shall inform the Earthwork Contractor and Geosynthetic Installers of these deficiency issues. The QAC shall inform the Project Coordinator of any deficiencies remaining uncorrected by the contractor.

1.2.6.3 Qualifications

The QAC shall be experienced in the preparation of Quality Assurance documentation including QA Forms, Reports, Certifications and Manuals. The QA Certifying Engineer shall be a licensed Professional Engineer. The QA Certifying Engineer and Quality Assurance Manager shall have sufficient knowledge and experience with landfill geosynthetic cap construction to enable him/her to implement the QA\QC Plan. QA Monitors shall have specific training in construction quality assurance of landfill geosynthetic cap systems to perform the required duties and be so designated by the QAE.

1.2.7 Quality Assurance Laboratory

The Quality Assurance Laboratory (QAL) is the firm (or firms) which conducts tests on soil and/or geosynthetic samples for the project. The Soil QAL and Geosynthetic QAL may be the same party. The test procedures shall be done in accordance with the test methods outlined in this QA\QC Plan.

2 DOCUMENTATION

The QAC shall document that the requirements of the QA\QC Plan have been addressed and satisfied.

The QAC shall provide the Project Coordinator with signed descriptive remarks, data sheets, and checklists to verify that required monitoring activities have been carried out. The QAC shall also maintain at the job site a complete file of all documents which comprise the QA\QC Plan, including plans and specifications, this QA\QC Plan, checklists, test procedures, daily logs, and other pertinent documents.

2.1 Daily Reports

2.1.1 Subgrade Preparation and Acceptance Reports

The Soil Quality Assurance Monitor shall complete a daily report and/or logs on prescribed forms outlining the monitoring activities for that day. The report shall consist of field notes, observations, test data sheets, construction problems and solution data sheets. A summary of the supporting data sheets along with final testing results and Soil Certifying Engineer's approval of the work shall be provided upon completion of construction.

The Project Coordinator and Site Quality Assurance/Quality Control Manager shall immediately be made aware of any nonconformance with the project specifications. In particular, the Project Coordinator shall be informed before the work in question is covered by overlying system layers. The Project Coordinator shall then determine its cause and recommend appropriate changes. When this type of evaluation is made, the results shall be documented, and any revision to procedures or project specifications shall be approved in writing by the Owner and Designer.

2.1.2 Geosynthetic Reports

The Quality Assurance Monitor shall complete a daily report and/or logs on prescribed forms outlining the monitoring activities for that day. The areas worked on, quantities installed, panel numbers, seams completed and approved, measures taken to protect unfinished areas overnight and other appropriate data and information. Failed seams, other panel areas, or other geosynthetics requiring remedial action shall be identified with regard to nature of action, required repair, and precise location. Repairs completed shall also be identified. Any problems or concerns with regard to operations on site should be noted. The report should also include information regarding the weather conditions.

The QAE shall review the daily reports submitted by the Quality Assurance Monitors. Any matters requiring action by the Project Coordinator shall be identified.

2.2 Test Reports

2.2.1 Granular Material Testing Reports

Records of field observations during placement and supplier certifications for the granular material components of the temporary cap construction shall be coordinated and compiled by the QAC. A summary of documentation shall be prepared by the QAC on an ongoing basis, and submitted to the Project Coordinator as required.

2.2.2 Geosynthetic Testing Reports

The QAC shall coordinate the destructive test reports from all sources. This includes field tests, Installer's laboratory tests (if performed), and QAL tests. A summary list of test samples pass/fail results shall be prepared by the QAC on an ongoing basis, and submitted to the Project Coordinator as required. The report shall also contain resolution on failed tests clearly documenting complete quality assurance conformance with established procedures.

2.3 Progress Reports

Progress reports shall be prepared by the QAEs and submitted to the Project Coordinator. These reports shall be submitted as required by the Project Coordinator.

2.4 Record Drawings

Record drawings shall be prepared by the QAC to document that the project specifications and the engineering plan requirements have been met. The record drawings of the constructed temporary cap shall include, at a minimum, the following information:

a. Plan views showing the grades of the following, as appropriate:
   i. Top of the prepared subgrade layer
   ii. Configuration of the below cap leachate and landfill gas control systems
   iii. Limits of temporary FML
   iv. Over liner structures and roads
   v. Surface water management system.
b. Plan views of the deployment of the flexible membrane liner panels and the locations of and identification of the destructive tests.

2.5 Construction Certification Report

Upon completion of the work, the QAC shall submit a Construction Certification Report to the Project Coordinator. This Report shall include, at a minimum, the the following information:

1. Parties and personnel involved with the project.
2. Scope of work.
3. Outline of project.
4. Quality assurance methods.
5. Geosynthetic manufacturer and aggregate supplier certifications.
6. Test results (conformance, destructive and non-destructive, repairs, re-tests, including laboratory tests).
7. Signature page, sealed and signed by a licensed Professional Engineer.
8. Record drawings.
9. Construction methods.
10. A list of changes that occurred during construction for which The Owner is requesting concurrence from the Ohio EPA.
11. A list of other changes which were approved subsequent to the start of construction.

The QAC shall state in the report that the installation has proceeded in accordance with this QA\QC Plan, except as otherwise approved by the Ohio EPA or as otherwise noted in the report.

3 PREPARED SUBGRADE PREPARATION

3.1 Description and Applicability

Prepared subgrade preparations consist of removal of existing vegetation, grading, removal of large stones as necessary that could damage the FML, and smooth drum rolling. A protective geotextile, geonet, or composite may be installed in select areas if in the judgment of the engineer, Project Coordinator, or the CQA personnel such is necessary to protect the FML. In areas where access roads are anticipated, a protective geosynthetic will be installed.

3.2 Subgrade Preparation and Evaluation

Upon completion of the subgrade preparation work, the QAC shall examine the subgrade and verify at a minimum, that:

1. The subgrade condition meets the criteria in the project specifications.
2. Identify areas that do not meet the requirements of the project specification and need repair; the QAC will monitor and document the repairs made to the subgrade.

At any time during construction of the prepared subgrade, the QAC shall indicate to the Project Coordinator any locations that are not adequate for placement of the material. Such defects in the subgrade shall be repaired by the Earthwork Contractor, at the direction of the Project Coordinator, such that the repaired areas meet the project specifications.

3.3 Construction Observation

Acceptance criteria for construction work shall be as identified in the project specifications. At a minimum, the QAC shall observe and record the following during the construction of the prepared subgrade:

1. Ensure that the prepared subgrade is prepared to a smooth surface, using a smooth drum roller;
2. Remove debris, organic materials, roots, or stones that may damage overlying geosynthetic components (No surface protrusions greater than 2 inches).
3. Accept in writing that the subgrade surface is acceptable for geomembrane installation prior to deployment of the geomembrane material.

3.4 Repairs

The Earthwork Contractor shall correct all deficiencies to meet the project specifications. If a project specification criterion cannot be met, or unusual weather conditions hinder work, the QAC and Designer shall develop and present to the Project Coordinator suggested solutions for his approval.

The QAC shall observe any repair and report corrective action and any noncompliance in the construction certification report.

3.5 Approval

Upon recommendation by the QAC, the Project Coordinator shall consider accepting the components of the temporary FML cap. At the Project Coordinator's discretion, the cap system may be accepted in sections or at points of substantial completion.

The Project Coordinator will accept the components of the temporary FML cap when:

1. The installation of the components is finished.
2. Verification of the adequacy of the constructed components, including repairs, if any, is completed in accordance with the QA\QC Plan.
3. Documentation of installation is substantially completed.
4. The QAC is able to recommend acceptance.

The QAC shall certify that installation of the components has proceeded in accordance with the portions of the QA\QC Plan except as noted to the Project Coordinator. This certification shall be provided in the Construction Certification Report as outlined in Section 2.5.

4 LEACHATE COLLECTION AND LANDFILL GAS COLLECTION COMPONENTS

4.1 Description and Applicability

Leachate collection and landfill gas collection components consist of highly permeable materials and piping. The materials shall meet the criteria outlined in the project specifications. The different types of leachate collection and landfill gas collection components are listed below:

1. Undercap leachate collector
2. Leachate toe collector
3. Combined leachate & landfill gas collector
4. Leachate collection forcemain/liquids header

4.2 Material Evaluation

Prior to the construction of the leachate collection and landfill gas collection components, source evaluation tests shall be performed to confirm the adequacy of the granular drainage materials procured from each on or off-site source area. At a minimum, the source certification shall confirm conformance of the material with component specifications.

The QAC shall examine the source certification and report any nonconformance to the Project Coordinator. The Project Coordinator shall accept or reject the material based on this review and the requirements of the project specifications.

4.3 Construction Observation and Documentation

The QAC shall observe the materials and procedures used by the Contractor during placement and construction of the various leachate collection and landfill gas collection components to ensure that the project specifications are met.

4.3.1 Undercap Collector

The QAC shall observe the construction of the undercap collector system including collector trench configuration, stone and piping placement, and validate pipe slotting has been certified by the manufacturer or supplier. The QAC will ensure that the undercap collector is constructed in accordance with the project specifications and design drawings for the project.

4.3.2 Leachate Toe Collector

The QAC shall observe the construction of the leachate toe collector. The QAC will document that the leachate toe collector is constructed in accordance with the project specifications and design drawings for the project. This documentation will include field observation reports which confirm that the existing base liner has not been damaged during excavation of the toe collector trench, and that the required geotextile cushion layer has been installed prior to the installation of the pipe bedding. Additionally, observe the construction of the toe collector system including collector trench configuration, minimum bedding thicknesses and piping placement, and verify pipe slotting has been completed in accordance with project requirements. The QAC shall document the installation of the geotextile cushion layer over the stone backfill / pipe bedding prior to the installation of the temporary FML cap, and the cushion geotextile meets the minimum specifications or has obtained a manufacture's certification.

4.3.3 Combined Leachate and Landfill Gas Collector

The QAC shall observe the trenching activities for the combined leachate and landfill gas collectors. The QAC will ensure that the combined leachate and landfill gas collectors are constructed in accordance with the project specifications and design drawings for the project. The QAC shall observe the construction of the combined leachate and landfill gas collector system including collector trench configuration, stone and piping placement, and validate pipe perforations or slotting has been certified by the manufacturer or supplier. The QAC shall document the installation of the geotextile cushion layer over the stone backfill / pipe bedding prior to the installation of the temporary FML cap, and the cushion geotextile meets the minimum specifications or has obtained a manufacture's certification.

4.3.4 Leachate Forcemain/Liquid Header

The QAC shall observe the construction of the leachate forcemain/liquid header. The QAC will ensure that the leachate forcemain/liquid header is constructed in accordance with the project specifications and design drawings for the project. Additionally the QAC shall observe the air pressure/leak testing for the leachate forcemain/liquid header to ensure that these components were constructed properly. If the piping fails the air pressure testing the source of the problem shall be sought out, repaired, and the testing re-performed. Appendix A of this plan contains the air pressure testing requirements.

4.4 Repairs and Retesting

The Contractor shall correct all deficiencies to meet the project specifications. If project specification criteria cannot be met, or unusual weather conditions hinder work, the QAC and Designer shall develop and suggest solutions to the Project Coordinator for his approval.

The QAC shall schedule appropriate retests when the work defect has been corrected. All retests by the QAC shall verify that the defect has been corrected before the Contractor performs any additional work in the area of the deficiency.

The QAC shall observe any repair and report corrective action and any noncompliance in the construction certification report.

5 FLEXIBLE MEMBRANE LINERS (FML)

5.1 Description and Applicability

Flexible Membrane Liners (FMLs) are low permeability geosynthetic barriers used in temporary cap systems.

The FML shall be tested in accordance with the following, unless the manufacturer's specifications for testing are more stringent than following:

1. For the purpose of testing every seaming apparatus in use each, peel tests shall be performed on scrap pieces of FML at the beginning of the seaming period and every five hours thereafter; and
2. Nondestructive testing shall be performed on one hundred percent FML seams; and
3. Destructive testing for peel shall be performed at least once every five hundred feet of seam length performed by each welding machine. This frequency is determined as an average taken through out the entire facility.

This Section is applicable to smooth and textured high-density polyethylene (HDPE) FMLs. This Section may need to be modified when using other FMLs.

5.2 Quality Control Documentation

Prior to the installation of any FML, the Manufacturer or Installer shall provide the Project Coordinator with the following information:

1. The origin (supplier's name and production plant) and identification (brand name and number) of the resin used to manufacture the FML and extrusion rods.
2. Copies of dated quality control certificates issued by the resin supplier.
3. Results of tests conducted by the Manufacturer to verify that the resin used to manufacture the FML meets the project specifications.
4. A list of the materials that comprise the FML, expressed in the following categories as percent by weight: polyethylene, carbon black, other additives.
5. A manufacturer’s specification for the FML that includes all properties measured using the appropriate test methods.
6. Written certification that the Manufacturer guarantees minimum values given in the specification.

7. Quality control certificates, signed by a responsible party employed by the Manufacturer, shall include roll identification numbers, testing procedures, and results of quality control tests. For example, manufacturer quality control testing for FML cap may include:
   a. Density (ASTM D1505) for incoming resin
   b. Carbon black content (ASTM D1603)
   c. Carbon black dispersion (ASTM D3015)
   d. Thickness (ASTM D5199)
   e. Tensile properties (ASTM D638)

These quality control tests shall be performed in accordance with manufacturer's specified test frequencies for each specified test.

The Manufacturer shall identify all rolls of FMLs with the following:

1. Manufacturer's name
2. Product identification
3. Thickness
4. Roll number
5. Roll width and length

The QAE shall review these documents and shall report any discrepancies with the above requirements to the Project Coordinator. The QAE shall verify that:

1. Property values certified by the Manufacturer meet all of its guaranteed specifications.
2. Measurements of properties by the Manufacturer are properly documented and meeting their minimum requirements.
3. Quality control certificates have been provided at the specified frequency for all rolls, and that each certificate identifies the rolls related to it.
4. Rolls are appropriately labeled.
5. Certified minimum properties meet the project specifications.
6. The Project Coordinator provides project specifications and a copy of the QA\QC Plan to the Installer.

5.3 Anchoring of FML

The QAC shall verify:

1. The FML is anchored according to the project plans.
2. Rounded corners are provided so as to avoid sharp bends in the FML.
3. Excessive amounts of loose soil are not allowed to underlie the FML at the anchor trench.

4. The FML runout at the top of the sideslope or sideslope bench is adequately drained to prevent ponding or softening of the adjacent soils prior to backfilling.
5. The FML runout anchor trench is backfilled in a timely to prevent surfact water run-on and run-off from moving under the FML.
6. The FML runout anchor is backfilled and compacted as required.

Care shall be taken when backfilling the FML runout anchor to prevent damage to the geosynthetic components. The QAC shall observe the backfilling operation and advise the Project Coordinator of any problems. Any problems shall be documented by the QAC in his daily report.

5.4 FML Deployment

5.4.1 Panel Nomenclature

A field panel is defined as a unit of FML that is to be seamed in the field. A field panel is a roll or a portion of a roll cut in the field. The QAC shall be responsible to ensure that each field panel is given an identification code (number or letter-number) consistent with the layout plan. This identification code shall be as simple and logical as possible and shall be agreed upon by the Project Coordinator, Installer and QAC.

In general, it is not appropriate to identify panels using roll numbers since roll numbers established in the manufacturing plant are usually cumbersome and are not related to location in the field. The QAC shall establish a table or chart showing correspondence between roll numbers and field panel identification codes. The field panel identification code shall be used for all quality assurance records.

5.4.2 Panel Deployment Procedure

The QAC shall review the panel deployment for suitability to actual field condition such as issues relating to temperature, wind, rain, subgrade desiccation and other site-specific conditions. The QAC shall verify that the condition of the underlying soil does not change detrimentally during installation.

The QAC shall record the identification code, location, and date of installation of each field panel.

5.4.3 Deployment Weather Conditions

The QAC shall inform the Project Coordinator of any weather-related problems that may not allow FML placement to proceed. The Project Coordinator will determine if the installation is to be stopped or special procedures are to be used.

The normal required weather conditions for seaming are as follows:

1. Ambient temperature between 32°F (0°C) and 104°F (40°C), unless approved by the Owners representative.
2. Dry conditions (no precipitation or other excessive moisture)
3. No excessive winds.

The QAC may verify that these weather conditions are fulfilled and notify the Project Coordinator in writing if they are not. The QAC shall measure ambient temperature in the area in which the panels are to be placed.

5.4.4 Method of Deployment

Before the FML is handled on site, the QAC shall verify that handling equipment to be used on the site is adequate and does not pose risk of damage to the FML. During handling, the QAC shall observe and verify that the Installer's personnel handle the FML with care.

The QAC shall verify the following:

1. Equipment used does not damage the FML by handling.
2. The prepared surface underlying the FML is acceptable immediately prior to FML placement.
3. Geosynthetic cushion layers immediately underlying or overlying the FML are clean and free of debris.
4. Personnel do not smoke or wear damaging shoes while working on the FML, or engage in other activities that could damage the FML.
5. The method used to unroll the panels does not cause excessive scratches or crimps in the FML and does not damage the supporting soil.
6. The method used to place the panels minimizes wrinkles especially differential wrinkles between adjacent panels.
7. Adequate temporary loading and/or anchoring (such as sandbags or tires), not likely to damage the FML, are placed to prevent uplift by wind. In case of high winds, continuous loading is recommended along edges of panels to minimize risk of wind flow under the panels.
8. Direct contact with the FML is minimized, and that the FML is protected by geotextiles, extra FML, or other suitable materials, in areas where excessive traffic may be expected. See Section 5.9 for FML protection.

The QAC shall inform the Project Coordinator if the above conditions are not fulfilled.

5.4.5 Damage and Defects

Upon delivery to the site, the QAC shall conduct a surface observation of all rolls for defects and for damage. This examination shall be conducted without unrolling rolls unless defects or damages are found or suspected. The QAC shall advise the Project Coordinator, in writing, of any rolls or portions of rolls that should be rejected and removed from the site because they have severe flaws, and/or minor repairable flaws.

The QAC shall examine each panel, after placement and prior to seaming, for damage and/or defects. The QAC shall advise the Project Coordinator which panels, or portions of panels, should be rejected, repaired, or accepted. Damaged panels, or portions of damaged panels, which have been rejected shall be marked and their removal from the work area recorded by the QAC. Repairs shall be made using procedures described in Section 5.8.

5.4.6 Writing on the FML

To avoid confusion, the Installer and the Geosynthetic QAC shall each use different colored markers that are readily visible for writing on the FML. The markers used must be semi-permanent and compatible with the FML.

5.5 Field Seaming

5.5.1 Seam Layout

In general, panel seams should be oriented parallel to the line of maximum slope, thus, oriented along, not across, the slope. In corners and odd-shaped geometric locations, the number of seams should be minimized. No horizontal seam should be less than 5-ft (1.5 m) from the toe or crest of the slope, areas of potential stress concentrations, or specifically defined in the design drawings and/or specifications or unless otherwise authorized by the Project Coordinator. Individual horizontal seams (butt seams) is permitted on slopes provided they are staggered and specifically approved by the Project Coordinator.

The QAC shall use a seam numbering system compatible with the panel numbering system.

The temporary FML cap shall be welded to the existing base liner. The QAC shall document in the daily reports that prior to welding that the base liner has not been damaged during preparatory activities for the FML cap deployment.

5.5.2 Accepted Seaming Methods

Approved processes for field seaming are fusion welding and extrusion welding. Proposed alternate processes shall be documented and submitted by the Installer to the Project Coordinator for approval. Only apparatus that have been specifically approved by make and model shall be used. The Project Coordinator shall submit all documentation regarding seaming methods to be used to the QAC for review.

5.5.2.1 Fusion Process

The QAC shall monitor ambient, seaming apparatus and FML surface temperatures at appropriate intervals and report any noncompliance to the Project Coordinator.

The QAC shall also verify that:

1. The Installer maintains on-site the number of spare operable seaming apparatus agreed upon at the pre-construction meeting.
2. Equipment used for seaming is not likely to damage the FML.
3. The electric generator is placed on a smooth base such that no damage occurs to the FML.
4. A smooth insulating plate or fabric is placed beneath the hot welding apparatus after usage such that no damage occurs to the FML.
5. A permanent or movable protective layer is used as required by the Installer directly below each overlap of FML that is to be seamed to prevent buildup of moisture between the sheets and to prevent debris from collecting around the pressure rollers.
6. In general, the FML panels are aligned to have an overlap of 4 to 6 in (100 mm to 150 mm) for fusion welding. In any event, the final overlap shall be sufficient to allow peel tests to be performed on the seam.
7. No solvent or adhesive is used.
8. The FML is protected from damage in heavy traffic areas.

5.5.2.2 Extrusion Process

The QAC shall verify that:

1. The Installer maintains on-site the number of spare operable seaming apparatus agreed upon at the pre-construction meeting.
2. Equipment used for seaming is not likely to damage the FML.
3. Prior to beginning a seam, the extruder is purged until all heat-degraded extrudate has been removed from the barrel.
4. Clean and dry welding rods or extrudate pellets are used.
5. The electric generator is placed on a smooth base such that no damage occurs to the FML.
6. Grinding is completed no more than one hour prior to seaming.
7. A smooth insulating plate or fabric is placed beneath the hot welding apparatus after usage such that no damage occurs.
8. The FML is protected from damage in heavy traffic areas.
9. Exposed grinding marks adjacent to an extrusion weld shall be minimized. In no instance shall exposed grinding marks extend more than ¼ in (6 mm) from the finished seamed area.

10. In general, the FML panels are aligned to have a nominal overlap of 3 in (75 mm) for extrusion welding. In any event, the final overlap shall be sufficient to allow peel tests to be performed on the seam.
11. No solvent or adhesive is used.
12. The procedure used to temporarily bond adjacent panels together does not damage the FML; in particular, the temperature of hot air at the nozzle of any temporary welding apparatus is controlled such that the FML is not damaged.

5.5.3 Seam Preparation

The QAC shall verify that prior to seaming, the seam area is clean and free of moisture, dust, dirt, debris or foreign material of any kind. If seam overlap grinding is required, the QAC must ensure that the process is completed according to the Manufacturer's instructions, and in a way that does not damage the FML. The QAC shall also verify that seams are aligned with the fewest possible number of wrinkles and "fishmouths".

5.5.4 Trial Seams

Trial seams shall be made on fragment pieces of FML liner to verify that conditions are adequate for production seaming. Such trial seams shall be made when an apparatus is started, operators change, or an apparatus is restarted. Trial seams shall be made under the same conditions as production seams.

The trial seam sample shall be at least 5 ft (1.6 m) long by 1 ft (0.3 m) wide (after seaming) with the seam centered lengthwise. Seam overlap shall be as indicated in Section 5.5.2. Three specimens shall be cut from the sample with a 1-inch (25 mm) wide die. The Installer shall cut the specimens at locations selected randomly along the trial seam sample by the QAC.

The specimens shall be tested in peel using a field tensiometer. The tensiometer shall be capable of maintaining a constant jaw separation rate of two inches per minute. They should not fail in the seam as described in Section 5.7.5. If a specimen fails, the entire trial seam operation shall be repeated. If the additional specimen fails, the seaming apparatus and seamer shall not be accepted and shall not be used for seaming until the deficiencies are corrected and two consecutive successful trial seams are achieved. The QAC shall observe all trial seam procedures.

The remainder of the successful trial seam sample shall be retained in the Project Coordinator's archives for possible laboratory testing. Each sample shall be assigned a number and marked accordingly by the QAC, who shall also log the date, hour, ambient temperature, number of seaming unit, name of seamer, and pass or fail description.

If agreed upon between the Project Coordinator and the QAE, and documented by the QAE in his daily report, the remaining portion of the trial seam sample can be subjected to destructive testing as indicated in Section 5.7.6. If a trial seam sample fails a test conducted by the QAL, then a destructive seam test sample shall be taken from each of the seams completed by the seamer during the shift related to the subject trial seam. These samples shall be forwarded to the QAL and, if they fail the tests, the procedure indicated in Section 5.7.7 shall apply. The conditions of this paragraph shall be considered satisfied for a given seam if a destructive seam test sample has already been taken.

5.5.5 General Seaming Procedures

During general seaming, the QAC shall ensure the following:

1. Fishmouths or wrinkles at the seam overlaps shall be cut along the ridge of the wrinkle in order to achieve a flat overlap.
   The cut fishmouths or wrinkles shall be seamed and any portion where the overlap is inadequate shall then be patched with an oval or round patch of the same FML extending a minimum of 6 in (150 mm) beyond the cut in all directions.
2. If seaming operations are carried out at night, adequate illumination shall be provided.
3. Seaming shall extend to the outside edge of panels placed in the anchor trench.
4. All cross seam tees shall be patched or be extrusion welded to a minimum distance of 4 in (100 mm) on each side of the tee.
5. No field seaming shall take place without the Master Seamer being present.
6. A firm substrate may be required to be provided by using a flat board, a conveyor belt, or similar hard surface directly under the seam overlap to achieve proper support.

The QAC shall verify that the above seaming procedures or any other procedures agreed upon and indicated in the project specific Quality Assurance Plan are followed, and shall inform the Project Coordinator and Site Quality Assurance/Quality Control Manager of any nonconformance.

5.5.6 Seaming Weather Conditions

5.5.6.1 Cold Weather Conditions

If seaming is conducted when the ambient temperature is below 32°F (0°C), the following conditions shall be met to ensure a quality installation:

1. FML surface temperatures shall be determined by the QAC at intervals of at least once per 100 feet (30 m) of seam length to determine if preheating is required. For extrusion welding, preheating is required if the surface temperature of the FML is below 32°F (0°C).

2. For fusion welding, preheating may be waived by the Project Coordinator based on a recommendation from the QAE, if the Installer demonstrates to the QAE's satisfaction that welds of equivalent quality may be obtained without preheating at the expected temperature of installation.
3. If preheating is required, the Geosynthetic QAC shall observe all areas of FML that have been preheated by a hot air device prior to seaming, to ensure that they have not been overheated.
4. Care shall be taken to confirm that the surface temperatures are not lowered below the minimum surface temperatures specified for welding due to winds or other adverse conditions. It may be necessary to provide wind protection for the seam area.
5. The Project Coordinator shall approve all preheating devices prior to use.
6. Additional destructive tests (as described in Section 5.7) shall be taken at an interval between 250 feet and 1000 feet (75 to 150 m) of seam length, at the discretion of the QAE.
7. Sheet grinding may be performed before preheating, if applicable.
8. Trial seaming, as described in Section 5.5.4, shall be conducted under the same ambient temperature and preheating conditions as the production seams.
9. Under cold weather conditions, new trial seams shall be conducted if the ambient temperature drops by more than 10°F from the initial trial seam test conditions. Such new seams shall be conducted upon completion of seams in progress during temperature drop.

5.5.6.2 Warm Weather Conditions

At ambient temperatures above 104°F, no seaming of the FML shall be permitted unless the Installer can demonstrate to the satisfaction of the Project Coordinator that FML seam quality is not compromised. Trial seaming, as described in Section 5.5.4, shall be conducted under the same ambient temperature conditions as the production seams. At the option of the QAC, additional destructive tests may be required for any suspect areas.

5.6 Nondestructive Seam Testing

5.6.1 Concept

The Installer shall nondestructively test all field seams over their full length using an air pressure test (for double fusion seams only), a vacuum test or other approved method. Air pressure testing and vacuum testing are described in Sections 5.6.2 and 5.6.3 respectively. The purpose of nondestructive tests is to check the continuity of seams. It does not provide quantitative information on seam strength. Nondestructive testing shall be carried out as the seaming work progresses, not at the completion of all field seaming.

For all seams, the Geosynthetic QAC shall:

1. Observe nondestructive testing procedures.
2. Record location, data, test unit number, name of tester, and outcome of all tests.
3. Inform the Installer and Project Coordinator of any required repairs.

Any seams that cannot be nondestructively tested shall be cap-stripped with the same FML. The QAC and Installer shall observe cap-stripping operations for uniformity and completeness.

5.6.2 Air Pressure Testing

Air pressure testing is applicable to double fusion welding which produces a double seam with an enclosed space.

1. The equipment for air pressure testing shall consist of the following:

   a. An air pump (manual or motor driven), equipped with pressure gauge and capable of generating and sustaining a pressure between 25 and 30 psi (160 and 200 kPa) and mounted on a cushion to protect the FML.
   b. A rubber hose with fittings and connections.
   c. A sharp hollow needle or other pressure feed device, approved by Project Coordinator.

2. The following procedures shall be followed:
   a. Seal both ends of the seam to be tested.
   b. Insert needle or other approved pressure feed device into the air channel created by the fusion weld.
   c. Insert a protective cushion between the air pump and the FML.
   d. Pressurize the air channel to a pressure of approximately 30-psi (200 kPa). Close valve and sustain pressure for at least 5 minutes.
   e. For 40-mil HDPE geomembrane seams, if pressure loss after the 5 minute test period exceeds 4 psi, locate faulty area and repair in accordance with Section 5.8.3.
   f. Cut opposite end of tested seam area once testing is completed to verify continuity of the air channel. If air does not escape, locate blockage and retest unpressurized area. Seam the cut end of the air channel.
   g. Remove needle or other approved pressure feed device and seal the hole in the FML.

5.6.3 Vacuum Testing

Vacuum testing is applicable to extrusion welding.

1. The equipment shall consist of the following:

a. A vacuum box assembly consisting of a rigid housing, a transparent viewing window, a soft neoprene gasket attached to the bottom, a porthole or valve assembly, and a vacuum gauge.
b. A pump assembly equipped with a pressure controller and pipe connections.
c. A rubber pressure/vacuum hose with fittings and connections.
d. A soapy solution. (Geosynthetic QAC shall ensure solution makes bubbles when air is passed through.)
e. A bucket and wide paintbrush, or other means of applying the soapy solution.

2. The following procedures shall be followed:

a. Wet a strip of FML approximately 12 in x 48 in (0.3 m x 1.2 m) with the soapy solution.
b. Place the box over the wetted area.
c. Close the bleed valve and open the vacuum valve.
d. Ensure that a leak-tight seal is created.
e. Energize the vacuum pump and reduce the applied pressure to approximately 5 psi (10 in of Hg\35 kPa) gauge.
f. For a period of approximately 10 seconds, apply vacuum with the box placed. While maintaining a seal, examine the FML through the viewing window for the presence of soap bubbles.
g. If no bubble appears after 10 seconds, close the vacuum valve and open the bleed valve, move the box over the next adjoining area with a minimum 3 in (75 mm) overlap, and repeat the process.
h. All areas where soap bubbles appear shall be marked and repaired.

5.6.4 Test Failure Procedures

The Installer shall complete any required repairs in accordance with Section 5.8.3. For repairs, the QAC shall:

1. Observe the repair and testing of the repair.
2. Mark on the FML that the repair has been made.
3. Document the repair procedures and test results.

5.7 Destructive Seam Testing

5.7.1 Concept

The purpose of destructive tests is to evaluate seam strength. Destructive seam tests shall be performed at selected locations. Seam strength testing shall be done as the seaming work progresses, not at the completion of all field seaming.

5.7.2 Location and Frequency

The QAC shall select where seam samples will be cut out for laboratory testing. Laboratory destructive testing may be performed at on-site or off-site locations, using calibrated test equipment. The frequency and locations shall be established as follows:

1. An average minimum frequency of one test location per 1000-ft (300 m) of seam length performed by each welding machine.
2. Test locations shall be determined during seaming at the QAC's discretion. Special consideration shall be given to locations where the potential for imperfect welding, such as overheating, contamination, offset welds exists.

The Installer shall not be informed in advance of the locations where the seam samples will be taken.

5.7.3 Sampling Procedures

The Installer shall cut samples at locations chosen by the QAC as the seaming progresses so that laboratory test results are available before the FML is covered by another material. The QAC shall:

1. Observe sample cutting.
2. Assign a number to each sample, and mark it accordingly.
3. Record sample location on layout drawing.
4. Record reason for taking the sample at this location (e.g., statistical routine, suspicious feature of the FML).

All holes in the FML resulting from destructive seam sampling shall be repaired. The continuity of the new seams in the repaired area shall be tested according to Section 5.8.3.

5.7.4 Sample Dimensions

At each sampling location, the Installer shall take two types of samples. First, three specimens for field-testing should be taken. Each of these samples shall be cut with a 1 in (25 mm) wide die, with the seam centered parallel to the width. The distance between these two samples shall be 42 in (1.1 m). If both samples pass the field test described in Section 5.7.5, a sample for laboratory testing shall be taken.

The sample for laboratory testing shall be located between the samples for field-testing. The sample for laboratory testing shall be 12 in (0.3 m) wide by 42 in (1.1 m) long with the seam centered lengthwise. The sample shall be cut into three parts and distributed as follows:

1. One 12 in wide x 18 in long (0.3 m x 0.5 m) portion for QAL testing.
2. One 12 in wide x 12 in long (0.3 m x 0.3 m) portion to the Installer for optional laboratory testing.
3. One 12 in wide x 12 in long (0.3 m x 0.3 m) portion to the Project Coordinator for archive storage, if Project Coordinator deems necessary.

Final determination of the sample sizes shall be made at the pre-construction meeting.

5.7.5 Field Testing

The three 1 in (25 mm) wide specimens mentioned in Section 5.5.4 and Section 5.7.4 shall be tested in the field using a tensiometer for peel adhesion and shall not fail according to GRI-GM 19 – "Seam Strength and Related properties of Thermally Bonded Polyolefin Geomembranes". The tensiometer shall be capable of maintaining a constant jaw separation rate of two inches per minute. If the test passes in accordance with this section, the sample qualifies for testing in the laboratory. Testing may be done on site at the discretion of the Project Coordinator.

If it fails, the seam should be repaired in accordance with Section 5.7.7. Final judgment regarding seam acceptability, based on the failure criteria provided in the project specifications, rests with the QAE.

The QAC shall witness all field tests and mark all samples and portions with their number. The QAC shall also log the date and time, ambient temperature, number of seaming unit, name of seamer, welding apparatus temperatures and pressures, and pass or fail description, and attach a copy to each sample portion.

5.7.6 Laboratory/Field Testing

Destructive test samples shall be packaged and shipped, if necessary, under the responsibility of the QAC in a manner that will not damage the test sample. The sample shall be shipped as soon as possible to expedite laboratory testing. The Project Coordinator will be responsible for storing the archive samples. The QAL shall test the samples.

Testing shall include peel adhesion (ASTM D4437). The minimum acceptable values to be obtained in these tests shall be the manufacturer's minimum specification. At least 5 specimens shall be tested, each in peel. A passing test shall meet the minimum acceptable values in at least 4 of the 5 specimens tested for each method.

The QAE shall review laboratory test results as soon as they become available, and make appropriate recommendations to the Project Coordinator.

5.7.7 Destructive Test Failure

When a sample fails a destructive test, whether that test is conducted by the Geosynthetic QAL or by field tensiometer, the Installer has two options:

1. The Installer can repair the seam between any two passing destructive test locations.
2. The Installer can trace the welding path to an intermediate location approximately 10 ft (3 m) from the point of the failed test in each direction and take a sample with a 1 in (25 mm) wide die for an additional field test at each location. If these additional samples pass the test, then full laboratory samples are taken. If these laboratory samples pass the tests, then the seam is repaired between these locations. If either sample fails, then the process is repeated to establish the zone in which the seam should be repaired.

All acceptable repaired seams shall be bound by two locations from which samples passing laboratory destructive tests have been taken. Passing laboratory destructive tests of trial seam samples taken as indicated in Section 5.5.4 may be used as a boundary for the failing seam. In cases exceeding 150 ft (50 m) of repaired seam, a sample taken from the zone in which the seam has been repaired must pass destructive testing.

The QAC shall document all actions taken in conjunction with destructive test failures.

5.8 Defects and Repairs

5.8.1 Identification

All seams and non-seam areas of the FML shall be examined by the QAC for identification of defects, holes, blisters, undispersed raw materials, large wrinkles and any sign of contamination by foreign matter. The FML surface shall be cleaned by the Installer prior to examination if the QAC determines that the amount of dust or mud inhibits examination.

5.8.2 Evaluation

Each suspect location both in seam and non-seam areas shall be nondestructively tested using the methods described in Section 5.6. Each location that fails the nondestructive testing shall be marked by the QAC and repaired by the Installer. Work shall not proceed with any materials that will cover locations that have been repaired until successful nondestructive and/or laboratory tests are obtained.

When seaming of the FML is completed, and prior to placing overlying materials, the QAC shall indicate to the Project Coordinator any large wrinkles that should be cut and re-seamed by the Installer. The number of wrinkles to be repaired should be kept to an absolute minimum. Therefore, wrinkles should be located during the coldest part of the installation period, while keeping in mind the forecasted weather to which the uncovered FML may be exposed. Wrinkles are considered to be large when the FML can be folded over on itself; this is generally a wrinkle that extends 12 in (0.3 m) from the subgrade. Seams produced while repairing wrinkles shall be nondestructively tested.

When placing overlying material on the FML, wrinkle development shall be minimized. In addition, small wrinkles should be isolated and covered as quickly as possible to prevent their growth. The placement of cover materials shall be observed by the QAC to ensure that wrinkle formation is minimized and that, in all cases, the FML is not folded over on itself.

5.8.3 Repair Procedures

Any portion of the FML exhibiting a flaw, or failing a destructive or nondestructive test, shall be repaired. Several procedures exist for the repair of these areas. The final decision as to the appropriate repair procedure shall be agreed upon between the Project Coordinator, Installer, Designer, and QAC.

1. The repair procedures available include:
    a. Patching, used to repair holes, tears, undispersed raw materials, and contamination by foreign matter.
    b. Spot welding, used to repair pinholes, or other minor, localized flaws.
    c. Capping, used to repair large lengths of failed seams.
    d. Extrusion welding the flap, used to repair areas of inadequate fusion seams which have an exposed edge. Repairs of this type shall be approved by the QAC and shall not exceed 100-ft (30 m) in total length.
    e. Removing the bad seam and replacing with a strip of new material welded into place.

2. For any repair method, the following provisions shall be satisfied:
    a. Surfaces of the FML which are to be repaired using extrusion methods shall be ground no more than one hour prior to the repair.

b. All surfaces shall be clean and dry at the time of the repair.

c. All seaming equipment used in repairing procedures shall meet the requirements of the project specific Quality Assurance Plan.

d. Patches or caps shall extend at least 3 in (75 mm) beyond the edge of the defect, and all corners of patches shall be rounded with a radius of approximately 3 in (75 mm).

Any portion of the FML that has been damaged due to weather (wind) or traffic (equipment, personnel, animals) shall be repaired using one of the above procedures. The final decision as to the appropriate repair procedure shall be agreed upon between the Project Coordinator, Installer, Designer, and QAC. Additionally any damage to the FML after certification shall be repaired using the above procedures and shall be re-certified.

5.8.4 Repair Verification

The QAC shall observe all nondestructive testing of repairs and shall record the number of each repair, date and test outcome. Each repair shall be nondestructively tested using the methods described in Section 5.6 as appropriate. Repairs that pass the nondestructive test shall be taken as an indication of an adequate repair. Repairs more than 150-ft (50 m) long require destructive test sampling. Failed tests require that the repair shall be redone and retested until a passing test result is obtained.

When placing overlying material on the FML, wrinkle development shall be minimized so that the FML is in direct and uniform contact with the underlying surface. If necessary, cover should be placed during the coolest weather available. In addition, small wrinkles should be isolated and covered to prevent their growth. The placement of cover materials shall be observed by the QAC to ensure that wrinkle formation is minimized and that the FML is not folded over on itself.

5.9 FML Protection

The quality assurance procedures indicated in this Section are intended only to assure that the installation of adjacent materials does not damage the FML cushion layers. The quality assurance of the adjacent materials themselves is covered in separate sections of this plan.

5.9.1 Soils

The Project Coordinator shall give a copy of the project specifications prepared by the Designer for placement of soils to the QAE. The QAE shall verify that these project specifications are consistent with geosynthetic state-of-practice such as:

1. Placement of soils on the FML shall not proceed at an ambient temperature below 32°F (0°C) nor above 104°F (40°C) unless approved by the Project Coordinator.

2. Equipment used for placing soil shall not be driven directly on the FML cushion layer.
3. A minimum thickness of 1-ft (0.3 m) of soil is specified between a light dozer, ground pressure of 5 psi (35 kPa) or lighter, and the FML cushion layer.
4. In any areas traversed by heavy construction, any vehicles other than low ground pressure vehicles approved by the Project Coordinator, the soil layer shall have a minimum thickness of 3-ft (0.9 m). This requirement may be waived if provisions are made to protect the FML through an engineered design. Drivers shall proceed with caution when on the overlying soil and prevent spinning of tires or sharp turns.

The QAC shall measure soil thickness and verify that the required thickness is present. The QAC must also verify that final thickness is consistent with the design and verify that placement of the soil is done in such a manner that the FML cushion layer damage is unlikely. The QAE shall inform the Project Coordinator if the above conditions are not fulfilled.

5.9.2 Sumps and Appurtenances

The Project Coordinator shall give a copy of the plans and project specifications prepared by the Designer for sumps and appurtenances to the QAC. The QAC shall review these plans and verify that:

1. Installation of the FML in sump and appurtenant areas, and connection of FML to sumps and appurtenances have been made according to project plans and specifications.
2. Extreme care is taken while welding around appurtenances since neither non-destructive nor destructive testing may be feasible in these areas.
3. The FML has not been visibly damaged while making connections to sumps and appurtenances.
4. A representative of the QAC shall be present at all times when the Installer is welding FML to appurtenant structures.

The QAC shall inform the Project Coordinator in writing if the above conditions are not fulfilled.

6 GEOTEXTILES, GEONETS AND GEOCOMPOSITES

6.1 Definition and Applicability

Geotextiles, geonets, or geocomposites may be used in protection and filtering applications on or under the temporary FML cap. This Section does not describe procedures for other applications such as erosion control or reinforcement. This section applies to the geosynthetic materials referenced above to act as a cushion layer for the temporary cap system. The selection of these materials will be made by the Earthwork Contractor (and documented by the QAC) provided the selected materials meet the minimum requirements outlined in the project specifications. This Section is applicable to nonwoven geotextiles made of polyester or polypropylene and not applicable to nonwoven geotextiles made of other materials or woven geotextiles.

The QAC shall observe the construction of all roads and drainage structures to be placed over the temporary FML. All precautions to protect the temporary FML shall be employed including those protective measures as laid forth in Section 5.9. A geosynthetic cushion shall be placed between all roadway soils and surface water drainage channel stone. Soils and gravel shall not be placed directly on top of the temporary FML.

6.2 Quality Control Documentation

Prior to the installation of any geosynthetic, the Manufacturer or Installer shall provide the Project Coordinator with the following information:

1. Reports on tests conducted by the Manufacturer to verify that resin used to manufacture the geotextile meets the Manufacturer's resin specifications.
2. Reports on quality control tests conducted by the Manufacturer to verify that the geotextile manufactured for the project meets the project specifications.
3. A list of the materials that comprise the geotextile, expressed in the following categories as percent by weight: base polymer, carbon black, other additives.
4. A specification for the geotextile that includes all properties published by the Manufacturer measured using the appropriate test methods.
5. Written certification that the Manufacturer guarantees minimum values given in the specification.
6. Written certification that the Manufacturer has continuously inspected the geotextile for the presence of needles and found the geotextile to be needle-free.

7. Quality control certificates, signed by a responsible party employed by the Manufacturer, shall include roll identification numbers, testing procedures and results of quality control tests as required by the project specifications.

These quality control tests shall be performed in accordance with the Manufacture's test methods at a frequency as specified by the manufacture's quality control specifications.

The Manufacturer shall identify all rolls of geosynthetics with the following:

1. Manufacturer's name
2. Product identification
3. Roll number
4. Roll dimensions

The QAE shall review these documents and shall report any discrepancies with the above requirements to the Project Coordinator. The QAE shall verify that:

1. Property values certified by the Manufacturer meet all of its guaranteed specifications.
2. Measurements of properties by the Manufacturer are properly documented and that the test methods used are acceptable.
3. Quality control certificates have been provided at the specified frequency for all rolls, and that each certificate identifies the rolls related to it.
4. Roll packages are appropriately labeled.
5. Certified minimum roll properties meet the project specifications.
6. The Project Coordinator provided the Installer project specifications and a copy of the QA\QC Plan.

6.3 Geosynthetic Deployment

During shipment and storage, the geosynthetic shall be protected from ultraviolet light exposure, moisture, mud, dirt, dust, puncture, cutting, or any other damaging or deleterious conditions. Geosythetic rolls shall be shipped and stored in relatively opaque and watertight wrappings. Wrappings shall not be removed until shortly before deployment.

The Installer shall ensure that geosynthetics are not damaged during handling. The geosynthetic shall be deployed as described below:

1. On slopes, the geosynthetics shall be securely anchored and then rolled down the slope in such a manner as to continually keep the geosynthetic sheet in tension.
2. In the presence of wind, all geosynthetics shall be weighted with sandbags or the equivalent. Such sandbags shall be installed during deployment and shall remain until replaced with cover material.

3. Geosynthetics shall be cut using a hook blade cutter for geotextiles or other shears for geonets only. If in place, special care shall be taken to protect other materials from damage that could be caused by the cutting of the geosynthetics.
4. The Installer shall take any necessary precautions to prevent damage to underlying layers during placement of the geosynthetic.
5. During placement of geosynthetics, care shall be taken not to entrap, in or beneath the geosynthetic, stones, excessive dust, or moisture that could damage the FML, cause clogging of drains or filters, or hamper subsequent seaming.
6. A visual examination of the geosynthetics shall be carried out over the entire surface, after installation, to ensure that no potentially harmful foreign objects are present.

The QAC shall note any noncompliance and report it to the Project Coordinator.

6.4 Seaming Procedures

Geotextiles shall be overlapped a minimum of 3-in (75 mm) prior to seaming. In general, no horizontal seams shall be allowed on sideslopes (seams along, not across the slope) except as part of a patch, unless approved by Project Coordinator. When horizontal seams are necessary, adjacent seams shall be staggered horizontally.

On slopes steeper than 10:1 (horizontal:vertical), all geotextiles shall be continuously sewn. Thermal bonding will be acceptable in limited areas with written approval of the Project Coordinator. Spot sewing is not allowed. On bottoms and slopes shallower than 10:1, geotextiles shall be continually sewn or thermally bonded with the written approval of the Project Coordinator.

Any sewing shall be done using polymeric thread with chemical and ultraviolet light resistance properties equal to or exceeding those of the geotextile. The color of the sewing thread shall contrast the background color of the geotextile. Sewing shall be done using machinery and stitch types specified by the manufacturer or as approved in writing by the Project Coordinator and the QAE.

At a minimum, the following requirements for joining the adjacent geonet shall be met:

1. Adjacent rolls shall be overlapped by at least 4 in (100 mm).
2. The geonet overlaps shall be tied with plastic fasteners. Tying devices shall be white or of contrasting color for easy inspection. Metallic devices are not allowed.
3. Tying shall be every 5-ft (1.5 m) along the length at the adjacent rolls, every 6 in (0.15 m) in the anchor trench and every 6 in (0.15 m) along end-to-end seams.
4. In the corners of the sideslopes of rectangular landfills, where overlaps between perpendicular geonet strips are required, an extra layer of geonet shall be unrolled

along the slope, on top of the previously installed geonet, from top to bottom of the slope.

5. When more than one layer of geonet is installed, joints shall be staggered.
6. When several layers of geonet are stacked, rolls shall be deployed in the same direction to prevent strands of one layer from penetrating the channels of the adjacent layer.

The QAC shall note any noncompliance and report it to the Project Coordinator.

6.5 Defects and Repairs

6.5.1 Identification

If a defect is identified in the geotextile, the QAC shall determine the extent and nature of the defect. If the defect is indicated by unsatisfactory test result, the QAC shall determine the extent of the deficient area by additional tests, observations, and a review of records and other means that the QAC deems appropriate.

6.5.2 Notification

After determining the extent and nature of the defect, the QAC shall promptly notify the Installer and Project Coordinator. A work deficiency meeting shall be held as required between the Installer, QAC, Designer, Project Coordinator and any other necessary parties to assess the problem, review alternative solutions, and implement an action plan.

6.5.3 Repair Procedures

The final decision as to the appropriate repair shall be agreed upon between the Project Coordinator, Installer, Designer, and QAE.

Any holes or tears in the geotextile shall be repaired using the following two procedures.

On sideslopes, a patch made from the same geotextile shall be thermally bonded or sewn into place in accordance with the project specifications. Should any tear exceed 10% of the width of the roll, that roll shall be removed from the slope and replaced.

On non-sideslope areas, a patch made from the same geotextile shall be thermally bonded or sewn into place with a minimum of 12-inch overlap in all directions. Care shall be taken to remove any soil or other material that may have penetrated the torn geotextile.

For geonets, if the hole or tear width is less than 50% of the width of the roll, the damaged area shall be repaired as follows:

1. A patch shall be placed extending 1-ft (0.3 m) beyond the edges of the hole or tear.
2. The patch shall be secured to the original geonet by tying every 6 in (0.15 m). Tying devices shall be as indicated in Section 6.4.

If the hole or tear width across the roll is equal to or more than 50% of the width of the roll, the damaged area shall be repaired as follows:

1. On the base of the landfill, the damaged area shall be cut out and the two portions of the geonet shall be joined as indicated in Section6.4.
2. On sideslopes, the damaged geonet roll shall be removed and replaced.

The QAC shall observe any repair and report any noncompliance with the above requirements in writing to the Project Coordinator.

6.5.4 GEOSYNTHETIC PROTECTION

All soil materials located on top of a geosynthetic shall be deployed in such a manner as to ensure:

1. The geotextile and underlying lining materials are not damaged.
2. Minimal slippage of the geosynthetic on underlying layers occurs.
3. No excess tensile stresses occur in the geosynthetic.

Any noncompliance with these guidelines or the project specifications shall be noted by the QAC and reported to the Project Coordinator.

LIMITATIONS

The work product included in the attached was undertaken in full conformity with generally accepted professional consulting principles and practices and to the fullest extent as allowed by law we expressly disclaim all warranties, express or implied, including warranties of merchantability or fitness for a particular purpose. The work product was completed in full conformity with the contract with our client and this document is solely for the use and reliance of our client (unless previously agreed upon that a third party could rely on the work product) and any reliance on this work product by an unapproved outside party is at such party's risk.

The work product herein (including opinions, conclusions, suggestions, etc.) was prepared based on the situations and circumstances as found at the time, location, scope and goal of our performance and thus should be relied upon and used by our client recognizing these considerations and limitations. Cornerstone shall not be liable for the consequences of any change in environmental standards, practices, or regulations following the completion of our work and there is no warrant to the veracity of information provided by third parties, or the partial utilization of this work product.

APPENDIX A

AIR PRESUURE TESTING

TESTING PIPING SYSTEMS

All pipe segments (i.e. carrier pipes and secondary containment pipes) that extend beyond the geomembrane limits shall be air tested in accordance with the following procedures.

The following procedures will be used for air testing:

- Ensure pipe section to be tested is clean and free of dirt, sand or other foreign material
- Pressure test in accordance with ASTM requirements
- Use the following equipment for air testing pipe:
  - Polyethylene flange adapter with steel blind flange
  - Temperature gauge (0°C to 100°C) tapped and threaded into blind flange
  - Pressure gauge (0 to 15 psig)
  - Inlet valve to facilitate air pressure hose
  - Ball valve to release pipe pressure at test completion
  - Polyethylene reducers to be used to adapt test flange to size of pipe being tested
  - Air compressor shall provide adequate air supply for testing
  - Pressurizing equipment shall include a regulator set to avoid over pressurizing and damaging otherwise acceptable pipe
- Provide verification and results of gauge calibration prior to (less than 60 days) and after project completion
- Use the following procedure when performing air tests:
  - Ensure that appropriate safety measures are in-place
  - Set pressurizing equipment regulator to avoid over pressurizing and damaging otherwise acceptable line
  - Install blind flange with test apparatus on one (1) end of section being tested and a fused cap on the opposite end
  - Apply test pressure of 10 psig to test segment
  - Observe test pressure for one (1) hour
  - Correct pressure drop for temperature change
  - Pressure drop over one (1) hour period should not exceed 1%

The Pipe Installation Contractor shall ensure that the following procedures are followed if a test segment fails:

- Check entire length of pipe and fusion joints for cracks, pinholes, perforations or other possible leakage points

- Check blocked risers and capped end for leakage and check gaskets at blind flanges
- Verify leaks by applying soap water solution and observe for bubble formation
- Repair pipe and fused joint leaks by cutting out leak area and re-fuse suitable segments
- After leaks are repaired, retest

The CQA Consultant shall perform the following:

- Verify and document that the testing procedures and results meet the requirements of the CQA Plan
- Observe and document all subsequent activities associated with the repairs required by the failing tests and the retesting of the failed segment.

PE PIPE PRESSURE TEST REPORT

Project Name/No.: ______________________________ Date: ____________

Contractor: ______________________________ Time: ____________

Person Performing Tests: ______________________________

Description/Location of Test Segment: (Pipe Diameter, Length, and SDR's)

____

Location of Pipe Test Segment

Station From: Station To:

T_i = Initial Temperature = ________ °C

P_i = Initial test pressure = ________ psig

P_c = Initial Pressure in psig corrected for temperature (T_t) at time "t"

t = Time in minutes from initiation of test

T_t = Temperature in °C at time 't'

P_t = Test pressure in psig at time 't'

$$P_c = \frac{(P_i + 14.7)(T_t + 273)}{(T_i + 273)} - 14.7$$

$$\text{Percent Pressure Drop} = \frac{P_c - P_t}{P_c} \times 100$$

Time (min)	T_t Temp Reading (°C)	P_t Gauge Pressure (psig)	P_c Corrected Pressure (psig)	Pressure Drop (%)
0				
20				
30				
40				
50				
60				

Pass/Fail: ____________ Retest (yes/no) ____________

Description/Nature of leaks repair of retest segment:

____

____

____

APPENDIX E

Summary of Data Analyses

SCS ENGINEERS

Summary of Statistical and Non-Statistical Analysis for Landfill Monitoring Data at Countywide Recycling and Disposal Facility

Presented to:

Republic Services

Countywide Recycling and Disposal Facility
3619 Gracemont Street, S.W.
East Sparta, OH 44626
(330) 874-3855

Presented by:

SCS ENGINEERS
2060 Reading Road, Suite 200
Cincinnati, OH 45202
(513) 421-5353

August 28, 2009
File No. 02209006

Summary of Statistical and Non-Statistical Analysis For Landfill Monitoring Data at Countywide Recycling and Disposal Facility

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PURPOSE OF REPORT

On March 31, 2009, SCS participated in a meeting among the landfill's representatives, Ohio EPA, and US EPA. The purpose of the meeting was to discuss the current monitoring program that is being done to satisfy the March 28, 2007 Director's Final Findings and Orders (DFFOs), the value and meaning of the data being collected, and possible changes to the monitoring program to make it more efficient and meaningful. Ohio EPA indicated that statistically significant trends and correlations in the data could be used to justify and support modifications in monitoring requirements. This report presents a summary of monitoring data, associated statistical analysis, and recommendations to modify the current monitoring program at the Countywide Landfill.

1 WELLHEAD AND DOWNHOLE TEMPERATURE MONITORING

Order 4.A.7 of the March 2007 FF&Os requires Countywide to measure the downhole temperatures at 10-foot increments in those landfill gas extraction wells with wellhead temperatures exceeding 150 degrees F on monthly basis. Countywide is proposing to eliminate this requirement, relying instead on wellhead temperature measurements to monitor for changes in temperature in the remediation area of the landfill. A statistical evaluation has been performed to determine the relationship between downhole and wellhead temperature measurements.

SUMMARY OF MONITORING DATA

Over time, 196 wells on the landfill have had wellhead temperature measurements with corresponding downhole temperature measurements. Wellhead and downhole temperatures have generally been measured monthly or bimonthly. This report examined data obtained from April 2005 to March 2009. There are 69,957 wellhead temperature measurements and 22,735 downhole temperature measurements monitoring wells. Because the intent of the statistical analysis is to explore the correlation between wellhead and downhole temperatures, the data were reduced to wellhead and downhole temperature measurements acquired on the same day. There were 133 wells with 409 temperature measurements taken from both the wellhead and downhole on the same day. The wells included in the analysis are presented below:

A2	PW-0041R(2)	PW-115	PW-128	PW-144	PW-158	PW-173	S1R	W-38	W-42R(2)
B1	PW-101	PW-116	PW-129	PW-145	PW-159	PW-174	T1R	W-39	W-5
B2R	PW-102	PW-117	PW-131	PW-146	PW-160	PW-175	U1R	W-42R(2)	W-56R(3)
C1R	PW-103R	PW-117R	PW-131R	PW-147R	PW-161	PW-176	V1	W-5	W-58R
C2R	PW-104	PW-118	PW-132	PW-148	PW-162	PW-177	W-10	W-56R(3)	W-60
D1	PW-105	PW-118R	PW-132R	PW-149	PW-163R	PW-178	W-11	W-58R	W-68
D2R	PW-106R	PW-119	PW-133	PW-14R(3)	PW-164	PW-179	W-12R	W-60	W-69
E1	PW-107	PW-119R	PW-134	PW-14R2(M)	PW-165	PW-180	W-13R	W-68	W-7
E2R	PW-108	PW-120	PW-135	PW-150	PW-166	PW-181	W-30R(M)	W-69	W-8
F1-M	PW-109	PW-121R	PW-136	PW-151	PW-167	PW-43R(2)	W-31R	W-7	W-9
F2	PW-110	PW-122R	PW-137	PW-152	PW-168(M)	PW-56R(2)	W-32R	W-8	W1R
I1R	PW-111	PW-123	PW-138	PW-153	PW-169	PW-57R	W-34	W-9	
K1	PW-112	PW-124	PW-142	PW-154	PW-170	PW-61R	W-35	W1R	
K1R	PW-113	PW-125	PW-142R	PW-155	PW-171	PW-62R(2)	W-36	W-38	
N1R	PW-114	PW-127	PW-143	PW-157	PW-172	PW-A1R2	W-37	W-39	

Downhole temperatures were measured at depths starting at ten feet and in increments of ten feet thereafter up to 120 feet deep. There are more shallow downhole temperature measurements (between 10 and 70 feet deep) than deep downhole temperature measurements. There are only three downhole temperature measurements at a depth of 120 feet.

SUMMARY OF STATISTICAL ANALYSES

Methods

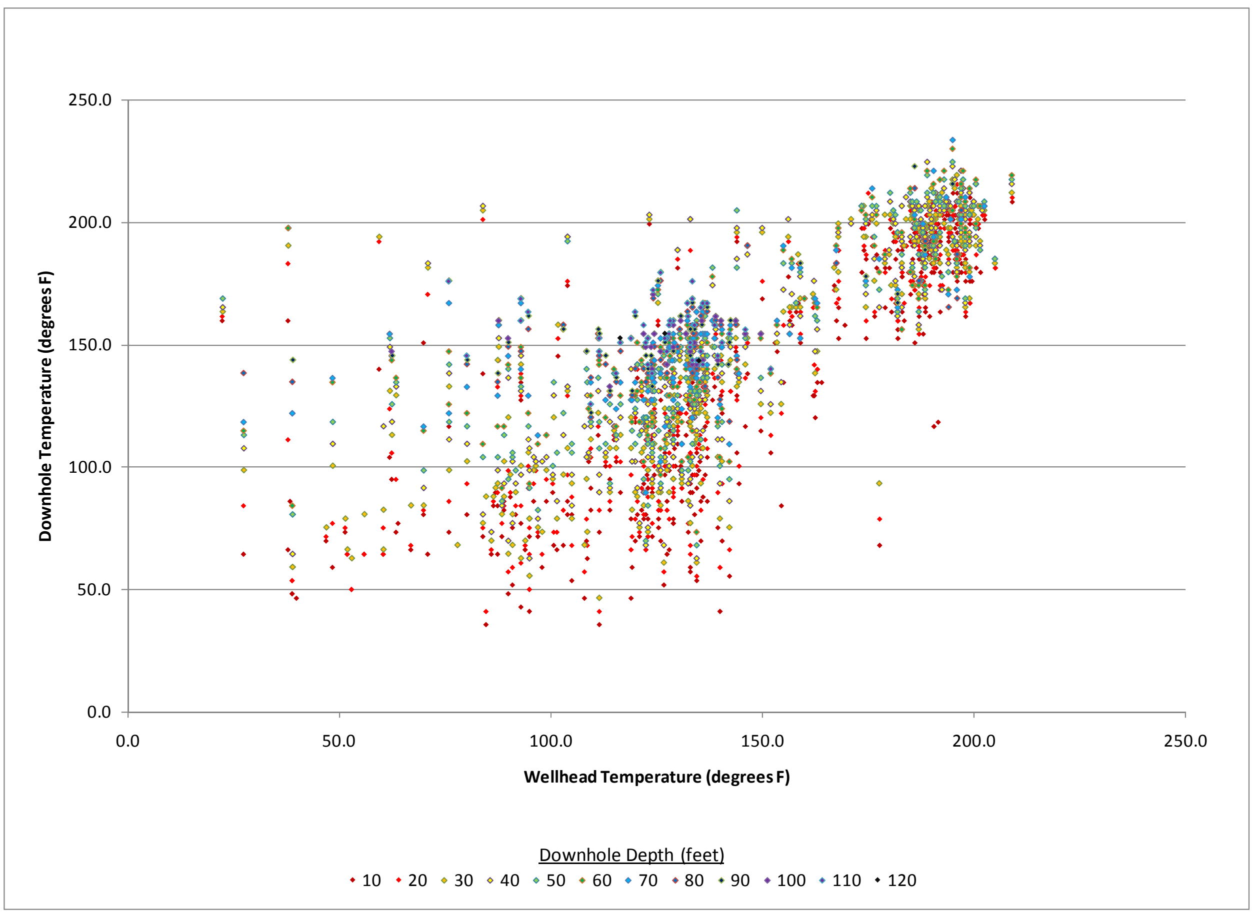
SCS used the method of least squares estimation to explore the relationship between downhole temperature and wellhead temperature. To reduce the frequency of downhole temperature monitoring, the ability to predict downhole temperatures based on wellhead temperatures was the targeted analysis. For this reason, the downhole temperature was the dependent variable and wellhead temperature was the independent variable.

Regression techniques are typically used when the primary interest lies in predicting from a model. The regression curve is the locus of points giving the downhole temperature means for the various wellhead temperature values. Of all the lines that could be drawn through a set of sample points, there is only one for which the sum of squares of vertical deviations is a minimum. In other words, there is only one line for which the distances from the line to the individual sample points is a minimum – this line represents the best fit of the data and is defined by the least squares equation.

The proportion of the downhole variability which can be explained by the least squares regression equation is defined as the coefficient of determination. The coefficient of determination (often called r^2) is restricted to the range from -1 to 1. An r^2 value of 1 happens only when all the data points lie on a straight line. On the other hand, an r^2 value close to zero indicates a weak linear relationship between downhole temperature and wellhead temperature.

Wellhead temperatures were plotted against the x-axis and corresponding downhole temperatures were plotted on the y-axis for a variety of depths. Exhibit 1 presents the plot of data.

Exhibit 1. Wellhead Temperature vs. Downhole Temperature for Various Depths



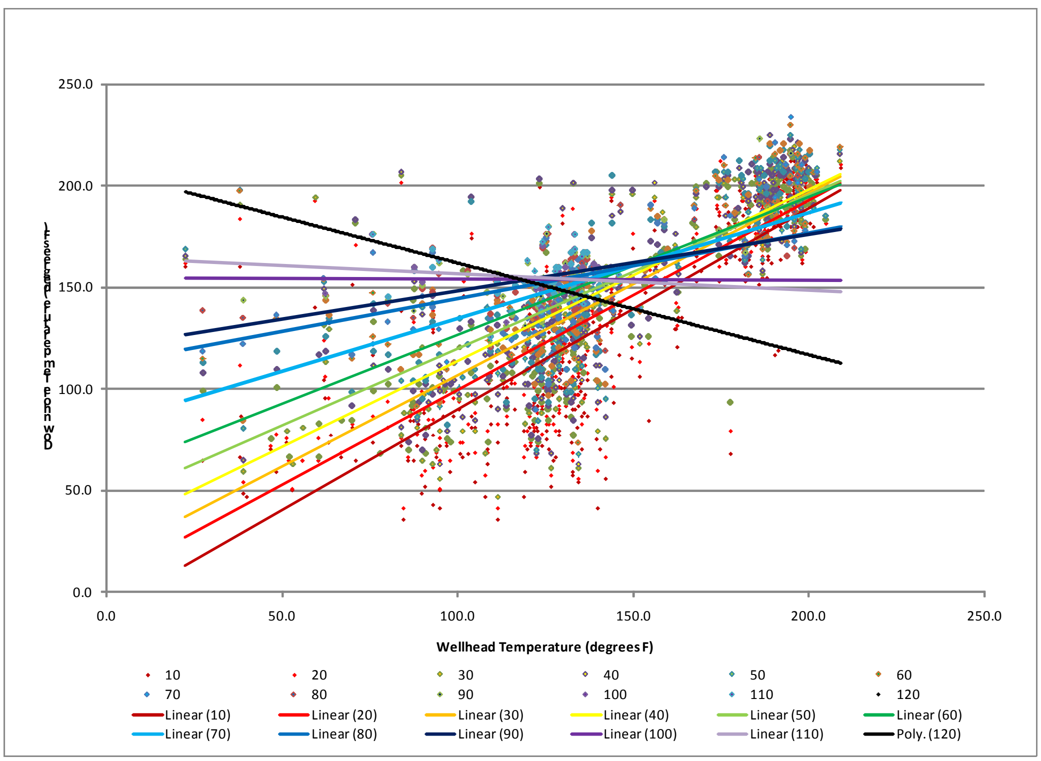
Results

A linear regression for each of the downhole depth offers the least squares regression lines presented in Exhibit 2.

Exhibit 2. Least Squares Regression Lines - All Data

Downhole Depth (feet)	Number of Data	Least Squares Regression Line	Correlation Coefficient (r^2)
10	409	Downhole Temp. = (0.99 * Wellhead Temp.) - 9.2	0.6972
20	372	Downhole Temp. = (0.94 * Wellhead Temp.) + 5.5	0.6599
30	366	Downhole Temp. = (0.90 * Wellhead Temp.) + 16.6	0.6540
40	314	Downhole Temp. = (0.84 * Wellhead Temp.) + 28.9	0.6198
50	253	Downhole Temp. = (0.76 * Wellhead Temp.) + 43.9	0.6077
60	197	Downhole Temp. = (0.68 * Wellhead Temp.) + 58.4	0.5817
70	140	Downhole Temp. = (0.52 * Wellhead Temp.) + 82.9	0.4748
80	102	Downhole Temp. = (0.32 * Wellhead Temp.) + 112.3	0.3067
90	85	Downhole Temp. = (0.28 * Wellhead Temp.) + 120.2	0.2288
100	64	Downhole Temp. = (-0.01 * Wellhead Temp.) + 155.1	0.0001
110	47	Downhole Temp. = (-0.08 * Wellhead Temp.) + 165.0	0.0131
120	3	Downhole Temp. = (-0.45 * Wellhead Temp.) + 207.4	0.5277

Exhibit 3. Wellhead Temperature vs. Downhole Temperature for Various Depths and Associated Regression Lines



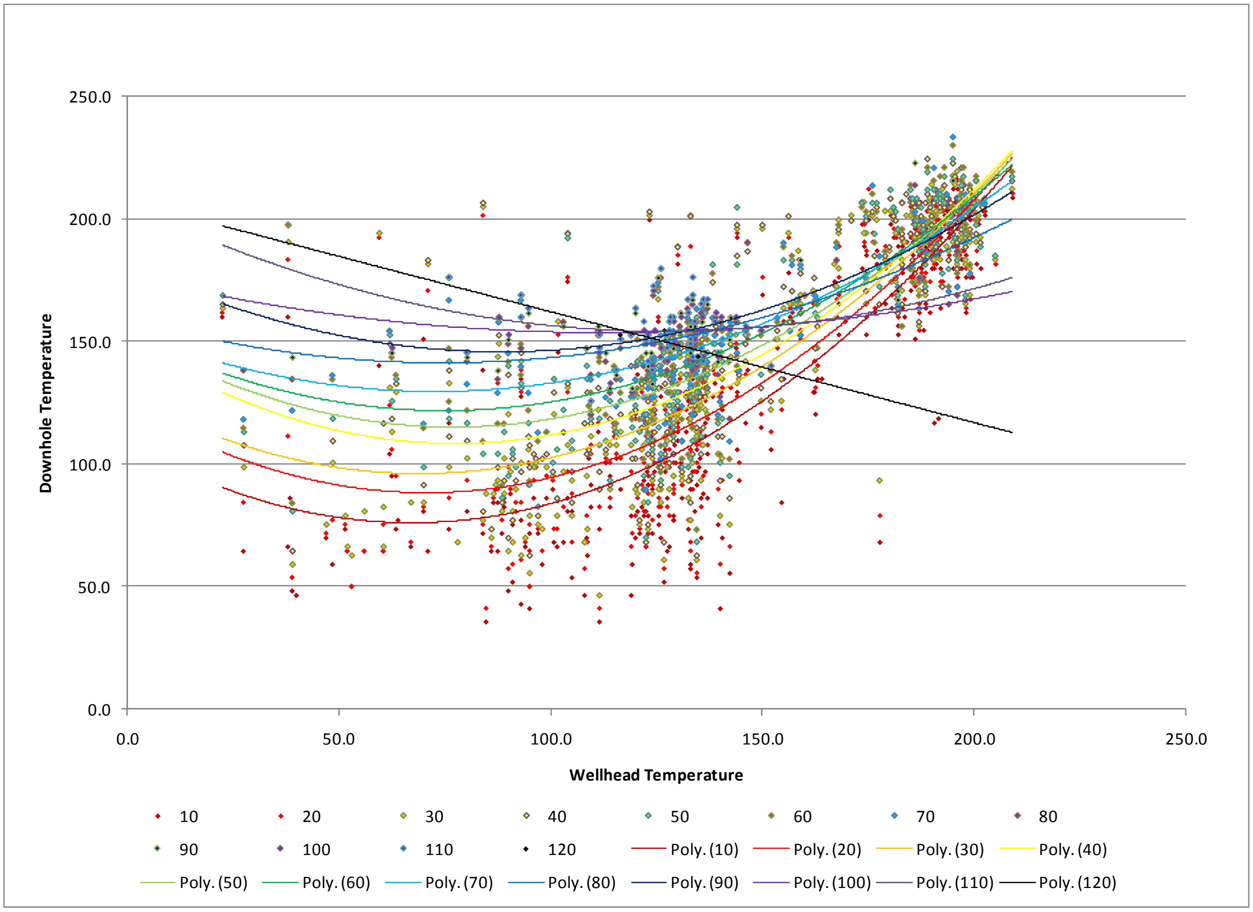
Second Order Polynomial Regression Analysis

Downhole temperature data appear to have greater scatter for wellhead temperatures below 100 degrees Fahrenheit. To increase the correlation coefficient, a second order linear regression line was fitted to the data. The results are presented in Exhibit 4.

Exhibit 4. Second Order Polynomial Lines – All Data

Downhole Depth (feet)	Number of Data	Least Squares Regression Line	Correlation Coefficient (r^2)
10	409	Downhole Temp = (0.0072 * Well Temp^2) - (0.9705* Wellhead Temp) + 108.5	0.7757
20	372	Downhole Temp = (0.0071 * Well Temp^2) - (1.0092* Wellhead Temp) + 128.7	0.7415
30	366	Downhole Temp = (0.0066 * Well Temp^2) - (0.9175* Wellhead Temp) + 124.7	0.7286
40	314	Downhole Temp = (0.0069 * Well Temp^2) - (1.0647* Wellhead Temp) + 149.8	0.7112
50	253	Downhole Temp = (0.0063* Well Temp^2) - (0.9705* Wellhead Temp) + 108.5	0.7382
60	197	Downhole Temp = (0.0056 * Well Temp^2) - (0.8342* Wellhead Temp) + 153.2	0.6903
70	140	Downhole Temp = (0.0046 * Well Temp^2) - (0.6688* Wellhead Temp) + 154.1	0.5966
80	102	Downhole Temp = (0.0033 * Well Temp^2) - (0.4844* Wellhead Temp) + 159.1	0.4195
90	85	Downhole Temp = (0.0045 * Well Temp^2) - (0.7938* Wellhead Temp) + 181.1	0.4003
100	64	Downhole Temp = (0.0018 * Well Temp^2) - (0.8171* Wellhead Temp) + 205.8	0.0228
110	47	Downhole Temp = (0.0032 * Well Temp^2) - (0.9705* Wellhead Temp) + 108.5	0.0281
120	3	Downhole Temp = -(0.4530* Wellhead Temp) + 207.4	0.5277

Exhibit 5. Wellhead Temperature vs. Downhole Temperature for Various Depths and Associated Second Order Polynomial Regression Lines



Analysis of Wellhead Temperatures Above 100 Degrees Fahrenheit

Upon examining the plot of the least squares regression lines, it appeared that more variability in downhole temperatures was evident for lower wellhead temperatures (less than 100 degrees Fahrenheit). Data appear clustered around wellhead temperatures of 140 degrees Fahrenheit and 200 degrees Fahrenheit. Lower wellhead temperatures were removed for the dataset and the analysis was repeated on the subsequent data. Results from this analysis are presented in Exhibit 4.

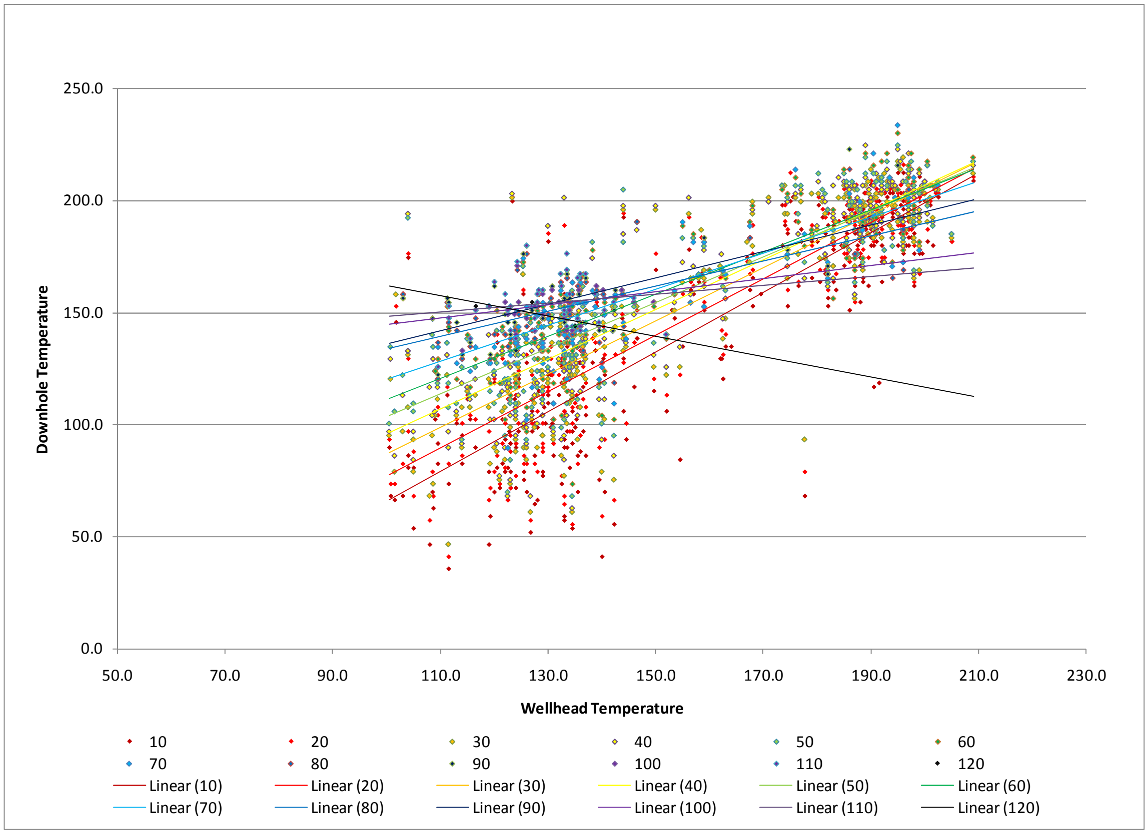
Exhibit 6. Least Squares Regression Lines – Wellhead Temperature Greater Than 100 Degrees Fahrenheit

Downhole Depth (feet)	Number of Data	Least Squares Regression Line	Correlation Coefficient (r^2)
10	348	Downhole Temp. = (1.33 * Wellhead Temp.) - 67.6	0.7650
20	315	Downhole Temp. = (1.26 * Wellhead Temp.) - 48.8	0.7630
30	310	Downhole Temp. = (1.19 * Wellhead Temp.) - 32.3	0.7526
40	275	Downhole Temp. = (1.11 * Wellhead Temp.) - 15.4	0.7446
50	224	Downhole Temp. = (1.02 * Wellhead Temp.) + 2.2	0.7382
60	173	Downhole Temp. = (0.94 * Wellhead Temp.) + 17.0	0.7096
70	123	Downhole Temp. = (0.80 * Wellhead Temp.) + 40.0	0.6111
80	90	Downhole Temp. = (0.56 * Wellhead Temp.) + 77.8	0.4626
90	74	Downhole Temp. = (0.59 * Wellhead Temp.) + 77.1	0.4469
100	56	Downhole Temp. = (0.29 * Wellhead Temp.) + 115.4	0.0687
110	42	Downhole Temp. = (0.20 * Wellhead Temp.) + 128.0	0.0281
120	3	Downhole Temp. = (-0.45 * Wellhead Temp.) + 207.4	0.5277

When eliminating downhole temperatures for wellhead temperatures less than 100 degrees Fahrenheit, the correlation coefficients of the associated least squares regression lines are improved.

Data pairs with wellhead temperatures from 100 to 130 degrees F and which had differences between wellhead and downhole temperatures greater than 40 degrees F were examined to identify the cause or causes of the greater variability at lower wellhead temperatures. Two causes were identified. Large temperature differences were present at deeper wells. With the temperatures increasing with depth through this depth range, deep wells where downhole temperatures were measured at depths from 90 to 120 feet were more likely to have larger differences between the wellhead and downhole temperatures. The second cause was low or no flow conditions at wells, due to operational issues. Wellhead temperatures cooled to temperatures approaching ambient air temperature at those wells which experienced operational issues that reduced or halted gas flow. This resulted in artificially large differences between wellhead and downhole temperatures, especially the deeper downhole temperatures.

Exhibit 7. Wellhead Temperature 100 Degrees Fahrenheit or Higher vs. Downhole Temperature for Various Depths and Associated Regression Lines



RECOMMENDATIONS FOR FURTHER MONITORING

According to the least squares regression analysis, wellhead temperature appears to be a good predictor of downhole temperature for depths between 10 and 70 feet (indicated by higher correlation coefficients). Visual inspection of the plots indicate that the regression lines for greater depths (80 to 120 feet) appear to fall in sequence with lower depths, i.e., there is a progression in slope and intercept of the regression lines. Interestingly, downhole temperatures for all depths appear to converge at around 190 degrees corresponding to wellhead temperatures of 190 degrees.

It appears that since wellhead temperature is a good predictor of downhole temperatures, the continued monitoring of downhole temperatures can be eliminated. Downhole temperatures are not needed to identify artificially low wellhead temperatures caused by operational issues. These artificially low wellhead temperatures can be identified by other monitoring, including the evaluation of wellhead temperature monitoring data itself.

2 LANDFILL SETTLEMENT

Order 4.A.3 of the March 2007 FF&Os requires Countywide to determine the volume of waste mass settlement that has occurred in the area where wellhead temperatures exceed 131 degrees F on a weekly basis. Countywide proposes to reduce the frequency of this determination to monthly. A statistical evaluation was performed to see if the change in frequency has any significant impact on the trend and/or interpretation of the data.

SUMMARY OF MONITORING DATA

Weekly landfill settlement volumes have been measured weekly from April 2006 to present. This report examined data obtained up to March 2009. Overall, there are 156 weekly settlement volumes in the dataset analyzed.

SUMMARY OF STATISTICAL ANALYSES

Methods

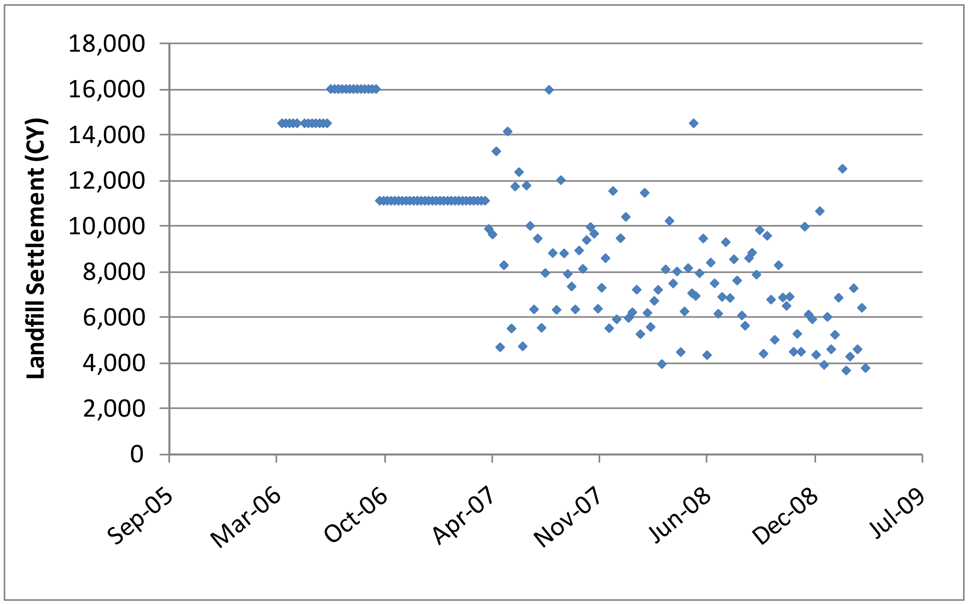
SCS used the method of least squares estimation to explore the relationship between landfill settlement volume and time. To reduce the monitoring frequency, the ability to predict settlement volume over time was the targeted analysis. For this reason, the settlement volume was the dependent variable and week number (indicated by 1 for the first week of monitoring, 2 for the second week and so on) was the independent variable.

Regression techniques are typically used when the primary interest lies in predicting from a model. The regression curve is the locus of points giving the settlement volume means for the various weekly monitoring timeframes. Of all the lines that could be drawn through a set of sample points, there is only one for which the sum of squares of vertical deviations is a minimum. In other words, there is only one line for which the distances from the line to the individual sample points is a minimum – this line represents the best fit of the data and is defined by the least squares equation.

The proportion of the settlement volume which can be explained by the least squares regression equation is defined as the coefficient of determination. The coefficient of determination (often called r^2) is restricted to the range from -1 to 1. An r^2 value of 1 happens only when all the data points lie on a straight line. On the other hand, an r^2 value close to zero indicates a weak linear relationship between settlement volume and time.

Week numbers were plotted against the x-axis and corresponding settlement volumes were plotted on the y-axis. Exhibit 6 presents the plot of data.

Exhibit 8. Weekly Landfill Settlement Volumes



Results

Landfill settlement volume based on weekly, monthly, and quarterly measurements was analyzed for trends over time. A linear regression for each of the monitoring frequencies offers the least squares regression lines presented in Exhibit 7.

Exhibit 9. Least Squares Regression Lines for Landfill Settlement for Weekly, Monthly, and Quarterly Monitoring Frequency

Monitoring Frequency	Number of Data	Least Squares Regression Line	Correlation Coefficient (r^2)
Weekly	156	LF Settlement Vol. = (-62.4 * Week #) + 14,417	0.6383
Monthly	36	LF Settlement Vol. = (-1204 * Month #) + 63,513	0.7651
Quarterly	12	LF Settlement Vol. = (-10,794 * Quarter #) + 193,878	0.8736

Exhibit 10. Weekly Landfill Settlement Volumes and Least Squares Regression Line

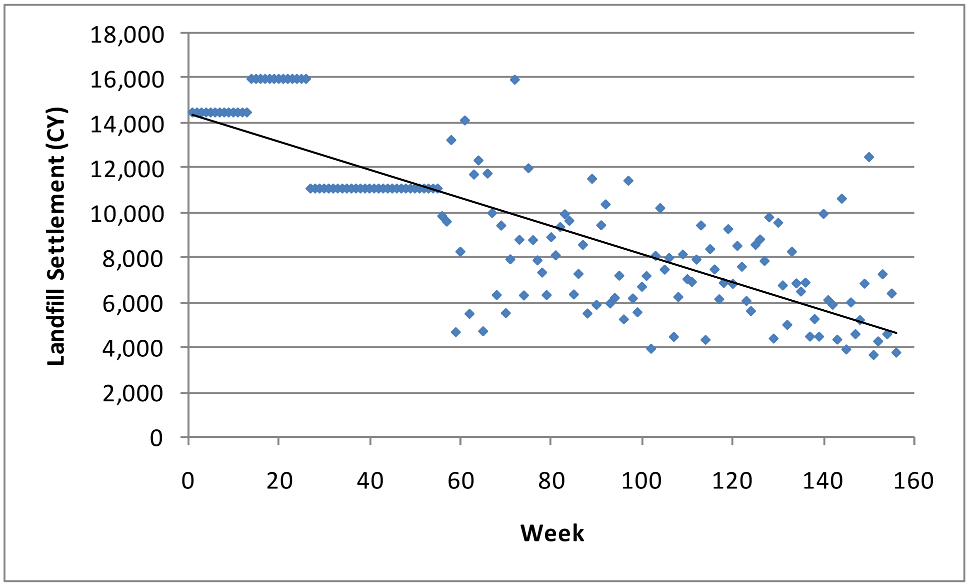


Exhibit 11. Monthly Landfill Settlement Volumes and Least Squares Regression Line

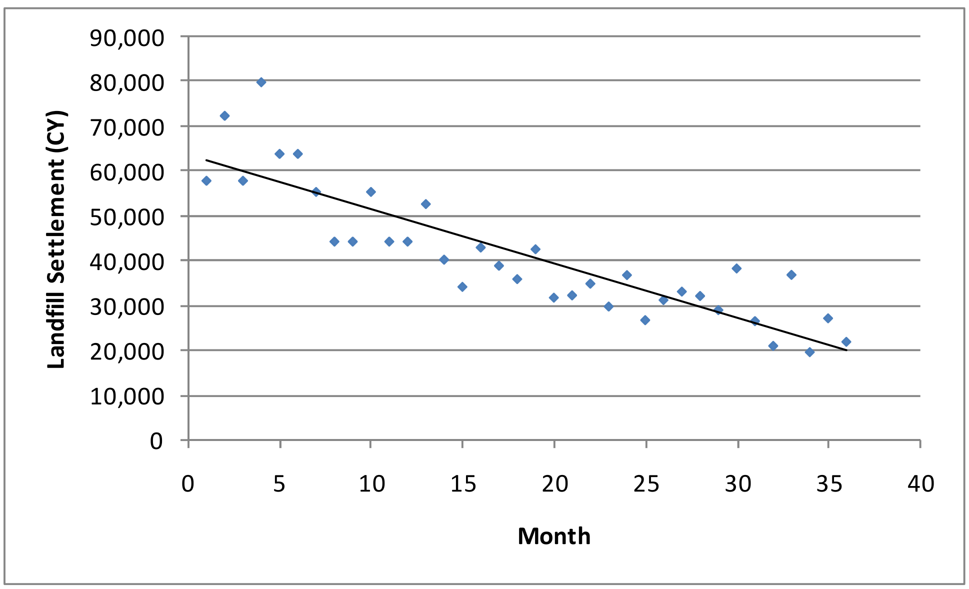
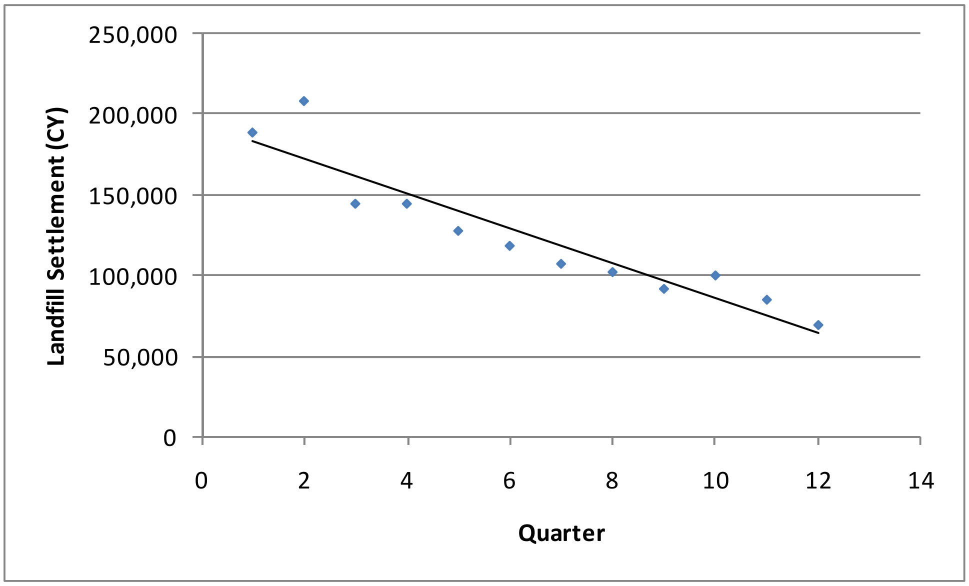


Exhibit 12. Quarterly Landfill Settlement Volumes and Least Squares Regression Line



RECOMMENDATIONS FOR FURTHER MONITORING

According to the least squares regression analysis, variability in quarterly landfill settlement measurements appear to be best explained by the regression line. Weekly landfill settlement measurements have higher variability and trends are not as evident. Some of this weekly variability is due to the use of GPS surveying technology, which has an accuracy of +/- 0.2 feet. This is close to the order of magnitude of the changes that occur over a week's time period. The changes in elevation that occur and are measured over a longer time period, i.e. monthly or quarterly, are large enough that variability due to the survey method is not significant. The evaluation of settlement is a long term tracking tool. It is not utilized to identify issues that require correction or remediation.

It appears that landfill settlement would be more predictable if the measurement frequency were reduced to monthly or quarterly.

3 LANDFILL SETTLEMENT, HYDROGEN FLOW RATE AT THE FLARES, AND LEACHATE VOLUME

Countywide has advanced the hypothesis that the decrease in settlement volume, decrease in volumetric hydrogen flow rate at the flares, and the decrease in volume of leachate removed show that the reaction is decreasing in strength in the 88-acre area of the landfill. Statistical analyses were preformed to evaluate this hypothesis.

SUMMARY OF MONITORING DATA

Weekly landfill settlement measurements were aggregated and converted to monthly measurements in order to compare with monthly leachate volumes from cells 1-6. Monthly leachate volumes between January 2007 and February 2009 were assessed. Monthly hydrogen flows were between June 2006 and March 2009 were also compared to monthly landfill settlement volume.

SUMMARY OF STATISTICAL ANALYSES

Methods

SCS used the method of least squares estimation to explore the relationship over time between landfill settlement and:

1. Hydrogen flow rate at the flares, and
2. Leachate volume.

Each of the variables was regressed by month number and the resulting least squares lines were compared.

The proportion of the settlement volume, hydrogen flow rate, and leachate volume which can be explained by the least squares regression equation is defined as the coefficient of determination. The coefficient of determination (often called r^2) is restricted to the range from -1 to 1. An r^2 value of 1 happens only when all the data points lie on a straight line. On the other hand, an r^2 value close to zero indicates a weak linear relationship between settlement volume and time.

Results

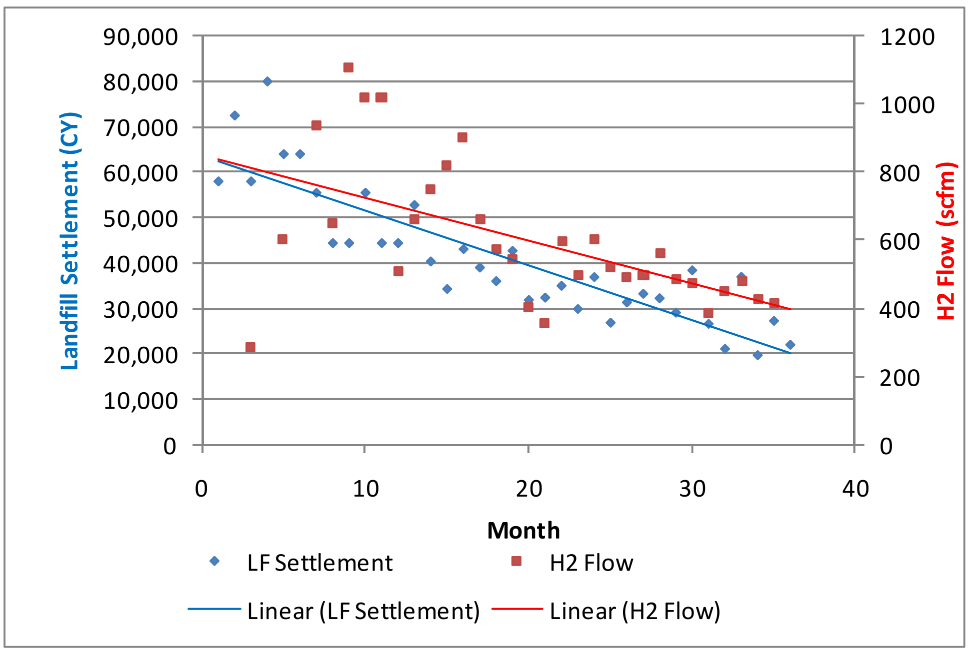
Landfill Settlement and Hydrogen Flow Rates

Landfill settlement and hydrogen flow rates have had similar decreasing trends. Looking at monthly data from April 2006 to March 2009, there are similar decreasing trends; however the correlation coefficient for the linear decreasing trend for hydrogen is not high due to significant scatter in 2006 and 2007.

Exhibit 13. Least Squares Regression Lines for Landfill Settlement and Hydrogen Flow Rate (April 2006 to March 2009)

Parameter	Percent Decrease	Least Squares Regression Line	Correlation Coefficient (r^2)
Monthly Landfill Settlement (cy)	66%	LF Settlement Vol. = (-1204 * Month #) + 63,513	0.7651
Hydrogen Flow Rate (scfm)	51%	Hydrogen Flow Rate = (-12.5 * Month #) + 848	0.3026

Exhibit 14. Monthly LF Settlement vs. Hydrogen Flow (April 2006 to March 2009)



A regression analysis using higher order polynomials was then used to increase the correlation coefficient. Exhibit 15 presents the equations and corresponding correlation coefficients. Graphs of the higher order regression curves are presented in subsequent exhibits.

Exhibit 15. Higher Order Least Squares Regression Lines for Hydrogen Flow Rate (April 2006 to March 2009)

Polynomial	Least Squares Regression Line	Correlation Coefficient (r^2)
Second Order	Hydrogen Flow Rate = (-0.5 *Month#^{2}) + (5.7 * Month#) + 708.6	0.3329
Third Order	Hydrogen Flow Rate = (0.1 * Month#^{3}) + (-8.2 *Month#^{2}) + (134.94 * Month#) + 146.8	0.5239
Fourth Order	Hydrogen Flow Rate = (-0.01 * Month#^{4}) + (1.2 * Month#^{3}) + (-35.5 *Month#^{2}) + (399.4 * Month#) + 614.3	0.6678

Exhibit 16. Monthly LF Settlement vs. Second Order Regression Line for Hydrogen Flow (January 2007 to March 2009)

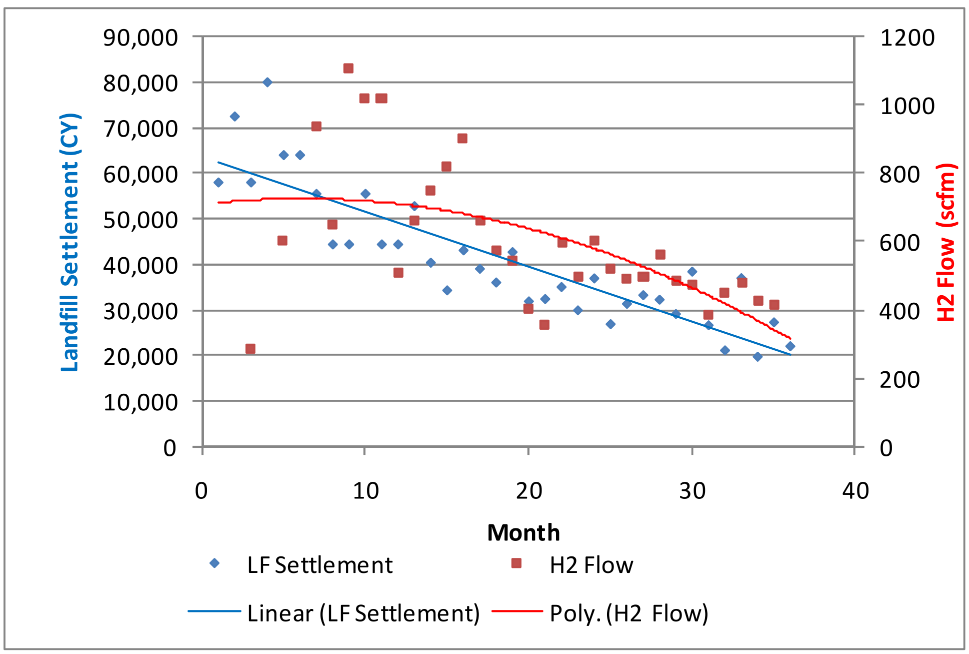


Exhibit 17. Monthly LF Settlement vs. Third Order Regression Line for Hydrogen Flow (January 2007 to March 2009)

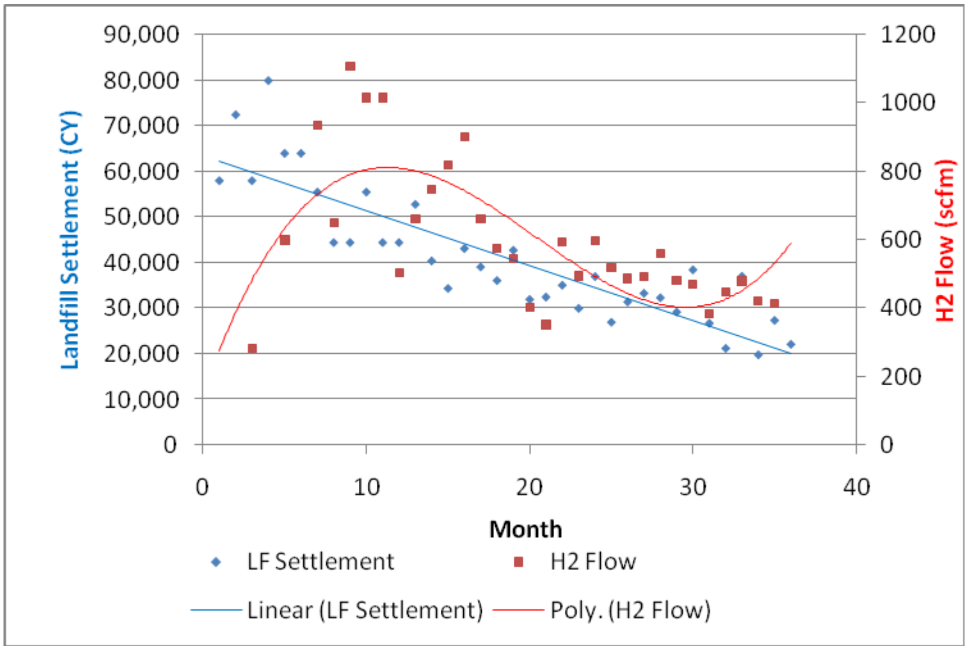
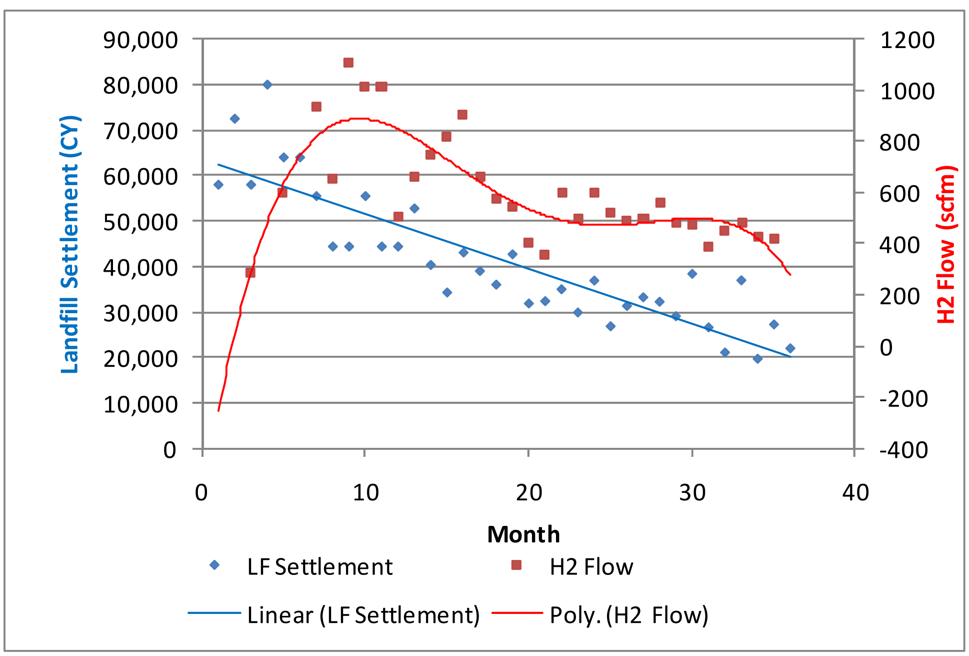


Exhibit 18. Monthly LF Settlement vs. Fourth Order Regression Line for Hydrogen Flow (January 2007 to March 2009)

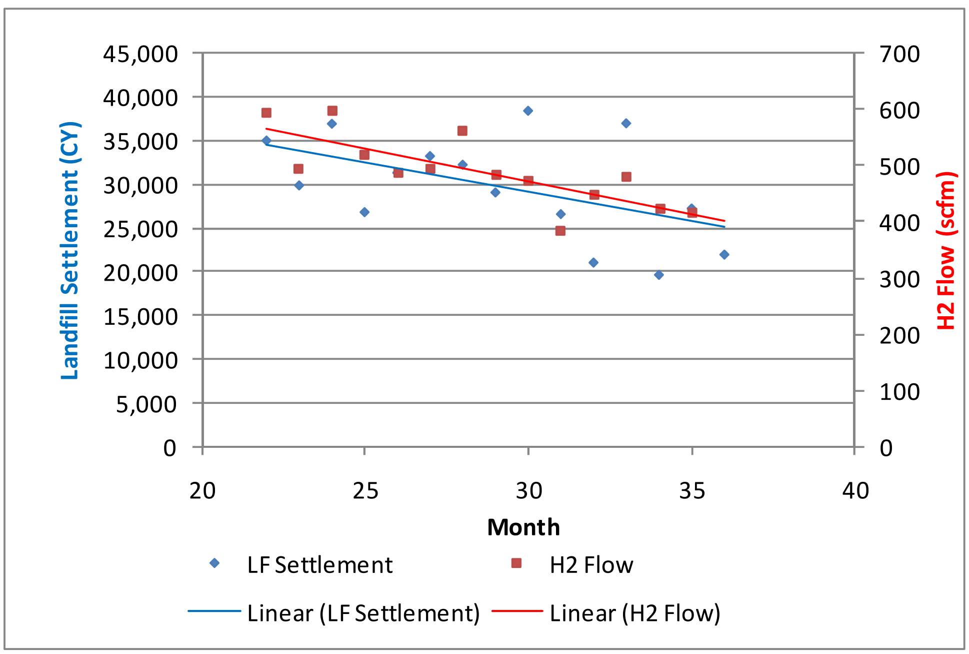


Adjusting the monthly data to look at more recent data (January 2008 to March 2009), hydrogen has a highly correlated decreasing linear trend. The decreasing trend in landfill settlement is very similar to that of hydrogen flow; however, the correlation of the more recent landfill settlement data has increasing variability thus decreasing the correlation coefficient.

Exhibit 19. Least Squares Regression Lines for Landfill Settlement and Hydrogen Flow Rate (January 2008 to March 2009)

Parameter	Percent Decrease	Least Squares Regression Line	Correlation Coefficient (r^2)
Monthly Landfill Settlement (cy)	26%	LF Settlement Vol. = (-679 * Month #) + 49,475	0.2652
Hydrogen Flow Rate (scfm)	27%	Hydrogen Flow Rate = (-11.7 * Month #) + 823	0.6010

Exhibit 20. Monthly LF Settlement vs. Hydrogen Flow (January 2008 to March 2009)



More recent hydrogen flow data (January 2008 to March 2009) have a stronger linear relationship as evident from the increasing correlation coefficient (from 0.3026 to 0.6010). Conversely, more recent landfill settlement data appears to have less of a linear relationship as evident from the decreasing correlation coefficient (from 0.7651 to 0.2652). In both cases, however, the decreasing trend is strong and similar.

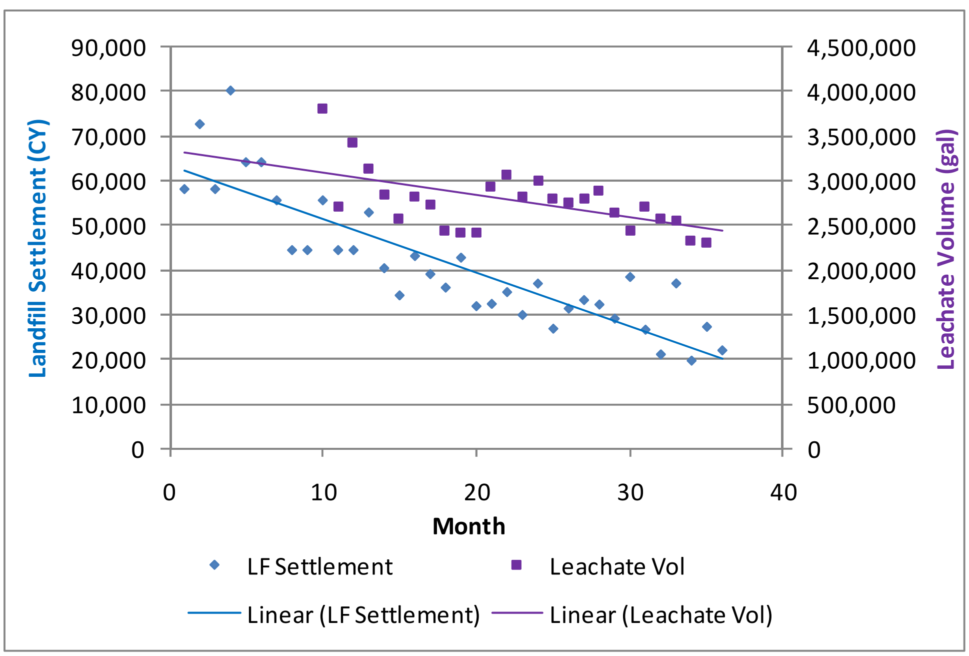
Landfill Settlement and Leachate Volume

Landfill settlement and leachate volume both have decreasing trends. Landfill settlement has a stronger decreasing trend than leachate volume. Even though the monthly data from both variables is decreasing, the correlation coefficient for the linear decreasing trend for leachate volume is not high due to significant scatter in 2006 and 2007.

Exhibit 21. Least Squares Regression Lines for Landfill Settlement and Leachate Volume (January 2007 to March 2009)

Parameter	Percent Decrease	Least Squares Regression Line	Correlation Coefficient (r^2)
Monthly Landfill Settlement (cy)	66%	LF Settlement Vol. = (-1204 * Month #) + 63,513	0.7651
Leachate Volume (gallons)	28%	Leachate Volume = (-24,834 * Month #) + 3,000,000	0.3172

Exhibit 22. Monthly LF Settlement vs. Leachate Volume (January 2007 to March 2009)



A regression analysis using higher order polynomials was then used to increase the correlation coefficient. Exhibit 15 presents the equations and corresponding correlation coefficients. Graphs of the higher order regression curves are presented in subsequent exhibits.

Exhibit 23. Higher Order Least Squares Regression Lines for Leachate Volume (January 2007 to March 2009)

Polynomial	Least Squares Regression Line	Correlation Coefficient (r^2)
Second Order	Leachate Volume = (781 *Month#^{2}) + (59,971 * Month#) + 4,000,000	0.3312
Third Order	Leachate Volume = (-510 * Month#^{3}) + (35,218 *Month#^{2}) + (-783,263 * Month#) + 8,000,000	0.5883
Fourth Order	Leachate Volume = (28 * Month#^{4}) + (-3,043* Month#^{3}) + (116,644 *Month#^{2}) + (2,000,000 * Month#) + 10,000,000	0.6211

Exhibit 24. Monthly LF Settlement vs. Second Order Regression Line for Leachate volume (January 2007 to March 2009)

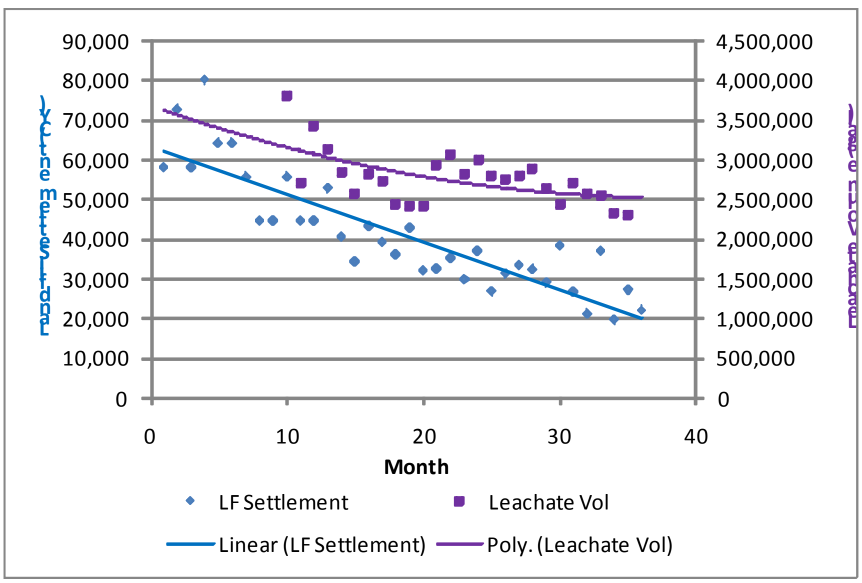


Exhibit 25. Monthly LF Settlement vs. Third Order Regression Line for Leachate Volume (January 2007 to March 2009)

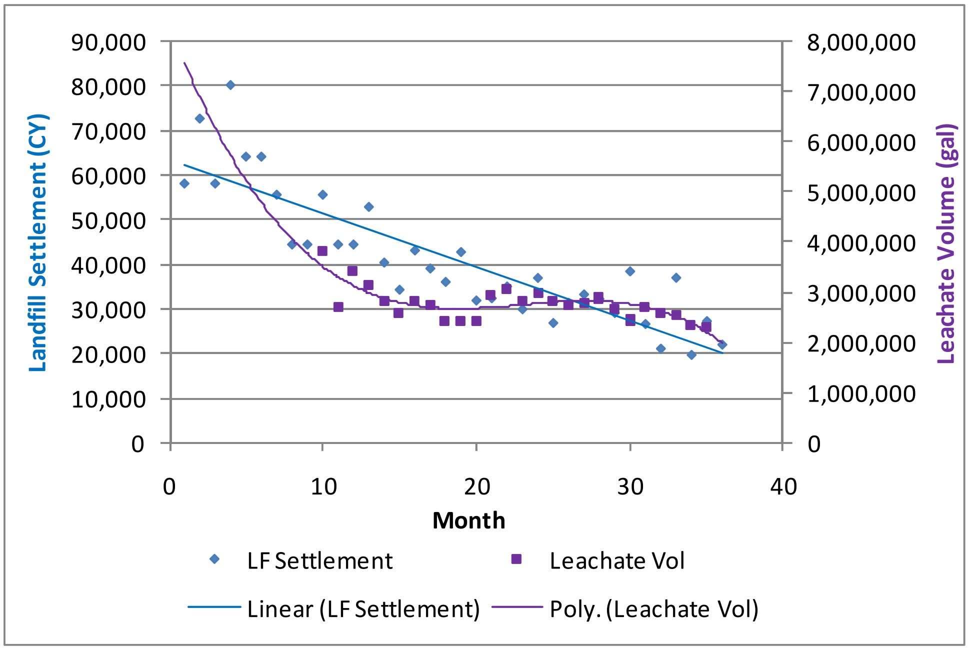
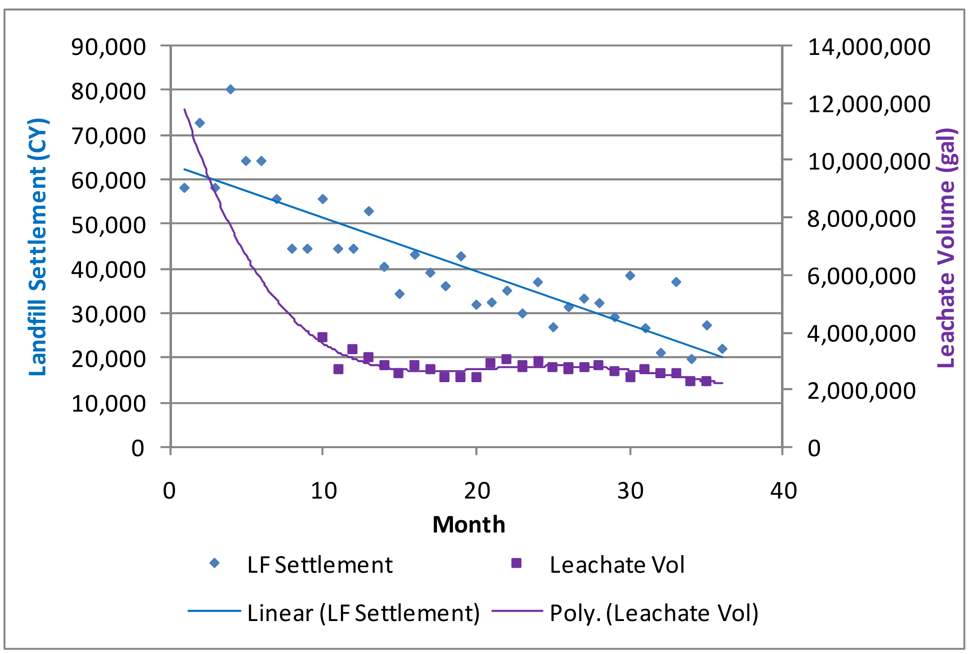


Exhibit 26. Monthly LF Settlement vs. Fourth Order Regression Line for Leachate Volume (January 2007 to March 2009)

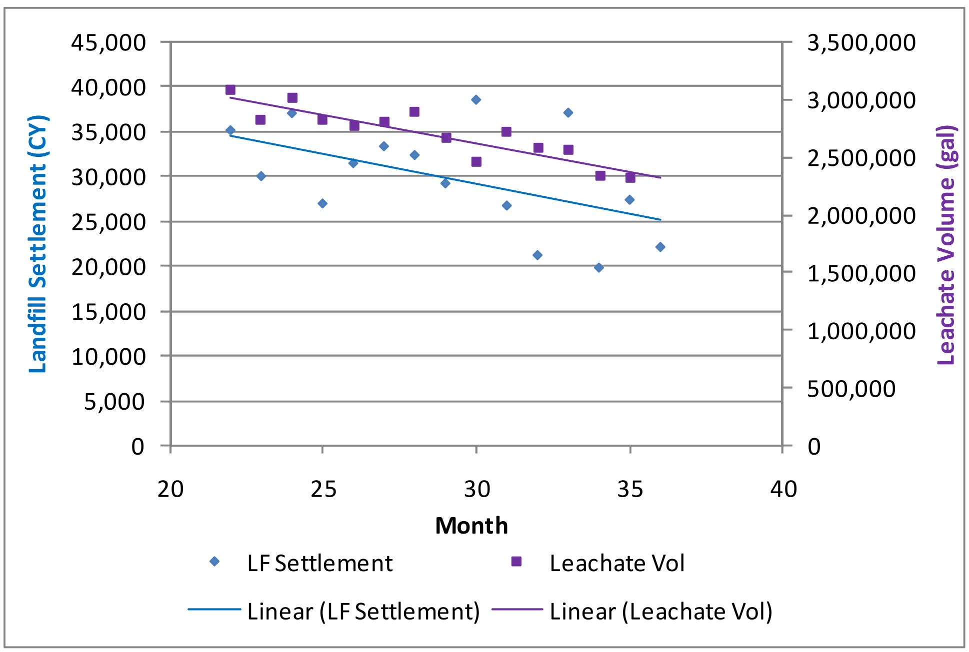


Adjusting the monthly data to look at more recent data (January 2008 to March 2009), leachate volume has a highly correlated decreasing linear trend. The decreasing trend in landfill settlement is very similar to that of leachate volume; however, the correlation of the more recent landfill settlement data has increasing variability thus decreasing the correlation coefficient.

Exhibit 27. Least Squares Regression Lines for Landfill Settlement and Leachate Volume (January 2008 to March 2009)

Parameter	Percent Decrease	Least Squares Regression Line	Correlation Coefficient (r^2)
Monthly Landfill Settlement (cy)	26%	LF Settlement Vol. = (-1204 * Month #) + 63,513	0.2652
Leachate Volume (gallons)	22%	Leachate Volume = (-49,229 * Month #) + 4,000,000	0.8007

Exhibit 28. Monthly LF Settlement vs. Leachate Volume (January 2008 to March 2009)



More recent leachate volume data (January 2008 to March 2009) have a stronger linear relationship as evident from the increasing correlation coefficient (from 0.3172 to 0.8007). Conversely, more recent landfill settlement data appears to have less of a linear relationship as evident from the decreasing correlation coefficient (from 0.7651 to 0.2652). In both cases, however, the decreasing trend is strong and similar.

RECOMMENDATIONS FOR FURTHER MONITORING

There are similarly decreasing trends when comparing monthly landfill settlement volume to hydrogen flow at the flares and monthly leachate volumes. The similar decreasing trends are indications of a reduction of reaction activity at the landfill. The correlation between these parameters demonstrates that the reduction in the leachate volume is due to a reduction in the reaction rather than a decrease in the performance of the leachate collection system. Hence monitoring frequency of leachate volume and hydrogen flow at the flares can be reduced to monthly or quarterly.

4 LEACHATE TEMPERATURE IN SUMPS AND LATERALS

Order 3.D of the March 2007 FF&Os requires Countywide to evaluate whether engineered components have been damage. To meet this requirement, Countywide has been measuring leachate temperature at locations where thermocouples have been installed in the selected locations in the leachate collection lines on a weekly basis. Order 4.A.5 of the March 2007 FF&Os requires Countywide to measure leachate temperature in the sumps serving areas with wellhead temperatures exceeding 131 degrees F on a weekly basis. Countywide proposes to modify the sampling frequency for each of these activities to monthly.

SUMMARY OF MONITORING DATA

Weekly leachate temperatures at eight leachate sump risers and nine thermocouple locations were measured between May 2007 and May 2009.

SUMMARY OF STATISTICAL ANALYSES

Methods

SCS used the method of least squares estimation to explore the relationship over time between leachate temperatures in sumps and laterals. Leachate temperatures at each of the sumps and laterals were regressed over time to assess increasing or decreasing trends.

The proportion of variability in leachate temperature which can be explained by the least squares regression equation is defined as the coefficient of determination. The coefficient of determination (often called r^2) is restricted to the range from -1 to 1. An r^2 value of 1 happens only when all the data points lie on a straight line. On the other hand, an r^2 value close to zero indicates a weak linear relationship between leachate temperature and time.

Results

Leachate temperatures at the sumps have remained fairly steady since 2006. There does not appear to be either an increasing or decreasing trend in the data – evident in the plot as well as corresponding low correlation coefficient. The exception to this is a decreasing linear trend in Sump #1 and an increasing linear trend in Sump #7.

Leachate temperatures at the thermocouples have remained fairly steady since 2006. There does not appear to be either an increasing or decreasing trend in the data – evident in the plot as well as corresponding low r-square value. The exception to this is a decreasing linear trend in Thermocouple Line 1D.

Exhibit 29. Least Squares Regression Lines for Leachate Temperature at Sumps (May 2007 to May 2009)

Sump	Number of Data	Least Squares Regression Line	Correlation Coefficient (r^2)
1	106	Leachate Temp. = (-0.0774 * Date) + 99	0.6178
2 North	106	Leachate Temp. = (-0.0052 * Date) + 276	0.0347
2 South	106	Leachate Temp. = (-0.0008 * Date) + 114	0.0006
3	106	Leachate Temp. = (-0.0078 * Date) + 425	0.0786
4	105	Leachate Temp. = (0.0117 * Date) - 343	0.0244
5 A/B	91	Leachate Temp. = (0.0285 * Date) - 1,016	0.2995
5 C/D	99	Leachate Temp. = (0.0105 * Date) - 301	0.0440
7	45	Leachate Temp. = (0.0222 * Date) - 796	0.06259

Exhibit 30. Leachate Temperature in Sumps

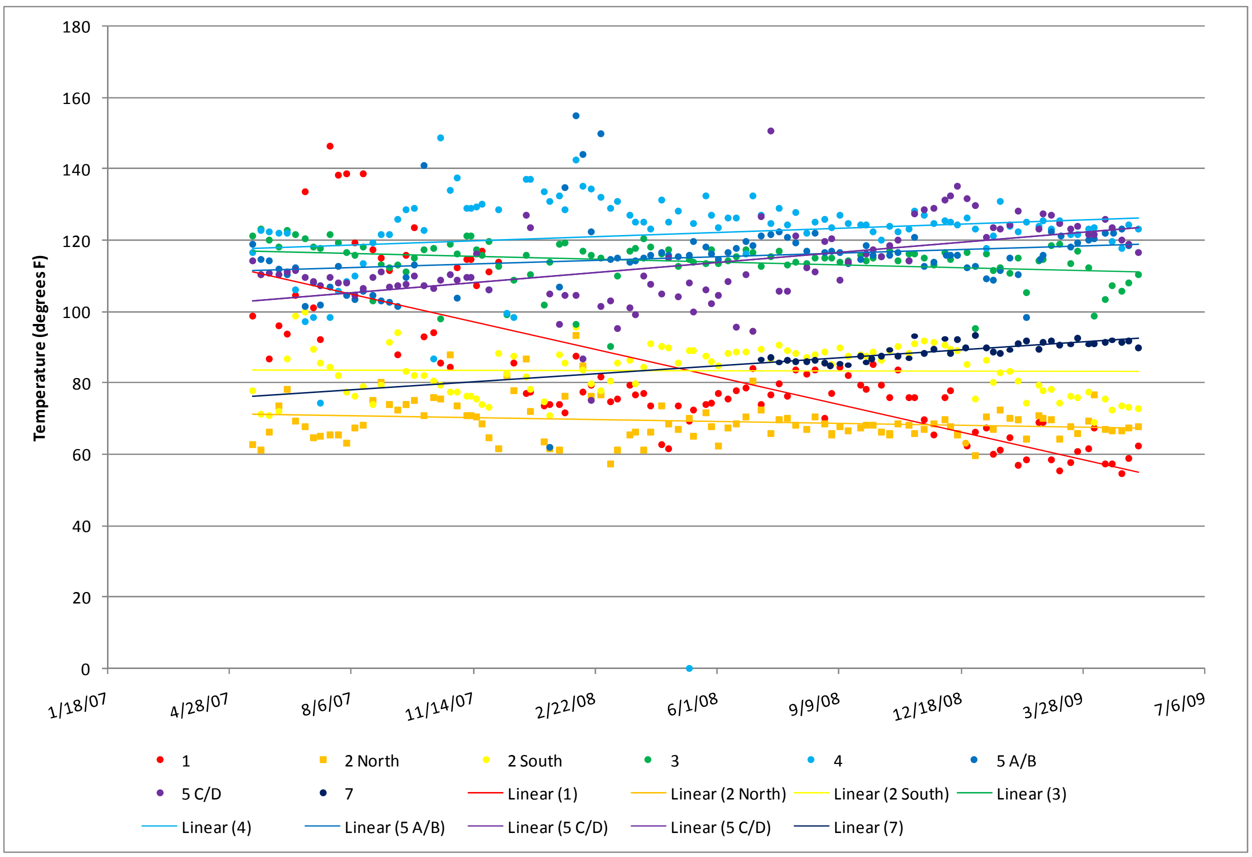
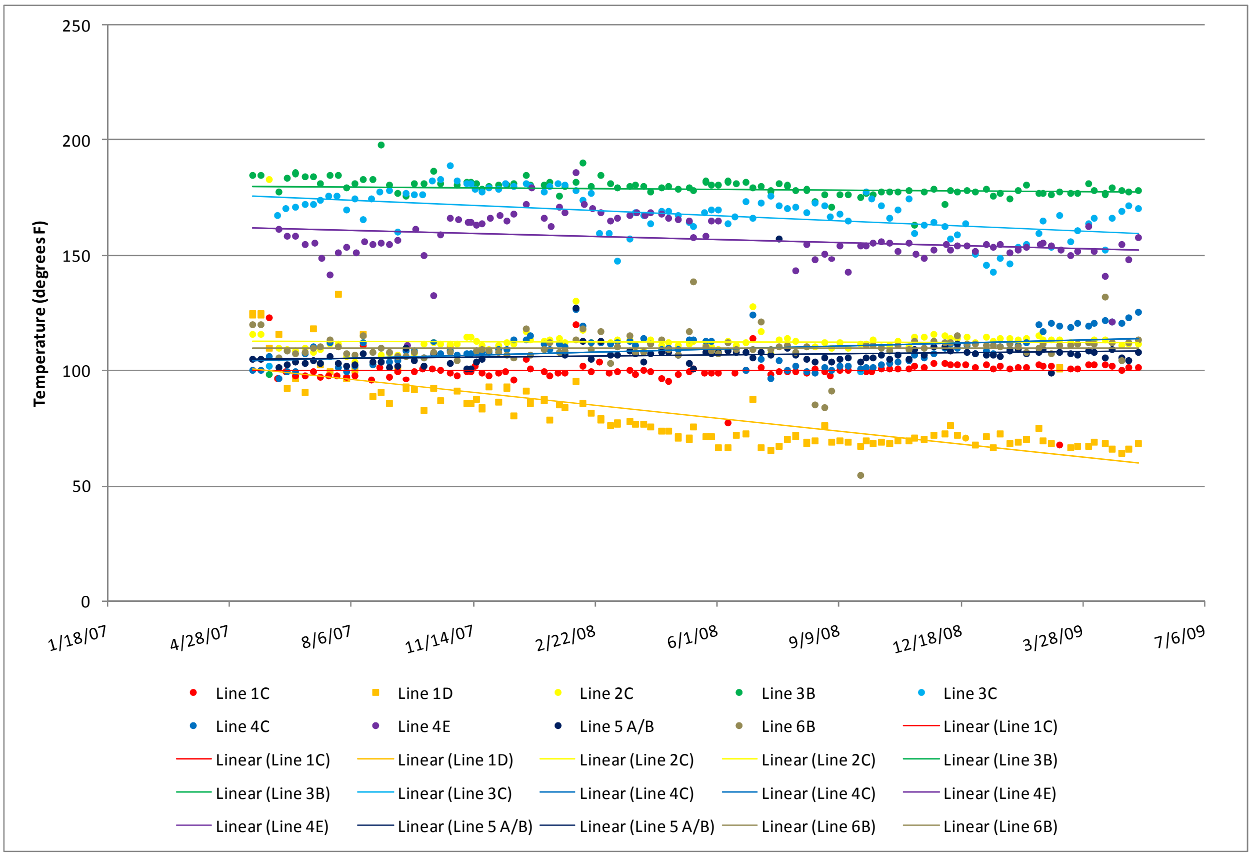


Exhibit 31. Least Squares Regression Lines for Leachate Temperature at Thermocouples (May 2007 to May 2009)

Sump	Number of Data	Least Squares Regression Line	Correlation Coefficient (r^2)
1C	104	Leachate Temp. = (-0.000002 * Date) + 99	0.0000
1D	106	Leachate Temp. = (-0.0006 * Date) + 2,304	0.6303
2C	106	Leachate Temp. = (-0.0002 * Date) + 85	0.0002
3B	105	Leachate Temp. = (-0.004 * Date) + 339	0.0095
3C	104	Leachate Temp. = (-0.0229 * Date) + 1073	0.1298
4C	104	Leachate Temp. = (0.0129 * Date) - 403	0.1619
4E	95	Leachate Temp. = (-0.0129 * Date) - 668	0.0689
5AB	94	Leachate Temp. = (0.0055 * Date) - 113	0.0359
6B	99	Leachate Temp. = (0.0006 * Date) - 85	0.0002

Exhibit 32. Leachate Temperature in Thermocouples



The low correlation coefficients for leachate temperatures indicate a lack of an increasing or decreasing trend.

RECOMMENDATIONS FOR FURTHER MONITORING

Weekly leachate temperature generally does not show statistically significant increasing or decreasing trends. Operationally, there is no value gained from weekly readings. Any remedial action to a significant change would require a project of many months duration to effect any change in leachate quality. Hence the monitoring frequency can be reduced to monthly.

5 LEACHATE INDICATOR PARAMETERS

Order 4.A.9 of the March 2007 FF&Os requires Countywide to sample the leachate collected from Cells 1 through 6A for pH, ammonia, aluminum, sodium, chloride, potassium, magnesium, fluoride, COD, and total alkalinity twice per month. Countywide proposes to modify the sampling frequency to quarterly. A statistical evaluation has been performed to see it the change in frequency has any significant impact on the trend and/or interpretation of the data.

SUMMARY OF MONITORING DATA

This report examined bimonthly leachate indicator parameters measured between April 2007 and May 2009.

SUMMARY OF STATISTICAL ANALYSES

Methods

SCS used the method of least squares estimation to explore the relationship over time between leachate indicator parameters. Select leachate indicator parameters were regressed over time to assess increasing or decreasing trends.

The proportion of variability in leachate indicator parameters which can be explained by the least squares regression equation is defined as the coefficient of determination. The coefficient of determination (often called r^2) is restricted to the range from -1 to 1. An r^2 value of 1 happens only when all the data points lie on a straight line. On the other hand, an r^2 value close to zero indicates a weak linear relationship between leachate temperature and time.

Results

SCS selected two indicator parameters: Chemical Oxygen Demand and Aluminum. Neither of these parameters appears to have a significant increasing or decreasing trend as can be seen on the graphs and low r^2 values. Aluminum had a few outliers that were removed so that trendlines could be plotted.

Exhibit 33. Least Squares Regression Lines for Leachate COD (April 2007 to May 2009)

Location	Number of Data	Least Squares Regression Line	Correlation Coefficient (r^2)
LE-E	48	COD = (-49 * Date) + 2,000,000	0.3516
LE-S	48	COD = (-37 * Date) + 1,000,000	0.2108
LE-N	48	COD = (21 * Date) + 779,184	0.0619

Exhibit 34. Chemical Oxygen Demand vs. Time (April 2007 to May 2009)

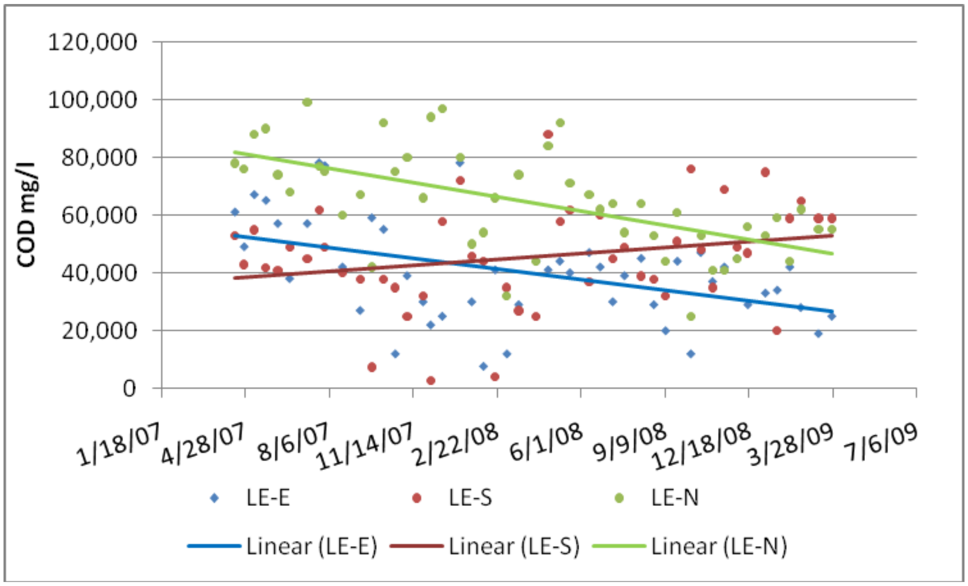
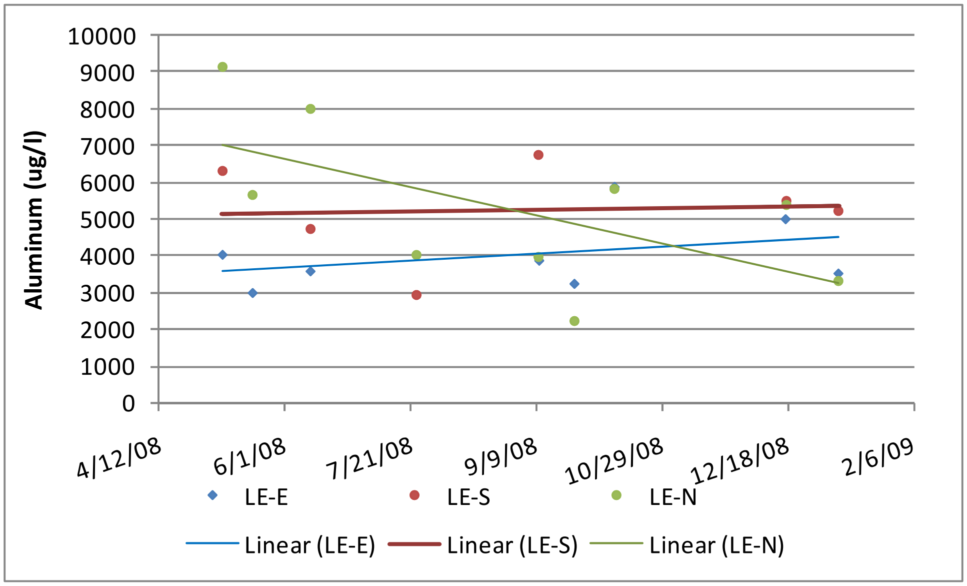


Exhibit 35. Least Squares Regression Lines for Leachate Aluminum (May 2008 to January 2009)

Location	Number of Data	Least Squares Regression Line	Correlation Coefficient (r^2)
LE-E	8	Aluminum = (3.8 * Date) + 149,310	0.1398
LE-S	6	Aluminum = (0.9 * Date) + 31,796	0.0048
LE-N	9	Aluminum = (-15.4 * Date) + 615,321	0.3815

Exhibit 36. Aluminum vs. Time
(May 2008 to January 2009)



Aluminum outlier measurements removed were:

Location	Date	Result	Units
LE-E	7/23/08	43800	ug/l
LE-S	5/19/08	19800	ug/l
LE-S	9/24/08	1300000	ug/l
LE-S	10/10/08	114000	ug/l

RECOMMENDATIONS FOR FURTHER MONITORING

Weekly leachate indicator parameters such as COD and Aluminum generally do not show statistically significant increasing or decreasing trends. Operationally, there is no value gained from bimonthly readings. Hence the monitoring frequency can be reduced to quarterly.

6 LEACHATE APPENDIX 1 PARAMETERS

Order 4.A.12 of the March 2007 FF&Os requires Countywide to sample the leachate collected from Cells 1 through 6A for the parameters listed in OAC 3745-27-10 Appendix I, including VOCs, metals, and non-metal inorganics on a monthly basis. Countywide proposes to modify the sampling frequency to quarterly. A statistical evaluation has been performed to see it the change in frequency has any significant impact on the trend and/or interpretation of the data.

SUMMARY OF MONITORING DATA

This report examined bimonthly leachate indicator parameters measured between April 2007 and March 2009.

SUMMARY OF STATISTICAL ANALYSES

Methods

SCS used the method of least squares estimation to explore the relationship over time between leachate Appendix I parameters. Select leachate Appendix I parameters were regressed over time to assess increasing or decreasing trends.

The proportion of variability in leachate indicator parameters which can be explained by the least squares regression equation is defined as the coefficient of determination. The coefficient of determination (often called r^2) is restricted to the range from -1 to 1. An r^2 value of 1 happens only when all the data points lie on a straight line. On the other hand, an r^2 value close to zero indicates a weak linear relationship between leachate temperature and time.

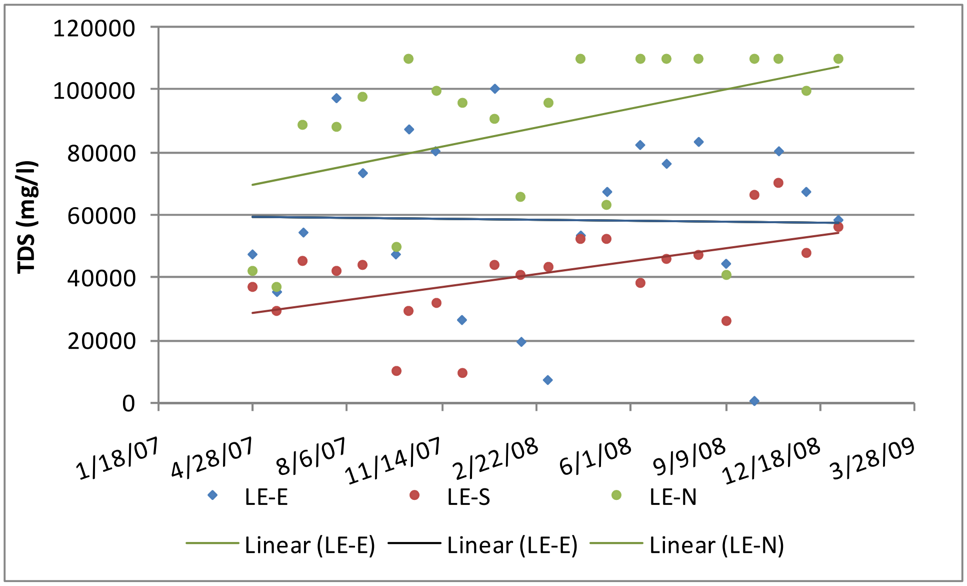
Results

Total Dissolved Solids (TDS) does not appear to have significant increasing or decreasing trends as indicated on the plot and the low r^2 values.

Exhibit 37. Least Squares Regression Lines for Leachate TDS (April 2007 to March 2009)

Location	Number of Data	Least Squares Regression Line	Correlation Coefficient (r^2)
LE-E	22	TDS = (-3.2 * Date) + 183,552	0.0005
LE-S	22	TDS = (41.2 * Date) – 2,000,000	0.2837
LE-N	22	TDS = (60.4 * Date) – 2,000,000	0.2047

Exhibit 38. TDS vs. Time (April 2007 to January 2009)

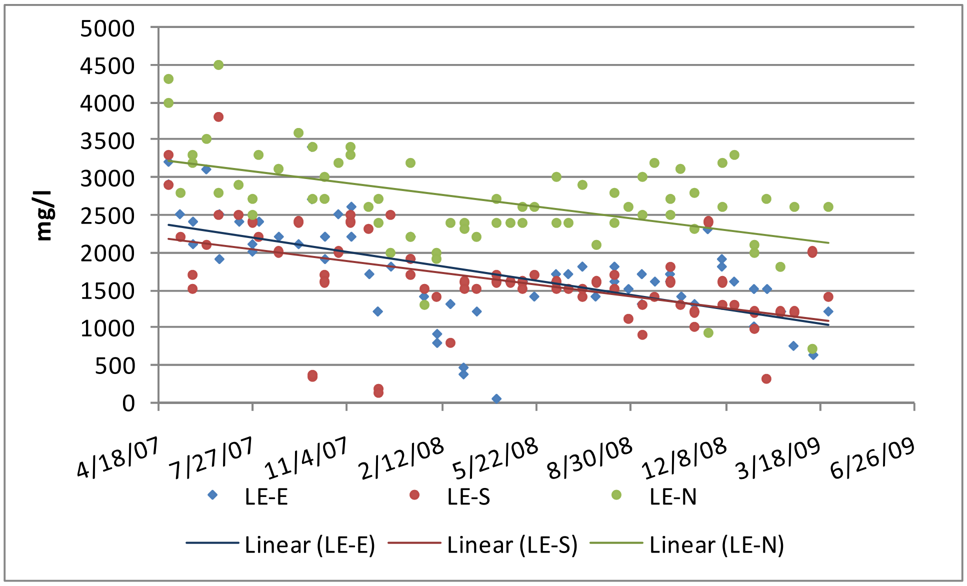


Ammonia does not appear to have significant increasing or decreasing trends as indicated on the plot and the low r^2 values.

Exhibit 39. Least Squares Regression Lines for Leachate Ammonia (April 2007 to March 2009)

Location	Number of Data	Least Squares Regression Line	Correlation Coefficient (r^2)
LE-E	22	TDS = (-1.9 * Date) + 63,991	0.3485
LE-S	22	TDS = (-1.6 * Date) + 63,520	0.2284
LE-N	22	TDS = (-1.6 * Date) + 63,991	0.2381

Exhibit 40. Ammonia vs. Time (April 2007 to March 2009)



RECOMMENDATIONS FOR FURTHER MONITORING

Because TDS and ammonia data do not have significant trends it is believed that the monitoring frequency could be reduced to quarterly.

7 NON-STATISTICAL ANALYSES

TO-15; HYDROGEN, ACETYLENE, AMMONIA, AND METHANE ANALYSES

Order 4.A.8 of the March 2007 FF&Os requires Countywide to sample all landfill gas extraction wells with temperatures greater than 150° F or CO readings greater than 100 ppmv and analyze the gas samples for TO-15C, hydrogen, acetylene, ammonia, and methane on a monthly basis. Countywide proposes to modify the sampling locations for the above laboratory analyses from the landfill gas extraction wells to the gas header sampling locations. The frequency of the sampling and analysis for ASTM D 1946 parameters (hydrogen, acetylene, ammonia, and methane) would be monthly. The frequency of the sampling and analysis for TO-15 would be quarterly. Additional D-1946 samples would be obtained monthly at the flare sampling locations for the purpose of determining caloric content of the combined gas flow combusted by the flare. Sampling and analysis for acetylene and ammonia would be eliminated.

This sampling can be conducted at the gas header sampling locations because:

- No decisions regarding remedial measures have or will be made based on the concentrations of these parameters at individual wells.
- A sufficient amount of baseline data has been collected to allow for future comparisons of conditions at the existing landfill gas extraction well locations, if they are required,
- Additional data will not provide useful data that will assist in characterizing conditions in the reaction area,
- Evaluation of the data shows that higher concentrations of VOCs are present where the wellhead temperatures are higher so that wellhead temperature can serve as a surrogate for VOC analysis (and as a field reading, wellhead temperature will give a real time indications of conditions, as opposed to waiting weeks for the results of laboratory analysis),
- The evaluation of the VOCs and hydrogen in the gas at the main headers feeding the blower flares will provide an indication in the event of a significant change in conditions that would warrant further testing at the individual gas extraction wells.

Previous evaluations have shown that the overall non-detect rate for the TO-15 parameters is approximately 66 percent. 18 of the 57 parameters were never detected. Only 11 parameters were detected at a 75 percent or greater frequency. In general, VOC concentrations have been stable or are declining over time and do not reveal any information that is useful in managing conditions in the remediation area.

Acetylene and ammonia are also considered byproducts of the aluminum reaction. The sampling and analysis of acetylene has proven to be problematic due to interferences in the laboratory analysis and its reactivity in the subsurface landfill environment. The laboratory analysis of ammonia in the landfill gas has proven to be problematic and the samples are being evaluated semi-quantitatively with Drager tubes. In addition, ammonia is very water soluble and tends to entrain in the leachate rather than the gas. The analysis of acetylene and ammonia can be eliminated with no impact to the operation and maintenance activities for the remediation area.

MONTHLY AERIAL INFRARED IMAGING

Order 4.A.10 of the March 2007 FF&Os requires Countywide to obtain infrared images of the facility on a monthly basis. Countywide proposes that the frequency be reduced from monthly to quarterly. Review of the aerial infrared images collected to date indicates that this methodology is not capable of detecting the subsurface aluminum/secondary waste reaction. It appears to be capable of detecting accumulations of leachate beneath the temporary membrane liner and warm gases where cracking has occurred in the ground under the cap. No decisions regarding remedial measures have or will be made based on these images. The revised schedule is sufficient as these images serve as confirmation of conditions that are identifiable in the field by other methods, including direct inspection.

TO-13A AND TO-9 ANALYSES

Order 4.A.11 of the March 2007 FF&Os requires Countywide to sample of each landfill gas extraction well exhibiting temperatures greater than 170° F of CO readings greater than 100 ppmv for TO-13A and TO9 on a monthly basis.

TO-13A

Countywide proposes that the TO-13 sampling be eliminated because:

- No decisions regarding remedial measures have or will be made based on the concentrations of these parameters at individual wells.
- A sufficient amount of baseline data has been collected to allow for future comparisons of conditions at the existing landfill gas extraction well locations, if they are required,
- Continued analysis at this frequency will not provide useful data that will assist in characterizing conditions in the reaction area,
- As expected, evaluation of the data shows that higher concentrations of semi-volatiles and PAHs are present where the wellhead temperatures are high so that wellhead temperature can serve as a surrogate for these analyses (and as a field reading, wellhead temperature will give a real time indications of conditions, as opposed to waiting weeks for the results of laboratory analysis),
- The evaluation of the compounds in the gas at the main header lines feeding the operating blower flares will identify any significant change in conditions that would warrant further testing at the individual gas extraction wells.

Previous evaluations have shown that the overall non-detection rate for the TO-13A parameters is approximately 91 percent. 42 of the 66 parameters were never detected and only 5 parameters were detected at a 50 percent or greater frequency.

Within the area of investigation, the wells with high semi-volatile organic compound and polynuclear aromatic hydrocarbon compound concentrations are those wells within the reaction area that also exhibit elevated temperatures. The presence or absence or concentration of individual TO-13A compounds does not provide any unique insight into the reaction status. There is no readily available industry wide database for these compounds for comparison. The significant amount of data generated in the past four months has resulted in an extensive baseline of information that makes continued analysis at the current number of sampling points and frequency unnecessary. The nature of the sample collection and laboratory analysis for this parameter group is that reducing the number of parameters reported does not change the effort and expense of sample collection or the laboratory analytical costs, since the same procedure is run, just reporting results for fewer parameters.

The evaluation of these parameters at the flares will provide a general characterization of reaction conditions over time.

TO-9

Countywide proposes to modify the sampling locations for the TO-9 analyses from the landfill gas extraction wells to the gas header sampling locations shown on the attached Figure 1, Gas Management Schematic. The frequency of the sampling and analysis for TO-9 parameters would be quarterly.

This sampling can be conducted at the gas header sampling locations because:

- No decisions regarding remedial measures have or will be made based on the concentrations of these parameters at individual wells.
- A sufficient amount of baseline data has been collected to allow for future comparisons of conditions at the existing landfill gas extraction well locations, if they are required,
- Additional data will not provide useful data that will assist in characterizing conditions in the remediation area,
- Evaluation of the data shows that higher concentrations of dioxins and furans are not necessarily present near the reaction area/wells with elevated wellhead temperatures and do not appear to be as closely related to the reaction as other parameters. The spikes in TO-9 parameter concentrations appear to be random and typically do not exist at the next monthly sampling event.
- A trigger value of 10,000 pg/m3 has been proposed. If the concentration at a gas header sampling location exceeds this trigger, the individual wells within the collection area of that header will be sampled and analyzed for TO-9 to attempt to determine the location where these compounds are originating.

Previous evaluations have shown that the overall detection rate for the TO-9 parameters is approximately 27 percent. Only 3 parameters were detected at a 75 percent or greater frequency.

Within the area of investigation, the wells with higher concentrations of dioxins and furans are more widely distributed compared with those wells with high TO-15 and TO-13A compounds which are generally located within the reaction area as defined by elevated wellhead temperatures. It is Countywide's position that the presence or absence of TO-9 compounds does not provide any unique insight into the reaction status. There is no readily available industry wide database for these compounds in landfill gas for comparison. The nature of the sample collection and laboratory analysis for this parameter group is that reducing the parameters reported does not change the effort and expense of sample collection or the laboratory analytical costs, since the same procedure is run, just reporting results for fewer parameters.

MBAS AND GLYCOL ANALYSES

Order 4 of the December 31, 2007 DFF&Os required that Countywide sample the liquid within selected landfill gas extraction wells and analyze for MBAS (Methylene Blue Active Substances) and glycol related compounds on a monthly basis. Countywide is proposing that these sampling requirements be eliminated. The sampling performed to date has established the presence of these surfactants in the liquid in the landfill gas extraction wells and has determined that the presence and/or absence of MBAS and glycols is not related to increases or decreases in well temperatures..

Glycols and MBAS' are typically present at low levels in household waste products. In addition, Countywide has received significant quantities of a liquid waste product from a large soap manufacturer for many years. This liquid waste was solidified and added to landfill, resulting in disposal of additional glycols and MBAS constituents.

Countywide has evaluated the concentrations of glycol related compounds against wellhead temperature. The parameters analyzed included:

- diethylene glycol monobutyl ether,
- dipropylene glycol monomethyl ether,
- ethylene glycol monobutyl ether, and
- propylene glycol.

There are approximately 119 gas extraction wells which have been sampled for glycol compounds. 110 wells had reportable concentrations of one of the four parameters. 85 wells had more than one data point for any of the four compounds. Graphs of glycol compound concentration and wellhead temperature over time were plotted for these wells. The graphs are presented in Appendix B. Most of these wells do not exhibit significant changes in glycol concentrations, do not show any apparent relationship between glycol concentration and wellhead temperature, or show an apparent relationship opposite to the hypothesized relationship, i.e. there is a temperature decrease associated with increased glycol compound concentrations.

There are some wells where the hypothesized potential relationship is sufficiently visually apparent to warrant further evaluation. Examples include the following wells. For each of these examples, specific operational causes for the decreases in the wellhead temperatures at each of these wells have identified by AEG and are listed after each well.

- D1 – watered in due to need to remove pump that was causing foaming
- PW-122R – no vacuum due to watered out or crushed lateral
- PW-127 – no vacuum due to construction on lateral
- PW-151 - watered in during the low temperature periods.
- PW-158 – lateral filled with liquid or frozen
- PW-161 – lateral filled with liquid
- PW-310 – well casing cracked by equipment
- V1 – lateral filled with liquid
- W-12R – valve closed slightly during tuning followed by decrease in available vacuum, resulting in no flow
- W-13R – valve closed slightly during tuning followed by decrease in available vacuum, resulting in no flow
- W-32 – broken well casing, obstructed at 32 feet, abandoned.

In each of the cases, a decrease or cessation of the flow of landfill gas through the wellhead, due to various operational issues, caused the wellhead temperature to approach or reach ambient air temperature.

In summary, the relationship of increased glycol compound concentration to decreased wellhead temperature was not supported. Short term drops in wellhead temperature are typically due to reduced landfill gas flow and not to increased glycol compound concentrations. No longer term changes to wellhead temperature appeared to be correlated with increased glycol compound concentrations. The spikes in the concentration of glycol compounds generally appeared to be random and typically did not exist through the next sampling event.

Appendix A

Data Summary

Wellhead and Downhole Temperature Measurements

			Downhole Depth (feet)											
Well	Date	Wellhead	10	20	30	40	50	60	70	80	90	100	110	120
A2	12/06/07	114.0	82.4	86.0	89.6	91.4	93.2							
A2	02/27/08	109.0	102.2	104.0	104.0	105.8	123.8	123.8						
A2	01/26/09	120.5	80.6	86.0	87.8	91.4	127.4	131.0						
B1	04/16/07	187.5	195.8											
B1	08/24/07	190.0	206.6											
B2R	06/29/07	160.0	168.8	168.8	168.8	168.8	168.8	168.8						
B2R	07/11/07	192.5	174.2	174.2	172.4	172.4	177.8							
B2R	02/15/08	185.0	170.6	176.0	179.6	179.6	179.6	179.6						
B2R	03/24/08	183.0	163.4	170.6	170.6	165.2	156.2	156.2						
B2R	10/08/08	187.5	179.6	177.8	176.0	176.0	176.0							
B2R	11/24/08	187.5	185.0	195.8	195.8	201.2	204.8							
C1R	01/09/08	87.5	64.4	132.8	143.6									
C1R	05/19/08	101.8	145.4	152.6	158.0									
C2R	01/29/09	136.0	87.8	95.0	107.6	114.8	136.4	141.8	141.8	143.6	143.6	143.6	141.8	
D1	01/09/08	100.8	68.0	73.4	120.2	129.2	134.6							
D1	12/04/08	130.5	98.6	129.2	143.6	145.4								
D1	01/26/09	104.0	86.0	129.2	131.0	132.8								
D2R	10/10/07	120.0	118.4	120.2	122.0	122.0	123.8	129.2	134.6	140.0	161.6	163.4	163.4	
D2R	05/20/08	94.8	91.4	100.4	105.8	111.2	116.6	122.0	129.2	156.2	161.6	163.4	163.4	
D2R	06/24/08	126.0	127.4	131.0	136.4	138.2	140.0	149.0	152.6	176.0	179.6	179.6	179.6	
D2R	10/08/08	129.0	111.2	113.0	116.6	122.0	127.4	132.8	136.4	159.8	159.8	158.0	159.8	
D2R	11/21/08	133.5	89.6	114.8	120.2	125.6	131.0	136.4	165.2	167.0	167.0	176.0	176.0	
D2R	02/06/09	122.0	78.8	80.6	84.2	89.6	95.0	102.2	127.4	140.0	149.0	154.4	158.0	
D2R	03/04/09	76.0	116.6	125.6	132.8	138.2	141.8	147.2	167.0	176.0	176.0	176.0	176.0	
E1	01/09/08	126.8	51.8	57.2	60.8	68.0	145.4	147.2						
E1	01/26/09	63.5	73.4	95.0	129.2	132.8	134.6	136.4						
E2R	10/10/07	93.0	127.4	129.2	131.0	131.0	132.8	136.4	140.0	147.2	159.8	159.8	159.8	
E2R	02/29/08	116.5	89.6	102.2	113.0	120.2	125.6	129.2	134.6	147.2	150.8	150.8	150.8	152.6
E2R	06/24/08	124.3	131.0	132.8	134.6	136.4	140.0	143.6	150.8	168.8	170.6	170.6	172.4	
E2R	12/03/08	128.0	98.6	105.8	113.0	118.4	123.8	129.2	149.0	154.4	158.0	158.0	158.0	
E2R	02/24/09	134.0	120.2	122.0	122.0	123.8	125.6	127.4	150.8	154.4	156.2	158.0	158.0	
E2R	03/04/09	93.0	134.6	138.2	141.8	145.4	147.2	149.0	167.0	168.8	168.8	168.8	168.8	
F1-M	01/26/09	119.0	46.4	66.2	120.2	127.4	127.4							
F2	10/10/07	122.0	93.2	100.4	107.6	118.4	120.2	140.0						
F2	12/06/07	121.5	82.4	91.4	105.8	114.8	118.4	134.6						
F2	06/11/08	120.5	136.4	140.0	141.8	141.8	141.8	150.8						
F2	12/15/08	122.8	96.8	109.4	118.4	118.4	120.2	134.6						
F2	02/24/09	122.5	80.6	111.2	114.8	116.6	120.2	127.4						
F2	03/04/09	121.5	102.2	129.2	131.0	132.8	141.8	143.6						
I1R	01/26/09	152.0	105.8	113.0	122.0	125.6	138.2	138.2	140.0	140.0	140.0	140.0	140.0	
K1	12/06/07	129.0	77.0	91.4	123.8									
K1R	01/26/09	108.7	62.6	68.0	73.4	129.2	134.6							
N1R	09/19/08	135.0	98.6	109.4	122.0	129.2	134.6	140.0	141.8	143.6	143.6	143.6	143.6	143.6
PW-0041R(2)	11/06/07	144.0	129.2	145.4	158.0	185.0	181.4							
PW-0041R(2)	04/03/08	146.5	138.2	150.8	152.6	186.8	190.4	190.4	190.4	190.4				
PW-0041R(2)	11/10/08	176.5	161.6	163.4	176.0	185.0	194.0	190.4						
PW-0041R(2)	01/23/09	192.0	163.4	174.2	183.2	190.4	195.8							
PW-101	01/09/08	133.0	57.2	64.4	77.0	84.2								
PW-101	01/26/09	48.5	59.0	77.0	100.4	109.4	118.4	134.6	136.4					
PW-102	08/24/07	196.0	212.0	215.6	219.2									
PW-102	10/29/07	189.5	199.4	204.8	208.4									
PW-103R	02/11/08	114.0	95.0	100.4	107.6	118.4	125.6	131.0	129.2	129.2	131.0	132.8		
PW-103R	05/20/08	123.8	111.2	118.4	122.0	127.4	132.8	136.4	138.2	141.8	145.4	149.0		
PW-103R	06/30/08	124.5	122.0	123.8	125.6	131.0	138.2	141.8	143.6	149.0	154.4	154.4		
PW-103R	12/29/08	129.0	95.0	100.4	104.0	109.4	114.8	120.2	134.6	147.2	147.2	149.0		

			Downhole Depth (feet)											
Well	Date	Wellhead	10	20	30	40	50	60	70	80	90	100	110	120
PW-103R	01/26/09	126.0	69.8	82.4	84.2	98.6	104.0	107.6	138.2	143.6	147.2	147.2		
PW-104	03/24/08	136.5	131.0	131.0	132.8	138.2	152.6	154.4	154.4					
PW-104	10/08/08	153.5	147.2	150.8	150.8	154.4	158.0	158.0	159.8					
PW-104	02/09/09	163.0	134.6	140.0	147.2	156.2	159.8	165.2	167.0					
PW-105	07/25/07	173.5	197.6	204.8	206.6	206.6	206.6	204.8						
PW-105	11/05/07	177.0	186.8	199.4	199.4	204.8	206.6	203.0						
PW-105	12/20/07	183.5	159.8	167.0	190.4									
PW-105	09/11/08	200.0	199.4	203.0	203.0	206.6	206.6							
PW-105	10/08/08	156.2	177.8	192.2	194.0	201.2								
PW-105	01/29/09	186.0	150.8	172.4	174.2	177.8								
PW-106R	11/30/07	187.0	185.0	190.4	192.2	186.8	186.8							
PW-106R	03/28/08	191.0	192.2	194.0	194.0	188.6	186.8	185.0						
PW-106R	06/30/08	188.5	195.8	197.6	199.4	192.2	190.4	190.4						
PW-106R	08/08/08	191.0	195.8	195.8	201.2	197.6	194.0	192.2						
PW-106R	12/09/08	185.5	174.2	176.0	179.6	183.2	181.4	174.2						
PW-107	04/01/08	115.0	111.2	113.0	114.8	116.6	138.2	140.0						
PW-107	11/06/08	130.0	109.4	116.6	120.2	123.8	125.6							
PW-107	02/26/09	127.0	105.8	122.0	123.8	132.8	136.4							
PW-107	03/11/09	120.0	69.8	78.8	89.6	102.2	109.4							
PW-108	07/26/07	192.0	195.8	197.6	208.4	208.4	208.4							
PW-108	11/06/07	104.0	174.2	176.0	194.0	194.0	192.2							
PW-108	02/08/08	38.0	159.8	183.2	190.4	197.6	197.6	197.6						
PW-108	04/03/08	183.0	177.8	179.6	181.4	181.4	186.8							
PW-108	07/17/08	185.5	185.0	192.2	203.0	206.6	208.4							
PW-108	09/17/08	196.5	201.2	201.2	203.0	203.0	208.4							
PW-108	01/29/09	22.5	159.8	161.6	163.4	165.2	168.8							
PW-108	02/27/09	123.3	199.4	201.2	201.2	203.0								
PW-109	05/01/08	86.5	84.2	86.0	87.8									
PW-109	07/24/08	87.0	89.6	91.4	91.4									
PW-109	03/11/09	94.0	66.2	68.0	69.8									
PW-110	02/08/08	84.8	35.6	41.0	87.8									
PW-110	05/01/08	89.0	86.0	87.8	102.2									
PW-110	07/24/08	90.5	87.8	89.6	96.8									
PW-110	08/04/08	93.0	77.0	84.2	100.4									
PW-110	03/11/09	67.0	66.2	68.0	84.2									
PW-111	02/06/08	132.5	73.4	77.0	86.0	93.2	98.6	104.0						
PW-111	05/01/08	134.5	96.8	113.0	122.0	125.6	131.0	140.0						
PW-111	07/25/08	135.3	102.2	113.0	125.6	127.4	131.0	134.6						
PW-111	11/06/08	123.0	78.8	87.8	98.6	104.0	109.4	113.0						
PW-111	03/11/09	88.5	71.6	77.0	80.6	84.2	86.0	91.4						
PW-112	05/01/08	131.0	86.0	91.4	95.0	102.2	109.4	118.4	123.8					
PW-112	06/05/08	129.3	107.6	116.6	129.2	138.2	143.6	147.2	150.8					
PW-112	07/07/08	128.8	111.2	114.8	123.8	132.8	136.4	140.0	143.6					
PW-112	11/06/08	133.0	93.2	105.8	116.6	123.8	127.4	129.2	132.8					
PW-112	03/11/09	126.0	89.6	89.6	89.6	91.4	93.2	96.8	102.2					
PW-113	04/01/08	131.0	91.4	93.2	93.2	96.8	98.6	102.2	109.4					
PW-113	11/06/08	137.0	86.0	107.6	120.2	131.0	136.4	140.0	141.8					
PW-113	02/26/09	129.0	134.6	138.2	140.0	147.2	149.0	152.6	154.4					
PW-113	03/11/09	129.0	78.8	87.8	95.0	104.0	111.2	120.2	127.4					
PW-114	11/06/07	138.3	127.4	138.2	149.0	174.2	181.4	177.8	159.8					
PW-114	10/08/08	157.0	158.0	161.6	165.2	170.6	183.2	185.0	181.4					
PW-114	11/10/08	167.5	159.8	167.0	172.4	183.2	190.4	190.4	188.6	183.2				
PW-114	01/23/09	155.0	134.6	158.0	163.4	172.4	183.2	188.6	190.4					
PW-115	04/12/07	189.0	186.8	194.0	197.6	224.6	219.2	221.0						
PW-115	07/26/07	209.0	208.4	210.2	212.0	215.6	217.4	219.2						

			Downhole Depth (feet)											
Well	Date	Wellhead	10	20	30	40	50	60	70	80	90	100	110	120
PW-115	10/22/07	176.0	190.4	194.0	201.2	203.0	206.6	210.2	213.8					
PW-115	11/06/07	186.5	194.0	195.8	197.6	194.0	199.4							
PW-115	02/08/08	168.0	152.6	176.0	194.0	195.8	197.6	197.6						
PW-115	04/03/08	174.5	185.0	186.8	194.0	199.4	201.2	203.0						
PW-115	07/17/08	200.5	215.6	215.6	215.6	215.6	215.6	217.4						
PW-115	08/08/08	194.0	204.8	206.6	206.6	208.4								
PW-115	09/17/08	199.0	204.8	204.8	204.8									
PW-115	11/26/08	201.5	179.6	188.6	192.2	190.4	188.6	206.6						
PW-116	04/12/07	184.5	179.6											
PW-116	11/06/07	40.0	46.4											
PW-116	01/08/08	162.5	167.0											
PW-116	02/08/08	130.0	122.0											
PW-116	04/03/08	169.5	158.0											
PW-117	07/26/07	199.0	210.2	212.0	212.0	212.0	213.8	213.8						
PW-117	08/24/07	195.0	215.6	215.6	215.6	215.6	215.6	215.6	215.6	215.6	215.6			
PW-117	04/03/08	195.0	201.2	203.0	204.8	204.8	204.8	204.8						
PW-117R	08/08/08	201.0	206.6	206.6	206.6									
PW-117R	09/17/08	201.0	197.6	199.4	201.2									
PW-117R	01/23/09	196.5	179.6	185.0	186.8									
PW-117R	02/03/09	199.0	167.0	167.0	168.8									
PW-118	04/12/07	192.0	192.2	194.0										
PW-118	05/08/07	191.0	204.8	204.8	208.4	208.4	208.4							
PW-118	11/06/07	190.0	195.8	195.8	197.6	197.6								
PW-118	01/10/08	191.0	185.0											
PW-118	01/23/08	190.0	183.2	188.6	195.8	201.2								
PW-118R	11/10/08	194.0	183.2	185.0	186.8	183.2	179.6	172.4	170.6	165.2				
PW-118R	01/23/09	196.0	183.2	188.6	190.4	186.8	183.2	177.8	172.4	168.8				
PW-119	07/27/07	198.0	181.4	181.4	181.4									
PW-119	01/17/08	195.5	185.0	188.6	192.2	192.2	192.2							
PW-119	03/28/08	194.0	194.0	195.8	197.6									
PW-119R	08/08/08	185.0	192.2	194.0	201.2	208.4	212.0	213.8						
PW-119R	01/23/09	198.0	176.0	179.6	183.2	188.6	190.4	197.6						
PW-120	07/23/07	193.5	208.4	188.6	188.6									
PW-120	11/30/07	182.0	188.6	194.0	195.8	195.8	195.8							
PW-120	12/07/07	190.0	188.6	194.0	195.8	197.6								
PW-120	01/08/08	174.0	188.6	190.4	194.0									
PW-120	06/06/08	186.5	192.2	206.6	206.6	206.6	208.4							
PW-120	07/17/08	192.5	203.0	203.0	212.0									
PW-120	12/09/08	186.0	172.4	197.6	204.8									
PW-121R	10/08/07	188.8	203.0											
PW-121R	08/08/08	195.5	203.0	206.6										
PW-121R	12/09/08	187.5	186.8											
PW-121R	02/27/09	173.5	179.6											
PW-122R	10/08/07	187.3	199.4	206.6										
PW-122R	08/08/08	174.0	194.0	197.6	206.6									
PW-123	09/28/07	189.0	203.0	203.0	206.6	210.2	212.0							
PW-123	11/05/07	197.5	203.0	206.6	213.8	213.8	217.4	221.0						
PW-123	01/18/08	197.0	183.2	186.8	195.8	201.2	204.8	210.2						
PW-123	02/15/08	192.0	183.2	195.8	203.0	206.6	210.2	217.4						
PW-123	09/18/08	193.0	201.2	204.8	208.4	213.8	217.4	221.0						
PW-123	10/08/08	198.0	192.2	194.0	197.6	201.2	206.6	208.4						
PW-123	11/24/08	197.0	194.0	199.4	203.0	210.2	213.8	215.6						
PW-123	12/23/08	197.0	179.6	195.8	197.6	201.2	203.0	204.8						
PW-124	04/12/07	188.0	176.0	183.2	190.4	192.2								
PW-124	09/24/07	175.5	201.2											

			Downhole Depth (feet)											
Well	Date	Wellhead	10	20	30	40	50	60	70	80	90	100	110	120
PW-124	10/24/07	186.0	195.8	197.6	199.4	199.4	197.6							
PW-124	02/08/08	188.0	170.6	181.4	190.4	194.0	195.8							
PW-124	07/17/08	180.3	197.6	201.2	203.0	208.4	212.0							
PW-124	08/08/08	181.5	185.0	192.2	194.0	199.4	203.0							
PW-124	09/17/08	199.0	199.4	201.2	203.0	203.0	203.0							
PW-124	11/26/08	188.0	174.2	183.2	185.0	185.0	186.8							
PW-124	01/23/09	199.0	177.8	181.4	190.4	192.2	194.0							
PW-125	12/29/08	124.5	96.8	100.4	109.4	113.0	127.4	134.6	134.6					
PW-127	04/11/08	140.5	122.0	131.0	134.6	138.2	141.8	154.4	156.2					
PW-127	09/19/08	136.5	116.6	125.6	134.6	145.4	161.6	167.0						
PW-127	01/26/09	134.5	91.4	100.4	113.0	131.0	159.8	163.4	163.4					
PW-128	04/16/08	132.3	127.4	136.4	143.6	147.2	152.6	158.0	159.8	163.4	167.0	167.0	167.0	
PW-128	08/07/08	136.0	127.4	132.8	140.0	145.4	154.4	159.8	163.4	165.2	167.0	167.0	167.0	
PW-128	09/19/08	137.0	104.0	118.4	129.2	138.2	145.4	150.8	154.4	163.4	165.2	167.0	167.0	
PW-128	01/26/09	123.0	91.4	98.6	111.2	125.6	132.8	136.4	138.2	152.6	152.6	152.6	152.6	
PW-129	04/16/08	133.5	134.6	140.0	143.6	147.2	149.0	156.2	158.0	165.2	168.8	168.8	168.8	
PW-129	09/19/08	135.5	86.0	107.6	123.8	134.6	143.6	149.0	154.4	161.6	165.2	165.2	165.2	
PW-129	01/26/09	134.0	80.6	96.8	109.4	120.2	131.0	136.4	140.0	149.0	150.8	150.8		
PW-131	06/24/08	162.3	129.2	141.8	168.8	176.0								
PW-131R	08/07/08	156.5	159.8	163.4	165.2	158.0	154.4	154.4	154.4					
PW-131R	09/18/08	159.0	161.6	163.4	168.8	161.6	152.6	152.6	152.6					
PW-131R	01/29/09	62.0	104.0	123.8	131.0	149.0	152.6	154.4	154.4					
PW-131R	02/09/09	162.5	120.2	131.0	138.2	147.2	161.6	167.0	168.8					
PW-132	05/08/07	158.0	163.4	165.2	165.2	167.0	167.0							
PW-132	07/26/07	205.0	181.4	181.4	183.2	185.0	185.0							
PW-132	02/15/08	189.5	161.6	174.2	185.0	190.4								
PW-132	04/03/08	192.0	192.2	195.8	203.0	204.8								
PW-132	05/19/08	188.5	165.2	174.2	188.6	194.0								
PW-132R	09/18/08	193.0	197.6	197.6	199.4	204.8	206.6							
PW-132R	10/02/08	144.0	192.2	194.0	195.8	197.6	204.8							
PW-132R	01/29/09	198.0	161.6	163.4	165.2	167.0	168.8							
PW-133	10/29/07	186.0	195.8	201.2	204.8	204.8	203.0	201.2	203.0	213.8	222.8			
PW-133	01/31/08	153.0	150.8											
PW-134	01/08/08	164.0	134.6											
PW-134	07/30/08	129.5	100.4											
PW-135	01/08/08	199.5	176.0											
PW-135	04/03/08	177.0	181.4											
PW-136	04/12/07	191.0	194.0											
PW-136	06/06/07	195.0	203.0											
PW-136	11/06/07	196.0	195.8											
PW-136	01/08/08	64.0	77.0											
PW-136	02/08/08	38.5	86.0											
PW-137	04/12/07	187.5	186.8											
PW-137	11/06/07	191.0	181.4											
PW-137	01/08/08	191.5	118.4											
PW-137	02/08/08	190.5	116.6											
PW-137	04/03/08	192.0	172.4											
PW-138	04/12/07	190.5	186.8											
PW-138	11/06/07	194.0	192.2											
PW-138	01/08/08	196.0	192.2											
PW-138	02/08/08	189.0	190.4											
PW-142	08/24/07	195.0	212.0	215.6	217.4	222.8	224.6	230.0	233.6					
PW-142	02/13/08	190.5	183.2	195.8	201.2	206.6	212.0	215.6	221.0					
PW-142	04/03/08	202.5	201.2	203.0	204.8	206.6	208.4	206.6	206.6					
PW-142R	08/08/08	193.5	203.0	204.8	206.6	208.4	210.2	210.2	210.2					

			Downhole Depth (feet)											
Well	Date	Wellhead	10	20	30	40	50	60	70	80	90	100	110	120
PW-142R	09/17/08	194.5	195.8	195.8	197.6	201.2	201.2	201.2	201.2					
PW-142R	01/23/09	190.5	179.6	181.4	183.2	186.8	190.4	192.2	194.0					
PW-143	04/12/07	189.5	190.4											
PW-143	11/06/07	70.0	150.8											
PW-143	01/08/08	197.0	186.8											
PW-143	02/08/08	191.0	188.6											
PW-143	04/03/08	189.5	190.4											
PW-144	04/16/08	111.3	113.0	116.6	122.0	131.0	136.4	152.6	154.4	154.4	156.2			
PW-144	08/07/08	142.5	131.0	131.0	143.6	149.0	152.6	156.2	158.0	159.8	159.8			
PW-145	01/22/09	134.5	105.8	107.6	111.2	114.8	129.2	132.8	136.4	140.0	141.8	141.8	143.6	
PW-146	04/11/08	133.0	105.8	120.2	127.4	131.0	136.4	140.0	140.0	141.8	145.4	147.2	149.0	
PW-146	01/22/09	80.3	80.6	93.2	102.2	109.4	116.6	122.0	132.8	141.8	143.6	145.4	145.4	
PW-147R	10/09/08	198.0	195.8	201.2	203.0	204.8	206.6	208.4	210.2					
PW-148	04/16/08	84.0	138.2	201.2	204.8	206.6								
PW-148	06/06/08	197.0	206.6	210.2	215.6	221.0								
PW-148	12/09/08	195.5	197.6	206.6	213.8	217.4								
PW-149	06/26/08	181.0	192.2	195.8	199.4	201.2	204.8							
PW-149	08/08/08	192.0	195.8	204.8	208.4	210.2								
PW-149	02/27/09	133.0	158.0	188.6	201.2	201.2								
PW-14R(3)	02/14/08	71.0	64.4	170.6	181.4	183.2								
PW-14R(3)	03/28/08	183.0	179.6	186.8	192.2	192.2								
PW-14R(3)	07/17/08	150.0	168.8	176.0	195.8	197.6								
PW-14R(3)	08/08/08	158.5	167.0	183.2	186.8									
PW-14R2(M)	04/23/07	175.0	199.4	212.0										
PW-150	01/08/08	180.0	181.4	186.8	186.8	188.6								
PW-150	02/13/08	130.0	181.4	185.0	188.6	188.6								
PW-150	06/06/08	194.0	203.0	204.8	206.6	206.6								
PW-150	08/08/08	200.0	206.6	208.4	208.4	208.4								
PW-150	12/09/08	196.0	199.4	203.0	208.4	208.4								
PW-150	01/23/09	195.0	179.6	188.6	190.4	194.0								
PW-151	11/30/07	162.0	129.2	165.2	170.6									
PW-151	01/08/08	180.5	163.4	168.8	174.2									
PW-151	03/25/08	59.5	140.0	192.2	194.0									
PW-151	08/29/08	196.5	199.4	199.4	201.2									
PW-151	02/27/09	191.5	185.0	190.4	194.0									
PW-152	11/30/07	168.0	165.2	168.8	179.6									
PW-152	12/07/07	167.0	174.2	172.4	181.4									
PW-152	07/17/08	183.0	188.6	190.4	206.6	206.6								
PW-152	08/08/08	184.0	190.4	190.4	201.2	210.2								
PW-152	12/09/08	185.5	190.4	197.6	206.6	206.6								
PW-153	04/23/07	187.0	197.6	194.0	204.8	206.6								
PW-153	07/23/07	185.0	204.8	204.8	206.6	194.0								
PW-153	10/22/07	171.0	199.4	201.2	201.2	199.4								
PW-153	11/29/07	186.0	190.4	192.2	192.2	190.4								
PW-153	12/07/07	190.0	190.4	190.4	190.4									
PW-153	01/08/08	189.0	186.8	188.6	190.4	192.2								
PW-153	02/13/08	190.0	183.2	186.8	188.6	190.4								
PW-153	06/06/08	194.5	195.8	197.6	204.8	206.6								
PW-153	07/17/08	197.0	203.0	204.8	206.6	212.0								
PW-153	08/08/08	199.5	203.0	203.0	204.8	206.6								
PW-153	12/09/08	189.7	192.2	197.6	203.0	204.8								
PW-153	01/23/09	197.0	190.4	190.4	192.2	195.8								
PW-154	04/23/07	191.0	203.0	203.0	208.4	208.4								
PW-154	11/30/07	190.0	179.6	186.8	194.0	194.0								
PW-154	12/07/07	189.0	186.8	190.4	194.0									

			Downhole Depth (feet)											
Well	Date	Wellhead	10	20	30	40	50	60	70	80	90	100	110	120
PW-154	01/08/08	197.5	183.2	186.8	190.4									
PW-154	02/13/08	181.5	167.0	168.8	174.2	176.0								
PW-154	03/28/08	187.0	188.6	188.6	197.6	199.4								
PW-154	06/06/08	188.5	192.2	192.2	197.6	206.6								
PW-154	08/08/08	191.0	199.4	199.4	203.0	212.0								
PW-154	12/09/08	192.0	179.6	186.8	194.0									
PW-154	01/23/09	196.0	172.4	179.6	181.4	190.4								
PW-155	04/23/07	190.0	188.6	190.4	199.4									
PW-155	05/21/07	186.0	197.6											
PW-155	07/23/07	190.0	206.6	208.4	213.8									
PW-155	10/08/07	190.0	206.6	208.4										
PW-155	12/07/07	190.0	190.4	194.0	195.8									
PW-155	03/28/08	168.0	188.6	188.6	199.4									
PW-155	06/26/08	179.0	181.4	188.6	203.0									
PW-155	08/08/08	191.5	199.4	203.0	210.2									
PW-155	12/09/08	188.0	154.4	176.0	183.2									
PW-157	04/16/08	128.3	114.8	123.8	129.2	134.6	143.6	145.4	149.0	158.0	159.8	159.8	159.8	
PW-157	01/22/09	90.0	95.0	98.6	120.2	136.4	140.0	141.8	145.4	149.0	150.8	152.6		
PW-158	03/28/08	119.3	59.0	71.6	82.4	102.2	114.8	118.4	127.4	129.2	131.0			
PW-158	04/16/08	124.0	71.6	77.0	87.8	104.0	116.6	122.0	127.4	132.8	132.8			
PW-158	05/30/08	132.5	118.4	161.6	161.6	161.6	161.6	161.6	161.6	161.6	161.6	161.6	161.6	
PW-158	07/01/08	130.8	100.4	122.0	136.4	147.2	149.0	152.6	161.6	161.6	161.6	159.8		
PW-158	08/29/08	140.3	129.2	143.6	145.4	149.0	158.0	158.0	158.0	158.0	159.8	159.8		
PW-158	09/19/08	135.8	127.4	143.6	143.6	150.8	158.0	159.8	158.0	158.0	158.0	159.8		
PW-159	02/27/08	115.5	102.2	104.0	107.6	111.2	113.0	116.6	123.8	134.6	136.4	138.2	138.2	
PW-159	12/29/08	123.0	91.4	95.0	98.6	104.0	111.2	116.6	131.0	138.2	140.0	141.8	141.8	
PW-159	01/26/09	124.0	89.6	95.0	102.2	107.6	109.4	118.4	136.4	138.2	140.0	140.0	138.2	
PW-160	12/29/08	139.5	75.2	89.6	104.0	111.2	116.6	118.4	120.2	136.4	141.8	143.6	145.4	
PW-160	01/26/09	133.5	96.8	100.4	100.4	104.0	109.4	114.8	120.2	138.2	141.8	141.8	143.6	
PW-161	02/27/08	122.5	66.2	66.2	68.0	68.0	69.8	89.6	89.6	134.6	145.4	149.0	150.8	
PW-161	12/29/08	133.0	59.0	68.0	77.0	95.0	102.2	141.8	147.2	149.0	149.0	150.8	150.8	
PW-161	01/26/09	135.5	69.8	82.4	93.2	104.0	111.2	143.6	147.2	147.2	147.2	147.2	147.2	
PW-162	02/08/08	39.0	48.2	53.6	59.0	64.4	80.6	84.2	122.0	134.6	143.6			
PW-162	01/26/09	133.0	89.6	104.0	118.4	127.4	131.0	152.6	156.2	156.2	156.2			
PW-162	02/08/08	39.0	48.2	53.6	59.0	64.4	80.6	84.2	122.0	134.6	143.6			
PW-162	01/26/09	133.0	89.6	104.0	118.4	127.4	131.0	152.6	156.2	156.2	156.2			
PW-163R	10/03/08	87.5	84.2	89.6	93.2	98.6	104.0	116.6	129.2	134.6	138.2			
PW-163R	12/04/08	103.0	68.0	82.4	96.8	113.0	122.0	156.2	158.0	158.0	156.2			
PW-163R	01/26/09	108.5	69.8	78.8	95.0	104.0	140.0	147.2	147.2	147.2	147.2			
PW-164	02/08/08	111.5	35.6	41.0	46.4	89.6	107.6	141.8	154.4	152.6	154.4	152.6	152.6	
PW-164	12/04/08	132.5	125.6	129.2	134.6	141.8	147.2	149.0	161.6	161.6	161.6	161.6		
PW-164	01/26/09	128.0	66.2	78.8	89.6	100.4	116.6	150.8	152.6	152.6	154.4	154.4	154.4	
PW-165	12/06/07	138.8	132.8	136.4	140.0	145.4	149.0	152.6	152.6	158.0	158.0	158.0	158.0	
PW-165	02/08/08	127.5	64.4	82.4	98.6	118.4	129.2	138.2	141.8	152.6	152.6	152.6	152.6	
PW-165	01/26/09	140.5	69.8	93.2	102.2	111.2	118.4	123.8	149.0	150.8	150.8	150.8	150.8	
PW-166	01/09/08	142.3	55.4	66.2	75.2	86.0	95.0	102.2	109.4	118.4	150.8	154.4	154.4	
PW-166	12/04/08	119.0	78.8	96.8	107.6	140.0	152.6	152.6	152.6	152.6	152.6	152.6	152.6	
PW-166	01/26/09	62.5	95.0	105.8	113.0	118.4	125.6	143.6	145.4	145.4	145.4	147.2		
PW-167	08/22/07	139.0	152.6	154.4	156.2	156.2	158.0	158.0	158.0	159.8	161.6	161.6		
PW-168(M)	02/08/08	134.5	53.6	55.4	60.8	62.6	68.0	73.4	138.2	141.8				
PW-168(M)	06/05/08	133.8	114.8	131.0	140.0	147.2	150.8	152.6	152.6	154.4				
PW-168(M)	07/07/08	134.5	125.6	141.8	143.6	149.0	152.6	152.6	154.4	158.0				
PW-168(M)	11/06/08	144.0	105.8	127.4	132.8	138.2	140.0	140.0	145.4	143.6				
PW-168(M)	03/11/09	130.0	113.0	114.8	118.4	123.8	129.2	132.8	147.2	149.0				
PW-169	05/01/08	124.0	91.4	91.4	93.2	95.0	105.8							

			Downhole Depth (feet)											
Well	Date	Wellhead	10	20	30	40	50	60	70	80	90	100	110	120
PW-169	06/05/08	124.0	107.6	113.0	120.2	131.0	143.6							
PW-169	07/07/08	124.5	120.2	116.6	118.4	122.0	131.0							
PW-169	11/06/08	125.5	75.2	82.4	89.6	100.4	114.8							
PW-169	03/11/09	123.0	71.6	71.6	73.4	75.2	84.2							
PW-170	02/06/09	154.5	84.2	122.0	125.6	134.6								
PW-171	01/26/09	108.0	46.4	57.2	68.0	116.6								
PW-172	01/26/09	111.5	73.4	82.4	89.6	96.8	118.4	143.6	145.4	145.4	147.2	147.2	147.2	
PW-173	04/11/08	109.5	91.4	104.0	111.2	116.6	118.4	120.2	120.2	120.2	122.0	125.6	125.6	
PW-173	06/24/08	132.0	113.0	122.0	127.4	129.2	136.4	140.0	141.8	154.4	154.4	154.4		
PW-173	11/21/08	127.5	86.0	100.4	109.4	113.0	120.2	136.4	141.8	138.2	141.8	141.8	147.2	
PW-173	02/03/09	129.0	77.0	89.6	95.0	122.0	122.0							
PW-173	03/04/09	132.3	136.4	141.8	145.4	147.2	147.2							
PW-174	04/11/08	87.8	138.2	143.6	149.0	152.6	158.0	158.0	158.0	159.8	159.8	159.8		
PW-174	06/30/08	143.8	147.2	149.0	152.6	159.8	159.8	159.8	159.8	158.0	159.8	159.8		
PW-174	09/11/08	142.0	150.8	152.6	152.6	141.8	141.8	141.8	141.8	141.8	141.8			
PW-174	10/08/08	125.4	158.0	159.8	167.0	172.4	170.6	172.4	174.2	176.0	176.0			
PW-174	01/02/09	159.0	150.8	154.4	165.2	177.8	179.6	181.4	181.4	183.2	183.2			
PW-174	02/06/09	174.5	152.6	159.8	165.2	170.6	174.2	176.0	176.0	177.8	177.8			
PW-175	10/08/08	199.0	192.2	194.0	194.0	195.8	194.0	194.0						
PW-175	01/29/09	188.5	168.8	168.8	168.8	170.6	172.4	174.2						
PW-175	02/09/09	198.0	185.0	188.6	192.2	194.0	194.0	195.8						
PW-176	10/08/08	183.0	177.8	181.4	183.2	194.0	195.8	195.8						
PW-176	01/29/09	187.0	154.4	154.4	156.2	158.0	163.4	168.8						
PW-176	02/09/09	200.5	181.4	186.8	190.4	194.0	197.6	199.4						
PW-177	06/05/08	96.0	86.0	93.2	98.6	104.0								
PW-177	11/03/08	96.5	98.6	98.6	100.4	102.2								
PW-177	12/10/08	95.0	50.0	64.4	78.8	98.6								
PW-177	01/19/09	98.0	59.0	64.4	73.4	102.2								
PW-177	02/02/09	93.0	42.8	60.8	62.6	96.8								
PW-178	11/03/08	78.0	68.0	68.0	68.0									
PW-179	06/05/08	99.0	86.0	95.0	98.6	104.0	113.0	113.0						
PW-179	07/24/08	101.5	66.2	73.4	78.8	86.0	105.8							
PW-179	11/03/08	100.5	89.6	93.2	95.0	96.8	100.4							
PW-179	12/10/08	91.0	51.8	59.0	68.0	77.0	104.0							
PW-179	01/19/09	90.0	48.2	57.2	64.4	69.8	95.0							
PW-179	02/02/09	95.0	41.0	50.0	55.4	62.6	91.4	93.2						
PW-180	11/10/08	109.5	82.4	107.6	118.4	120.2	125.6	129.2	134.6	136.4				
PW-180	01/29/09	27.5	64.4	84.2	98.6	107.6	113.0	114.8	118.4	138.2				
PW-181	05/30/08	130.5	122.0	134.6	143.6	154.4	154.4	156.2	156.2	156.2				
PW-181	01/26/09	144.5	93.2	100.4	134.6	136.4	138.2	138.2	138.2					
PW-43R(2)	01/23/09	197.0	190.4	192.2	194.0	195.8	197.6	199.4	201.2	204.8				
PW-56R(2)	02/02/09	188.5	163.4	177.8	183.2	183.2	181.4	188.6	186.8	192.2	188.6			
PW-57R	02/02/09	199.0	176.0	177.8	179.6	181.4	181.4	181.4	177.8					
PW-61R	01/29/09	38.0	66.2	111.2										
PW-62R(2)	01/29/09	179.0	165.2	179.6	183.2	185.0	186.8	186.8						
PW-A1R2	02/27/09	202.0	203.0	203.0	204.8	204.8	206.6							
S1R	01/22/09	146.0	116.6	136.4	141.8	149.0	152.6	154.4	154.4	154.4	154.4	154.4	156.2	
T1R	01/22/09	127.0	96.8	100.4	102.2	104.0	107.6	111.2	116.6	141.8	150.8	152.6	152.6	154.4
U1R	01/26/09	149.7	114.8	120.2	125.6	131.0	136.4	152.6	154.4	154.4	154.4	154.4		
V1	01/26/09	125.5	78.8	86.0	98.6	131.0	140.0							
W-10	03/11/09	47.0	69.8	71.6	75.2									
W-11	03/11/09	51.5	73.4	75.2	78.8									
W-12R	03/11/09	95.0	71.6	75.2	78.8	107.6								
W-13R	02/26/09	104.0	80.6	96.8	107.6	132.8								
W-13R	03/11/09	60.5	66.2	75.2	82.4	116.6								

Well	Date	Wellhead	Downhole Depth (feet)											
			10	20	30	40	50	60	70	80	90	100	110	120
W-30R(M)	01/29/09	187.0	161.6	165.2	170.6	174.2	174.2	174.2	176.0	176.0				
W-31R	01/19/09	182.0	152.6	159.8	163.4	163.4	168.8	170.6	172.4	170.6	170.6			
W-31R	02/02/09	182.0	156.2	159.8	161.6	161.6	163.4	167.0	165.2	167.0	167.0			
W-32R	01/19/09	105.0	80.6	87.8	93.2	96.8	109.4							
W-32R	02/02/09	105.0	53.6	68.0	78.8	84.2	105.8							
W-34	03/11/09	97.0	71.6	73.4	75.2	78.8	82.4	109.4	113.0					
W-35	03/11/09	86.0	64.4	66.2	69.8	73.4								
W-36	03/11/09	84.0	71.6	75.2	77.0	80.6	104.0	109.4						
W-37	03/11/09	89.0	82.4	84.2	87.8	93.2	113.0	116.6						
W-38	03/11/09	121.0	71.6	73.4	75.2	77.0	113.0	118.4						
W-39	02/26/09	76.0	73.4	86.0	98.6	111.2	118.4	125.6	122.0					
W-39	03/11/09	70.0	80.6	82.4	84.2	91.4	98.6	114.8	116.6					
W-42R(2)	01/23/09	177.7	68.0	78.8	93.2	165.2	172.4	179.6	185.0					
W-5	03/11/09	53.0	50.0	50.0	62.6									
W-56R(3)	02/02/09	196.0	176.0	177.8	179.6	179.6	183.2	185.0	186.8	186.8				
W-58R	01/19/09	136.5	96.8	111.2	122.0	127.4	131.0	131.0	132.8	132.8				
W-58R	02/02/09	140.0	41.0	59.0	78.8	93.2	100.4	104.0	125.6	127.4				
W-60	03/11/09	113.0	100.4	102.2	104.0	105.8	109.4	120.2	127.4	141.8	145.4			
W-68	03/11/09	91.8	80.6	84.2	89.6	93.2	98.6							
W-69	03/11/09	91.0	75.2	77.0	80.6	102.2	105.8							
W-7	03/11/09	52.0	64.4	64.4	66.2									
W-8	03/11/09	56.0	64.4	64.4	80.6									
W-9	03/11/09	60.5	64.4	64.4	66.2									
W1R	02/09/09	188.0	183.2	188.6	192.2	197.6	199.4	199.4	199.4					

Landfill Settlement

Month	Month Number	Landfill Settlement (CY)
Apr-06	1	58,000
May-06	2	72,500
Jun-06	3	58,000
Jul-06	4	80,000
Aug-06	5	64,000
Sep-06	6	64,000
Oct-06	7	55,500
Nov-06	8	44,400
Dec-06	9	44,400
Jan-07	10	55,500
Feb-07	11	44,400
Mar-07	12	44,400
Apr-07	13	52,789
May-07	14	40,366
Jun-07	15	34,303
Jul-07	16	43,087
Aug-07	17	39,027
Sep-07	18	36,034
Oct-07	19	42,704
Nov-07	20	31,890
Dec-07	21	32,406
Jan-08	22	35,022
Feb-08	23	29,917
Mar-08	24	36,924
Apr-08	25	26,872
May-08	26	31,349
Jun-08	27	33,243
Jul-08	28	32,261
Aug-08	29	29,108
Sep-08	30	38,408
Oct-08	31	26,640
Nov-08	32	21,125
Dec-08	33	36,977
Jan-09	34	19,730
Feb-09	35	27,281
Mar-09	36	22,030

Hydrogen Flow Rate and Leachate Volume

Month	Month Number	Hydrogen Flow Rate (scfm)	Leachate Volume (gal)
Apr-06	1		
May-06	2		
Jun-06	3	284	
Jul-06	4		
Aug-06	5	599.2	
Sep-06	6		
Oct-06	7	934.6	
Nov-06	8	650.5	
Dec-06	9	1105.1	
Jan-07	10	1014.3	3,810,700
Feb-07	11	1014.3	2,718,900
Mar-07	12	504	3,433,700
Apr-07	13	662	3,131,300
May-07	14	747.3	2,838,500
Jun-07	15	818.9	2,581,600
Jul-07	16	901.2	2,836,200
Aug-07	17	659.7	2,731,900
Sep-07	18	574.2	2,449,100
Oct-07	19	544.8	2,422,600
Nov-07	20	401.8	2,415,900
Dec-07	21	353.1	2,935,000
Jan-08	22	593.8	3,076,800
Feb-08	23	494.8	2,824,400
Mar-08	24	597.8	3,000,000
Apr-08	25	518.2	2,809,100
May-08	26	487.6	2,756,100
Jun-08	27	492.6	2,794,500
Jul-08	28	560.5	2,884,400
Aug-08	29	482.4	2,655,900
Sep-08	30	471.7	2,450,900
Oct-08	31	383.1	2,711,100
Nov-08	32	448.4	2,572,600
Dec-08	33	480	2,564,000
Jan-09	34	422	2,333,100
Feb-09	35	415	2,312,878
Mar-09	36		

Leachate Temperature in Sumps

Date	Leachate Sump Riser Number							
	1	2 North	2 South	3	4	5 A/B	5 C/D	7
5/17/07	98.7	62.8	78.1	121	116.7	118.8	114.2	
5/24/07	110.3	61.3	71.3	123.1	122.8	114.8	110.3	
5/31/07	86.5	66.1	71.1	119.9	122.6	114.3	110.9	
6/7/07	95.9	73.7	72.39	118.2	122	112.1	110.4	
6/14/07	93.7	78.1	87.1	122.6	122	110.2	111	
6/21/07	104.3	69.4	99	121.7	106.3	112.4	111.5	
6/29/07	133.7	67.9	100.1	120.4	97.4	101.4	109.7	
7/6/07	101.1	64.9	89.7	118.1	98.3	108.1	108.3	
7/12/07	91.9	65.1	85.7	117.7	74.3	101.7	107.3	
7/19/07	146.3	65.4	84.5	121.7	98.5	106.8	109.7	
7/26/07	138.2	65.5	82.1	119.4	105.7	112.7	107.9	
8/2/07	138.5	63.1	77.8	116.5	108.5	104.5	108	
8/9/07	119.1	67.5	76.4	115.9	110.1	103.6	104.5	
8/16/07	138.5	68.2	79	118.2	113.5	105.6	106.4	
8/23/07	117.3	75	74.1	102.9	119.5	104.4	109.5	
8/30/07	114.9	80.2	79.5	113.2	121.9	103	111.1	
9/6/07	111.5	74.1	91.4	112.3	121.7	102.7	107	
9/13/07	87.9	72.3	94.1	112.9	126	101.5	107.3	
9/20/07	115.7	74.1	83.5	111.2	128.9	109.5	107.7	
9/27/07	123.3	75.2	82.3	115.1	129.1	113.1	109.9	
10/4/07	92.7	70.9	82.1	117.1	123.1	141.1	107.1	
10/12/07	94.1	76.1	80.9	117.6	86.9		106.5	
10/18/07	85.5	75.7	79.7	97.7	148.9		108.9	
10/26/07	84.5	87.9	77.7	118.7	134.2		110.4	
11/1/07	112.1	73.5	77.8	116.3	137.6	103.7	108.7	
11/9/07	114.5	71.1	76.3	121.1	129.1		109.6	
11/12/07	114.5	71.1	76.3	121.1	129.1		109.6	
11/16/07	107.1	70.5	75.7	117.4	129.6		116.1	
11/21/07	117	68.5	74.1	115.9	130.1			
11/27/07	111.2	64.8	73.5	119.5	106.4		105.9	
12/5/07	113.7	61.5	88.3	112.5	128.6			
12/11/07	82.2	82.1	82.8	99.1	99.8			
12/17/07	85.3	77.9	87.7	108.8	98.3			
12/27/07	77.1	86.7	81.7	115.9	137.1		127.1	
12/31/07	77.5	72.2	78.3	110.3	137.3		123.4	
1/11/08	73.5	63.6	74.9	101.9	133.6			
1/16/08	74	61.7	71	113.7	130.9	62	105	
1/23/08	73.9	61.3	87.9	118.8	132.7	107	96.5	
1/28/08	71.7	76.3	85.9	119.3	128.7	134.8	104.5	
2/6/08	87.5	93.3	95.7	96.3	142.7	154.9	104.5	
2/12/08	77.5	84.9	83.9	116.7	135.3	143.9	86.5	
2/19/08	79.3	76.4	79.8	115.9	134.5	122.3	75	
2/26/08	81.6	76.7	77.9	115	132.2	150	101.5	
3/5/08	74.5	57.4	80.8	90.1	129.2	114.7	103	
3/11/08	75.3	61.4	85.9	109.9	130.9	114.9	95	
3/21/08	79.4	65.4	86.7	116.7	127.2	113.7	101	
3/26/08	76.5	66.2	79.9	117.7	125.3	114.4	99	
4/2/08	76.9	61.4	84.5	120.5	125.3	115.1	110	
4/7/08	73.5	66.4	91.1	118	123.3	115.7	107.5	
4/16/08	62.8	73.7	90.4	116.3	131.6	116.5	105	

Date	Leachate Sump Riser Number							
	1	2 North	2 South	3	4	5 A/B	5 C/D	7
4/22/08	61.4	68.6	89.9	117.3	125.4	115.9	115	
4/30/08	73.3	66.9	85.8	112.5	128.5	115.6	104	
5/9/08	69.4	70.2	89.3	114.7	-	115.9	108	
5/12/08	72.3	65.3	89.4	113.7	124.9	119.5	100	
5/22/08	73.7	71.7	87.8	113.3	132.8	118.1	106	
5/27/08	74.3	67.8	86	117.4	127	116.1	102	
6/2/08	77.1	62.3	84.8	113.4	123.6	114.5	104.5	
6/10/08	75.5	67.3	88.5	114.3	126.4	116.5	108.5	
6/16/08	77.9	68.5	88.9	115.2	126.5	117.7	95.5	
6/24/08	78.7	70.7	88.7	117.1	116.3	119.6	110.5	
6/30/08	83.8	80.7	94.7	116.4	132.5	118.7	94.5	
7/7/08	73.7	72.3	89.8	112.5	127.3	121.1	126.7	86.5
7/15/08	76.7	65.9	87.1	115.3	124.7	121.7	150.7	87.1
7/22/08	79.5	69.7	90.7	116.9	129.1	122.3	105.7	85.7
7/28/08	76.2	70.3	89.2	113.1	124.5	121	105.5	86.4
8/4/08	83.4	68.1	88.3	113.6	128.1	119.1	121.3	85.9
8/13/08	82.4	66.9	87.3	113.4	122.3	117.1	112.4	85.8
8/20/08	83.7	70.4	88.1	115.1	125.3	122.1	111.2	86.3
8/28/08	70.1	68.5	88.8	114.8	126	116.7	119.8	85.5
9/2/08	77	65.7	85.5	114.9	123.8	116.9	120.3	84.7
9/9/08	84.3	67.7	89.9	113.6	127.1	116.7	108.8	85.3
9/16/08	82.1	66.6	87.6	114.1	124.7	113.6	113.7	84.9
9/26/08	79.2	67.3	88.1	115.7	124.3	114.8		87.4
10/1/08	78.1	68.3	87.8	114.1	124.5	118.6	116.1	85.7
10/6/08	85.1	68.1	88.7	115.1	122.4	115.7	117.2	86.8
10/13/08	79.1	66.3	86.7	115.4	120.1	115.3	115.5	87.4
10/20/08	75.8	65.7	89.4	116.7	123.9	115.9	118.5	89.3
10/27/08	83.6	68.5	90.3	114	122.5	116.5	120.1	87.5
11/5/08	75.7	68.3	88.3	116.1	123.2	114.3	114.1	86.9
11/10/08	75.9	65.9	91.2	116.1	128.5	120.7	127.3	93.3
11/17/08	69.7	67.1	92.1	114.9	127.1	112.8	128.5	88.4
11/25/08	65.3	68.7	91.5	113.1	125	113.9	128.9	89.5
12/5/08	75.9	69.9	90.8	116.5	125.8	115.7	131.2	92.5
12/9/08	77.8	67.9	89.7	114.6	125.1	115.9	132.4	88.4
12/15/08	65.7	65.7	89.1	115.9	124.5	115.8	135.2	92.2
12/22/08	62.1	63.3	85.3	116.5	126.5	112.3	131.7	89.9
12/29/08	66.1	59.7	75.8	95.1	123.3	112.6	129.7	93.5
1/7/09	67.2	70.5	86.7	116.2	118	109.2	120.9	89.9
1/13/09	60.1	66.9	80.3	111.3	121.5	108.9	123.5	88.7
1/19/09	61	72.4	83.1	112.1	131.1	111.7	123.1	88.2
1/27/09	64.7	70.3	83.3	110.7	124.1	115.1	124.4	89.3
2/2/09	56.9	69.7	80.9	114.8	122.4	110.5	128.3	91.1
2/9/09	58.4	64.5	74.7	105.3	125.1	98.4		91.9
2/20/09	69	71	79.7	114.1	123.9	114.6	123	89.4
2/23/09	68.7	70.3	78.1	114.7	125.7	115.7	127.4	91.4
3/2/09	58.5	69.9	78.3	118.4	123.3	122.3	127.2	91.8
3/9/09	55.3	64.3	74.7	118.8	125.6	121.1	124.5	90.7
3/18/09	57.6	67.9	76.6	113.5	121.8	118.1	123	90.9
3/23/09	60.7	65.9	76.2	116.7	121.9	119.3	123.8	92.7
4/1/09	61.5	69.3	77.8	112.2	123.2	120.1	121.5	90.9
4/6/09	67.1	76.6	69.1	98.5	123.7	120.6	121.6	91.1
4/15/09	57.1	67.1	75.7	103.3	122.3	121.9	125.7	91.4
4/21/09	57.1	66.7	72.6	107.3	119.7	121.9	123.5	92.1
4/28/09	54.5	66.8	73.7	105.5	117.7	123.3	119.9	91.5
5/4/09	58.7	67.6	73.3	108.1	124.3	118.7	118.8	91.8
5/12/09	62.3	67.7	73.1	110.3	123.5		116.7	90

Leachate Temperature in Laterals

Date	Thermocouple Ruser Number								
	Line 1C	Line 1D	Line 2C	Line 3B	Line 3C	Line 4C	Line 4E	Line 5 A/B	Line 6B
5/17/07		124.2	115.3	184.7		100.1		104.7	119.9
5/24/07		124.2	115.3	184.7		100.1		104.7	119.9
5/31/07	123.1	109.7	183.1	98.3	102.2	106.2			
6/7/07	96.5	115.7	109.7	177.4	167.5	96.6	161.2	101.3	105.8
6/14/07	99.4	92.2	108.8	183.3	170.3	99.4	158	102.7	108.7
6/21/07	97.6	96.5	108.3	185.6	171.1	99.6	158.1	103.6	107.2
6/29/07	98.1	90.1	109.5	184.1	171.9	107.4	154.6	103.3	107.8
7/6/07	99.9	117.8	107.5	184.2	172.2	110.5	155.5	104.1	109.7
7/12/07	97	102.1	108.9	181.1	174.1	103.1	148.8	102.9	110.3
7/19/07	98	99.1	111.3	184.5	175.5	112.4	141.1	105.8	113.5
7/26/07	98.1	132.9	111.1	184.5	175.8	101.5	150.9	103.1	110.2
8/2/07	97.5	96.2	105.7	179.1	169.9	99.5	153.3	102.1	107.5
8/9/07	97.6	99.9	103.8	180.9	174.7	101.7	151.1	102.3	106.8
8/16/07	111.1	115.5	112	182.9	165.5	112.1	156.1	107.2	115
8/23/07	96.1	88.6	102.3	182.9	174.5	102.7	154.9	103.4	108.2
8/30/07	101.3	90.3	106.5	197.9	177.4	103.5	155.2	103.4	109.8
9/6/07	97.4	85.6	106.9	180.3	178.3	103.9	154.5	101.5	108.3
9/13/07	99.4	100.1	106.5	176.8	160.3	104.4	156.7	102.1	106.5
9/20/07	96.3	92.4	108.9	175.5	176.7	108.3	110.7	109.5	106.4
9/27/07	99.8	91.3	107.4	181.3	176.5	108.7	161.4	104.5	108.1
10/4/07	101.1	82.7	111.1	181.1	176.5	105.7	150	102.1	105.8
10/12/07	101.1	92.1	112	186.3	182.1	112.5	132.1	107.5	107.9
10/18/07	100.3	86.7	111.3	181.1	183.1	107.1	159		
10/26/07	99.1	109.8	111.5		188.8	108.7	165.9	103.3	108.1
11/1/07	97.7	91	111.4	180.6	182.5	106.6	165.6		104.5
11/9/07	99.8	85.7	114.1	181.5	180.9	107.3	164.1	100.8	
11/12/07	99.8	85.7	114.1	181.5	180.9	107.3	164.1	100.8	
11/16/07	102.3	87.3	112.7	181.1	178.9	108.4	163.1	103.8	108.5
11/21/07	99.1	83.4	110.6	178.9	177.7	107.9	163.4	104.6	109.3
11/27/07	97.9	92.5	109	179.7	179.5	107.7	165.8		108.7
12/5/07	99.3	86.1	111	180.5	178.5	109	167.1		108.1
12/11/07	99.9	92.4	112	180.5	180.9	108.9	164.9		106.9
12/17/07	96.1	80.3	111.6	181	179.6	113.4	167.9		105.3
12/27/07	105.2	90.8	116.9	184.9	181.3	113.7	172		118.5
12/31/07	101	85.8	112.9	180.7	179.7	115.5	179.2		107.1
1/11/08	99.7	87	112.6	180.6	177.6	111.6	166.3		109.4
1/16/08	98.1	78.4	113.1	181.9	179.7	109.2	162.5		112.5
1/23/08	99.3	84.8	113.9	175.9	181.1	111.6	171.1		108.2
1/28/08	98.9	83.7	111.9	179.9	180.4	110.1	168.3	106.7	108.7
2/6/08	120.1	94.9	129.9	181.7	178.1	126.7	185.9	127.1	113.5
2/12/08	102.1	85.5	117.3	190.2	173.9	119.3	172.1	112.7	118.1
2/19/08	99.6	81.3	111.8	179.8	176.8	112.3	170	104.7	109.5
2/26/08	103.7	78.6	112.2	184.7	159.4	111.9	168.7	112.7	117.1
3/5/08	99.3	75.7	112.1	180.9	159.5	111.4	164.9	106.5	103.3
3/11/08	99.6	76.8	113.2	179.5	147.7	112.5	166.1	106.6	110.5
3/21/08	100.1	77.9	113.2	180.1	156.9	112.9	167.1	108.3	115.2
3/26/08	98.5	76.4	110.4	180.4	168.5	110.8	168.5	107.4	108.3
4/2/08	100.5	76.5	108.1	179.7	167.3	114.3	167.5	103.5	108.2
4/7/08	99.7	75.1	112.9	177.7	163.4	111.9	168.5	107.1	111.5
4/16/08	96.6	73.5	110.7	179.4	169.1	109.3	167.8	108.1	113.3

Date	Thermocouple Ruser Number								
	Line 1C	Line 1D	Line 2C	Line 3B	Line 3C	Line 4C	Line 4E	Line 5 A/B	Line 6B
4/22/08	95.6	73.5	111.9	180.1	169.3	109.9	166.1	107.8	109.5
4/30/08	98.4	70.8	110.5	178.7	167.3	108.9	165.5	106.8	107.1
5/9/08	99.5	70.2	111.3	179.4	164.4	113.3	164.6	103.1	116.9
5/12/08	101	75.2	112.6	178.3	162.2	113.4	157.9	100.7	138.8
5/22/08	99.2	71.3	110.7	182	168.6	112.8	158.3	107.7	110.7
5/27/08	99.3	70.9	110.3	180.3	169.4	113	164.9	107.1	108.7
6/2/08	99.1	66.4	109	180.5	169.7	107.5	164.7	107.9	107.7
6/10/08	77.5	66.2	112.5	182	163.8			108.4	112.2
6/16/08	99.2	71.5	110.5	181.1	166.9			107.7	109.3
6/24/08	100.2	72.4	112.1	181.6	173.1	100.4		107.9	
6/30/08	114.3	87.1	127.5	179.1	166.1	124.3		105.7	109.3
7/7/08	101.7	66.5	116.6	180	172.9	104.7		107.8	121.3
7/15/08	98.7	64.9	107.4	177.8	175.5	96.5		106.7	109.1
7/22/08	99.7	67.1	113.1	181.1	171.3	104.3		157.2	110.5
7/28/08	99.4	70.1	113.5	180.2	170.1	100.1		109.5	111.3
8/4/08	99.9	71.4	112.4	178.1	170.9	101.9	142.9	106.5	108.3
8/13/08	98.8	68.4	110.4	178.4	168.4	99.4	154.5	104.7	110.7
8/20/08	100.7	69.1	110.2	173.2	172.9	98.9	147.9	103.8	84.8
8/28/08	99.9	76.1	111.9	176.2	171.7	101.3	150.3	105.7	83.9
9/2/08	97.8	68.9	109.6	170.9	166.7	100.1	148.3	103.7	91.4
9/9/08	100.3	69.4	111.8	176.2	167.7	101.7	153.9	105.1	
9/16/08	100.5	68.7	109.8	176.2	165.1	101.7	142.6	105.2	
9/26/08	99.6	67	111.1	174.9	99.6	100.5	154.1	103.9	54.3
10/1/08	99.8	69.5	111.1	176.7	177.6	101.1	154	105.7	111
10/6/08	99.7	68.3	112.9	176.3	174.7	101.2	155.3	105.6	111.2
10/13/08	100.7	68.9	110.3	177.4	171.4	102.3	155.8	106.5	110
10/20/08	100.9	68.1	110.7	177.3	166.3	103.3	155.3	104.6	108.7
10/27/08	100.7	69.2	112.5	177.3	169.9	103.5	151.5	106.5	110.9
11/5/08	100.9	69.5	109.9	178.3	174.3	104.1	155.5	104.9	109.5
11/10/08	102.3	70.5	114.6	163.2	159.2	106.8	150.7	109.1	113.1
11/17/08	101.5	69.9	114.4	177.5	162.9	105.7	148.5	106.8	110.1
11/25/08	103.1	71.6	115.5	178.8	164.5	107.5	152.1	110.3	112.7
12/5/08	103.2	72.5	114.7	172.2	162.7	109.6	154.5	110.1	112.5
12/9/08	102.8	75.7	113.6	177.9	157.2	111.7	152.4	108.4	112.5
12/15/08	102.5	71.9	113.8	177.6	158.7	109.5	154.1	111.5	115.2
12/22/08	102.5	70.9	114.5	178.1	163.5	111	154.1	108.1	111.9
12/29/08	101.7	67.7	111.9	177.6	150.7	107.2	151.5	107.5	111.9
1/7/09	102.9	70.9	114.3	178.7	145.5	108.5	154.7	106.9	111.2
1/13/09	101.1	66.3	112.8	175.8	142.5	107.5	153.3	106.9	110.9
1/19/09	102.2	72.3	113.5	177.1	148.9	110.7	154.7	106.2	110.5
1/27/09	101.1	68.1	113.5	174.7	146.4	109.3	151.1	108.5	111.7
2/2/09	101.6	68.9	113.4	178.1	153.6	110.9	152.5	108.9	110.3
2/9/09	101.7	69.9	113.9	180.3	154.5	112.3	153.5	107.4	107.9
2/20/09	102.7	74.9	114.9	176.7	159.7	119.9	154.8	107.7	109.9
2/23/09	101.9	69.3	112.9	177.1	164.7	117.3	155.4	108.9	111.7
3/2/09	102.1	68.1	113.1	176.4	153.3	120.9	153.9	98.8	107.7
3/9/09	67.7	100.8	113.3	177.6	167.5	119.3	152.1	107.9	111
3/18/09	100.9	66.2	111.7	177.1	156.1	119.1	149.9	107.3	110.9
3/23/09	100.9	66.9	111.6	176.8	160.5	120.4	151.5	106.7	111.7
4/1/09	102.8	67.1	111.9	181	163.5	119.4	162.4	108.3	112.4
4/6/09	102.5	68.6	112.9	178.3	166.3	120.5	151.7	107.6	111.9
4/15/09	102.5	68.3	113.2	176.6	152.5	121.7	140.6	105.7	132.3
4/21/09	101.8	65.9	111.9	179.1	166.3	121.5	120.7	109.1	112.1
4/28/09	100.5	63.9	110.5	177.9	169.3	120.5	154.4	105.3	104.3
5/4/09	101.5	65.6	111.3	177.7	171.5	123.3	147.9	104.5	112.3
5/12/09	101.5	68	111.1	178.1	170.4	125.5	157.8	107.9	113.6

Leachate Indicator Parameters – Chemical Oxygen Demand (COD) – mg/l

Date	LE-E	LE-S	LE-N
4/16/07	61000	53000	78000
4/27/07	49000	43000	76000
5/9/07	67000	55000	88000
5/23/07	65000	42000	90000
6/6/07	57000	41000	74000
6/20/07	38000	49000	68000
7/11/07	57000	45000	99000
7/25/07	78000	62000	77000
8/1/07	77000	49000	75000
8/22/07	42000	40000	60000
9/12/07	27000	38000	67000
9/26/07	59000	7400	42000
10/10/07	55000	38000	92000
10/24/07	12000	35000	75000
11/7/07	39000	25000	80000
11/26/07	30000	32000	66000
12/5/07	22000	2800	94000
12/19/07	25000	58000	97000
1/9/08	78000	72000	80000
1/23/08	30000	46000	50000
2/6/08	7700	44000	54000
2/20/08	41000	4100	66000
3/5/08	12000	35000	32000
3/19/08	29000	27000	74000
4/9/08	44000	25000	44000
4/23/08	41000	88000	84000
5/7/08	44000	58000	92000
5/19/08	40000	62000	71000
6/11/08	47000	37000	67000
6/24/08	42000	60000	62000
7/9/08	30000	45000	64000
7/23/08	39000	49000	54000
8/12/08	45000	39000	64000
8/27/08	29000	38000	53000
9/10/08	20000	32000	44000
9/24/08	44000	51000	61000
10/10/08	12000	76000	25000
10/22/08	47000	48000	53000
11/5/08	37000	35000	41000
11/19/08	42000	69000	41000
12/4/08	45000	49000	45000
12/17/08	29000	47000	56000
1/7/09	33000	75000	53000
1/21/09	34000	20000	59000
2/5/09	42000	59000	44000
2/18/09	28000	65000	62000
3/11/09	19000	59000	55000
3/27/09	25000	59000	55000

Leachate Indicator Parameters – Aluminum – ug/l

Date	LE-E	LE-S	LE-N
5/7/08	4030	6310	9130
5/19/08	2990		5680
6/11/08	3580	4720	7980
7/23/08		2920	4040
9/10/08	3870	6750	3990
9/24/08	3240		2240
10/10/08	5880		5800
12/17/08	5000	5500	5400
1/7/09	3520	5200	3300

Leachate Appendix I Parameters – Total Dissolved Solids (TDS) – mg/l

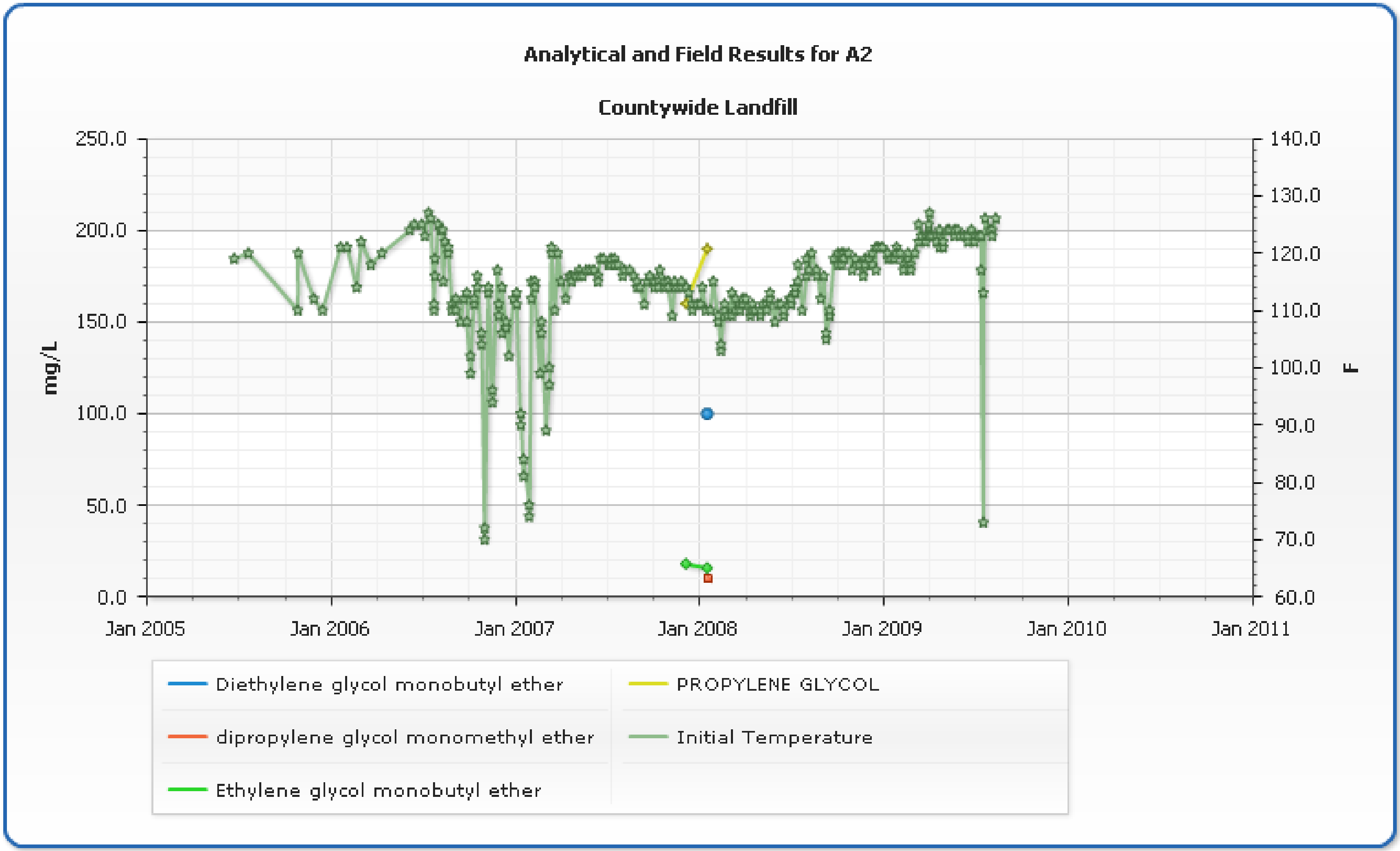
Date	LE-E	LE-S	LE-N
4/27/07	47000	37000	42000
5/23/07	35000	29000	37000
6/20/07	54000	45000	89000
7/25/07	97000	42000	88000
8/22/07	73000	44000	98000
9/26/07	47000	10000	50000
10/10/07	87000	29000	1.10E+05
11/7/07	80000	32000	1.00E+05
12/5/07	26000	9500	96000
1/9/08	1.00E+05	44000	91000
2/6/08	19000	41000	66000
3/5/08	6800	43000	96000
4/9/08	53000	52000	110000
5/7/08	67000	52000	63000
6/11/08	82000	38000	110000
7/9/08	76000	46000	110000
8/12/08	83000	47000	110000
9/10/08	44000	26000	41000
10/10/08	95	66000	110000
11/5/08	80000	70000	110000
12/4/08	67000	48000	100000
1/7/09	58000	56000	110000

Leachate Appendix I Parameters – Ammonia – mg/l

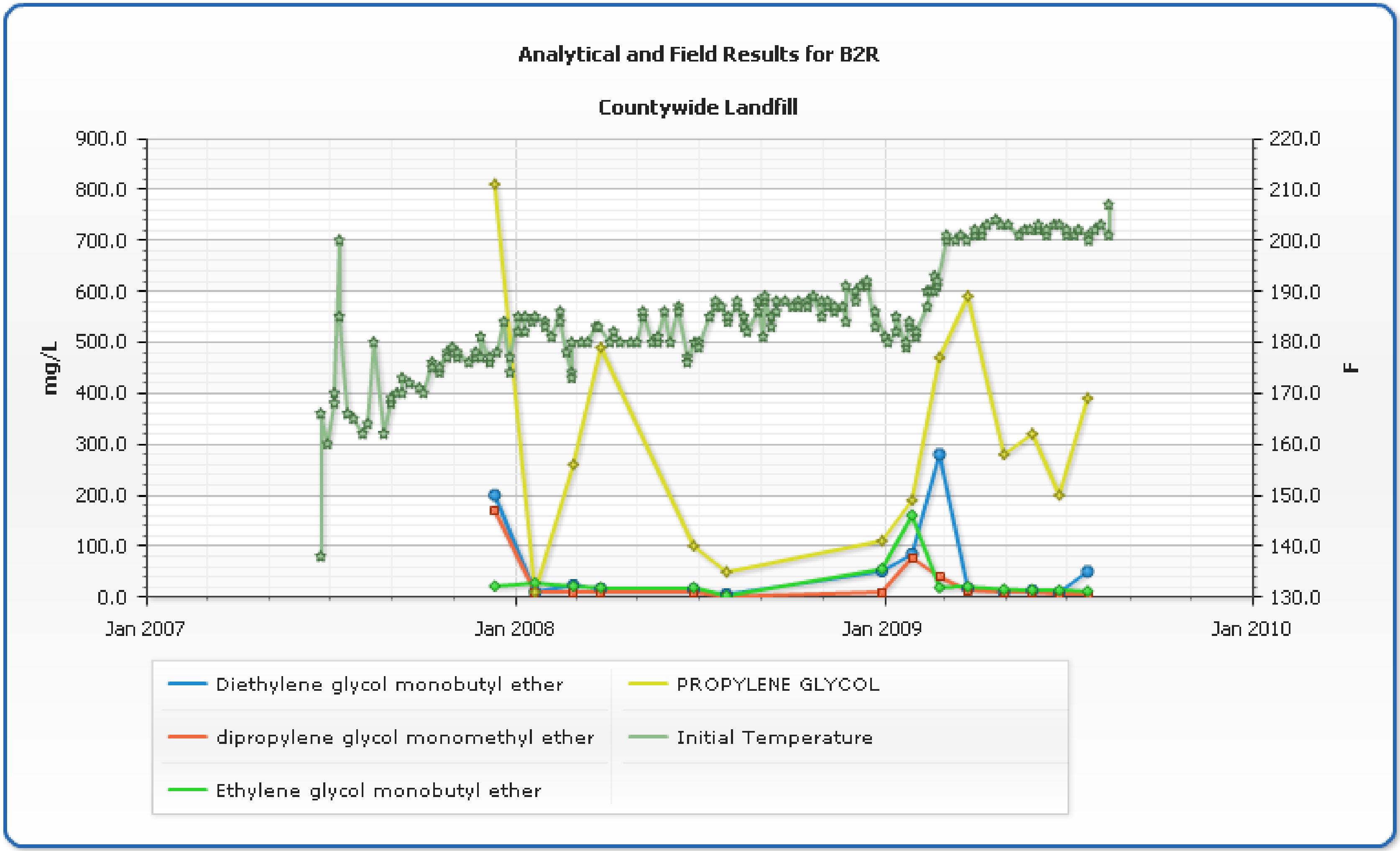
Date	LE-E	LE-S	LE-N
4/27/07	2900	2900	4000
4/27/07	3200	3300	4300
5/9/07	2500	2200	2800
5/23/07	2100	1700	3200
5/23/07	2400	1500	3300
6/6/07	3100	2100	3500
6/20/07	2500	2500	4500
6/20/07	1900	3800	2800
7/11/07	2400	2500	2900
7/25/07	2000	2400	2500
7/25/07	2100	2400	2700
8/1/07	2400	2200	3300
8/22/07	2200	2000	3100
9/12/07	2100	2400	3600
9/26/07	3400	330	3400
9/26/07	2700	360	2700
10/10/07	2200	1700	3000
10/10/07	1900	1600	2700
10/24/07	2500	2000	3200
11/7/07	2600	2400	3300
11/7/07	2200	2500	3400
11/26/07	1700	2300	2600
12/5/07	1200	160	2400
12/5/07	1200	120	2700
12/19/07	1800	2500	2000
1/9/08	1900	1900	3200
1/9/08	2200	1700	2200
1/23/08	1400	1500	1300
2/6/08	780	1400	2000
2/6/08	900	1400	1900
2/20/08	1300	780	2400
3/5/08	360	1600	2400
3/5/08	450	1500	2300
3/19/08	1200	1500	2200
4/9/08	1600	1700	2400
4/9/08	33	1600	2700
4/23/08	1600	1600	2400
5/7/08	1600	1600	2600
5/7/08	1600	1500	2400
5/19/08	1400	1700	2600
6/11/08	1700	1600	3000
6/11/08	1600	1500	2400
6/24/08	1700	1500	2400
7/9/08	1800	1500	2900
7/9/08	1800	1400	2900
7/23/08	1400	1600	2100
8/12/08	1800	1500	2800
8/12/08	1600	1700	2400
8/27/08	1500	1100	2600
9/10/08	1300	900	2500
9/10/08	1700	1300	3000
9/24/08	1600	1400	3200
10/10/08	1600	1600	2700
10/10/08	1700	1800	2500
10/22/08	1400	1300	3100
11/5/08	1200	1200	2800
11/5/08	1300	1000	2300
11/19/08	2300	2400	930
12/4/08	1900	1600	3200
12/4/08	1800	1300	2600
12/17/08	1600	1300	3300

Appendix B

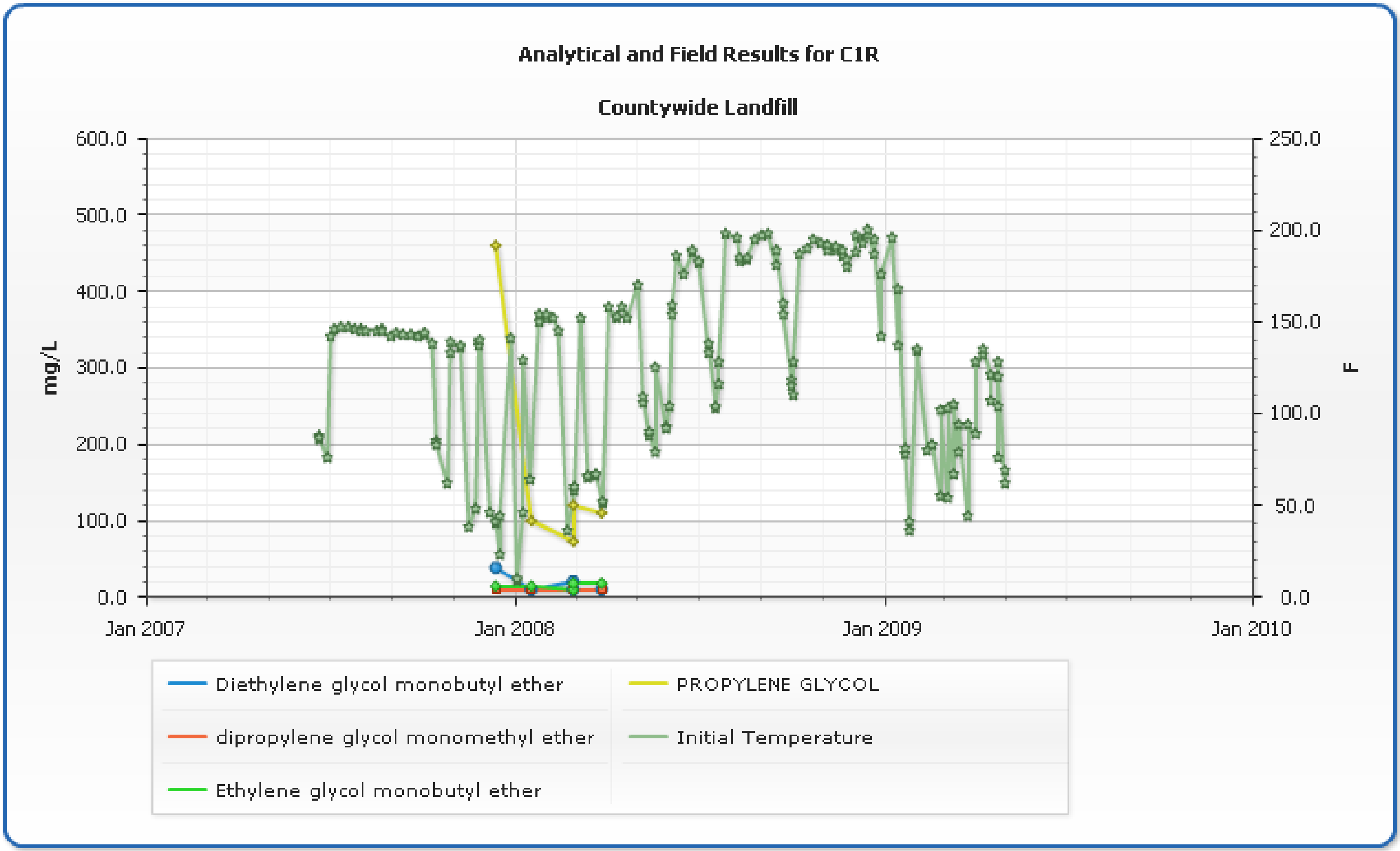
Glycol Plots by Well

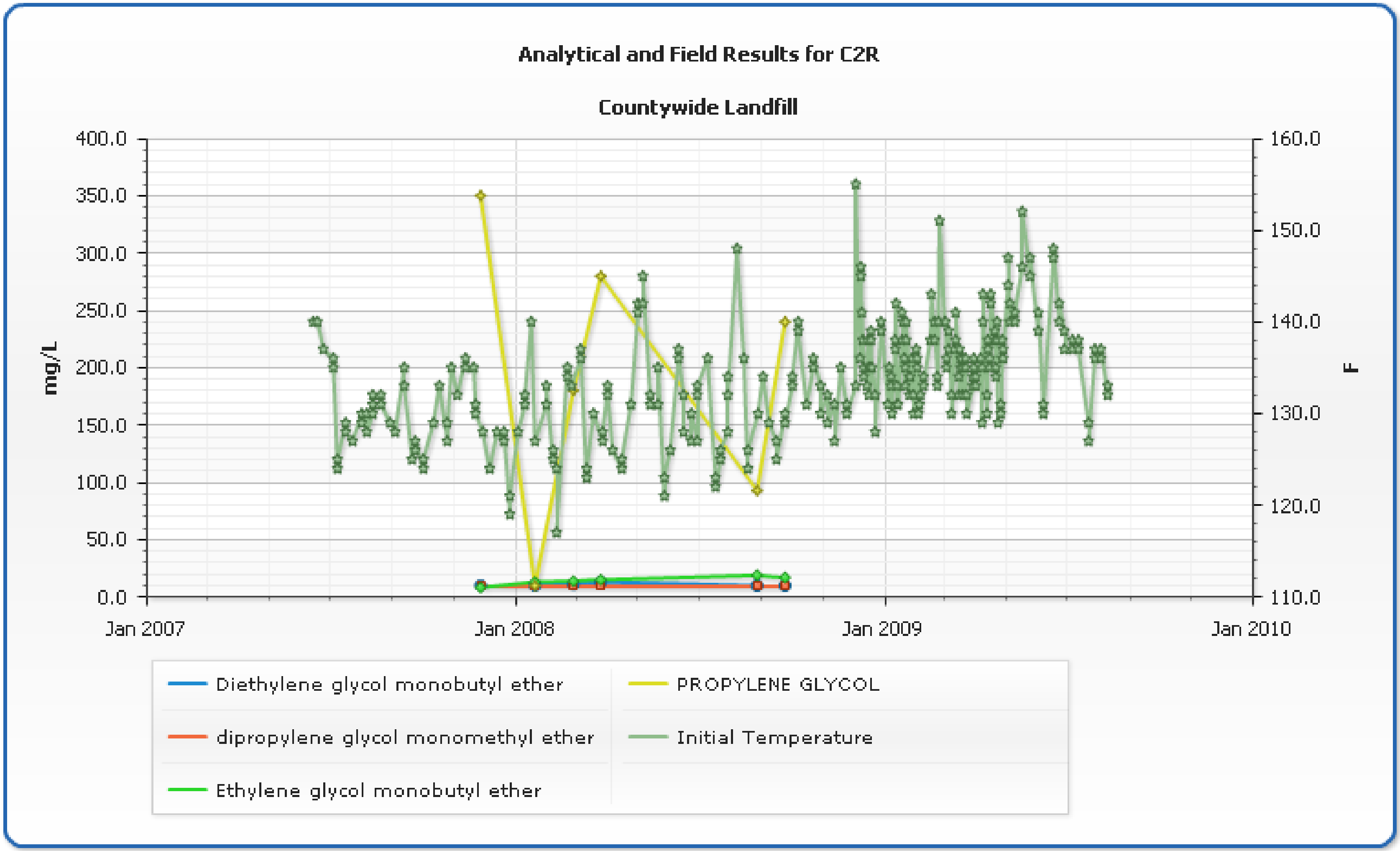


Analytical and Field Results for A2
Countywide Landfill
mg/L
F
250.0
200.0
150.0
100.0
50.0
0.0
140.0
130.0
120.0
110.0
100.0
90.0
80.0
70.0
60.0
Jan 2005
Jan 2006
Jan 2007
Jan 2008
Jan 2009
Jan 2010
Jan 2011
Diethylene glycol monobutyl ether
PROPYLENE GLYCOL
dipropylene glycol monomethyl ether
Initial Temperature
Ethylene glycol monobutyl ether

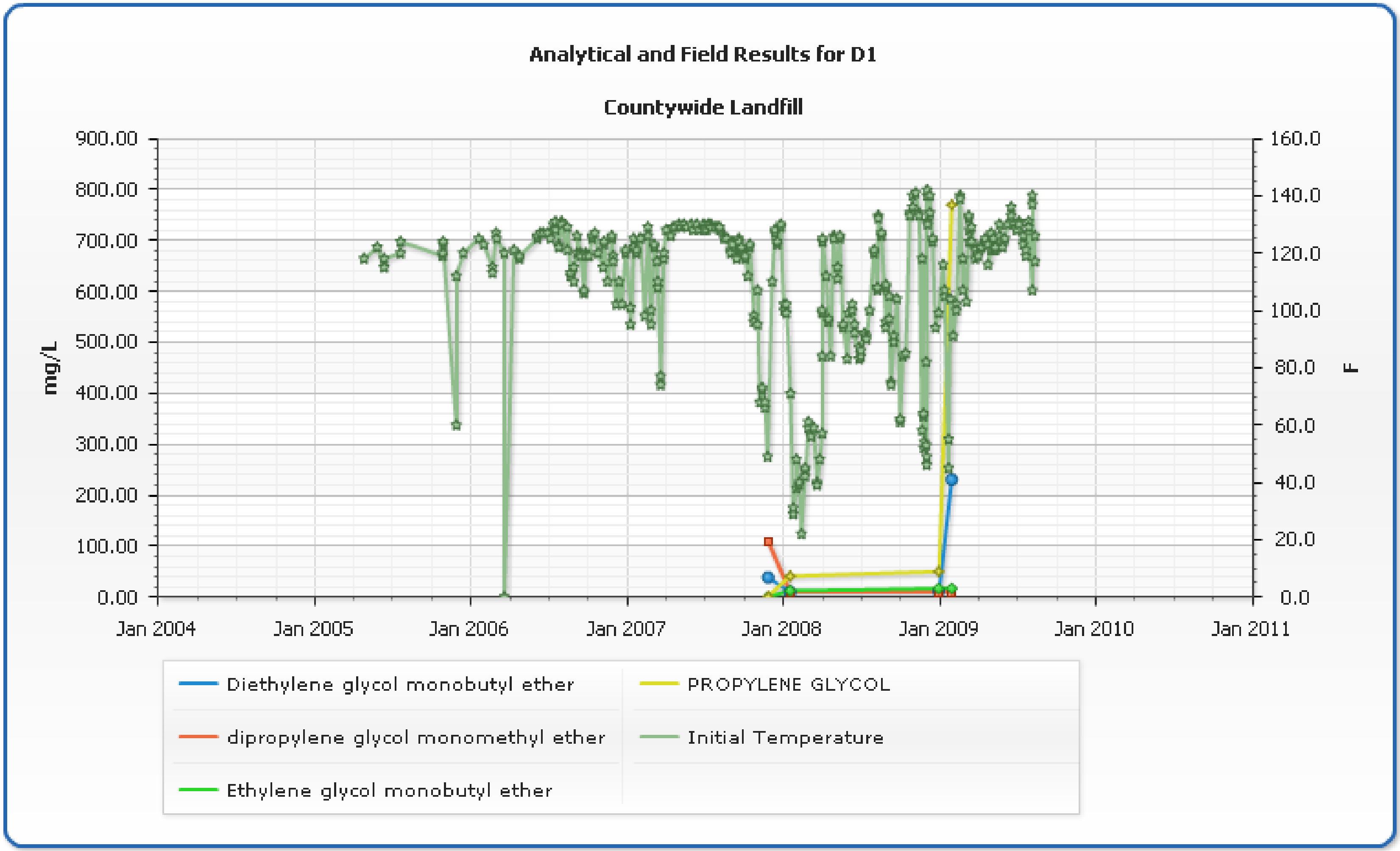


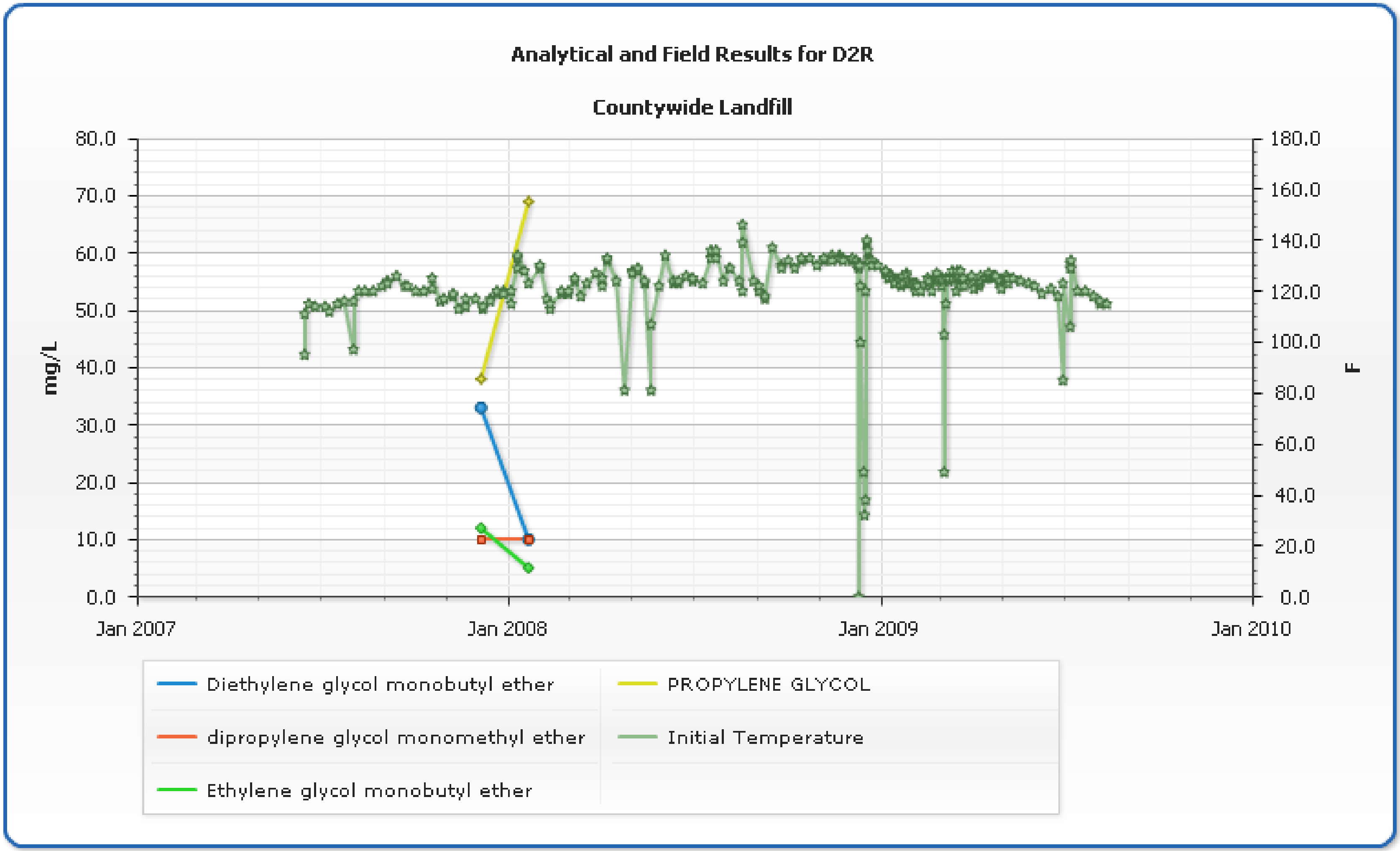
Analytical and Field Results for B2R
Countywide Landfill
mg/L
F
900.0
800.0
700.0
600.0
500.0
400.0
300.0
200.0
100.0
0.0
220.0
210.0
200.0
190.0
180.0
170.0
160.0
150.0
140.0
130.0
Jan 2007
Jan 2008
Jan 2009
Jan 2010
Diethylene glycol monobutyl ether
PROPYLENE GLYCOL
dipropylene glycol monomethyl ether
Initial Temperature
Ethylene glycol monobutyl ether

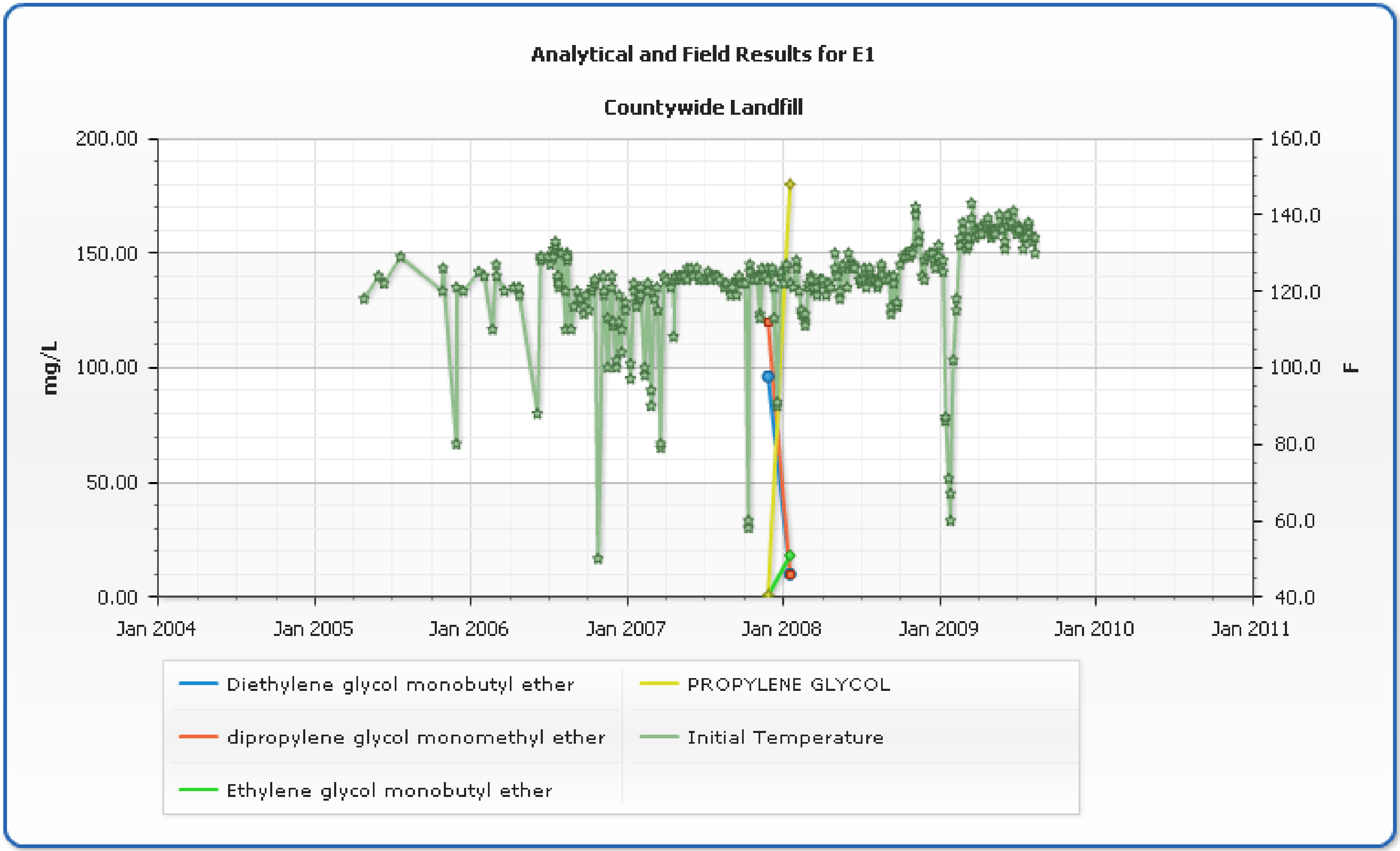

Analytical and Field Results for C1R
Countywide Landfill
600.0
500.0
400.0
300.0
200.0
100.0
0.0
mg/L
250.0
200.0
150.0
100.0
50.0
0.0
F
Jan 2007
Jan 2008
Jan 2009
Jan 2010
Diethylene glycol monobutyl ether
dipropylene glycol monomethyl ether
Ethylene glycol monobutyl ether
PROPYLENE GLYCOL
Initial Temperature

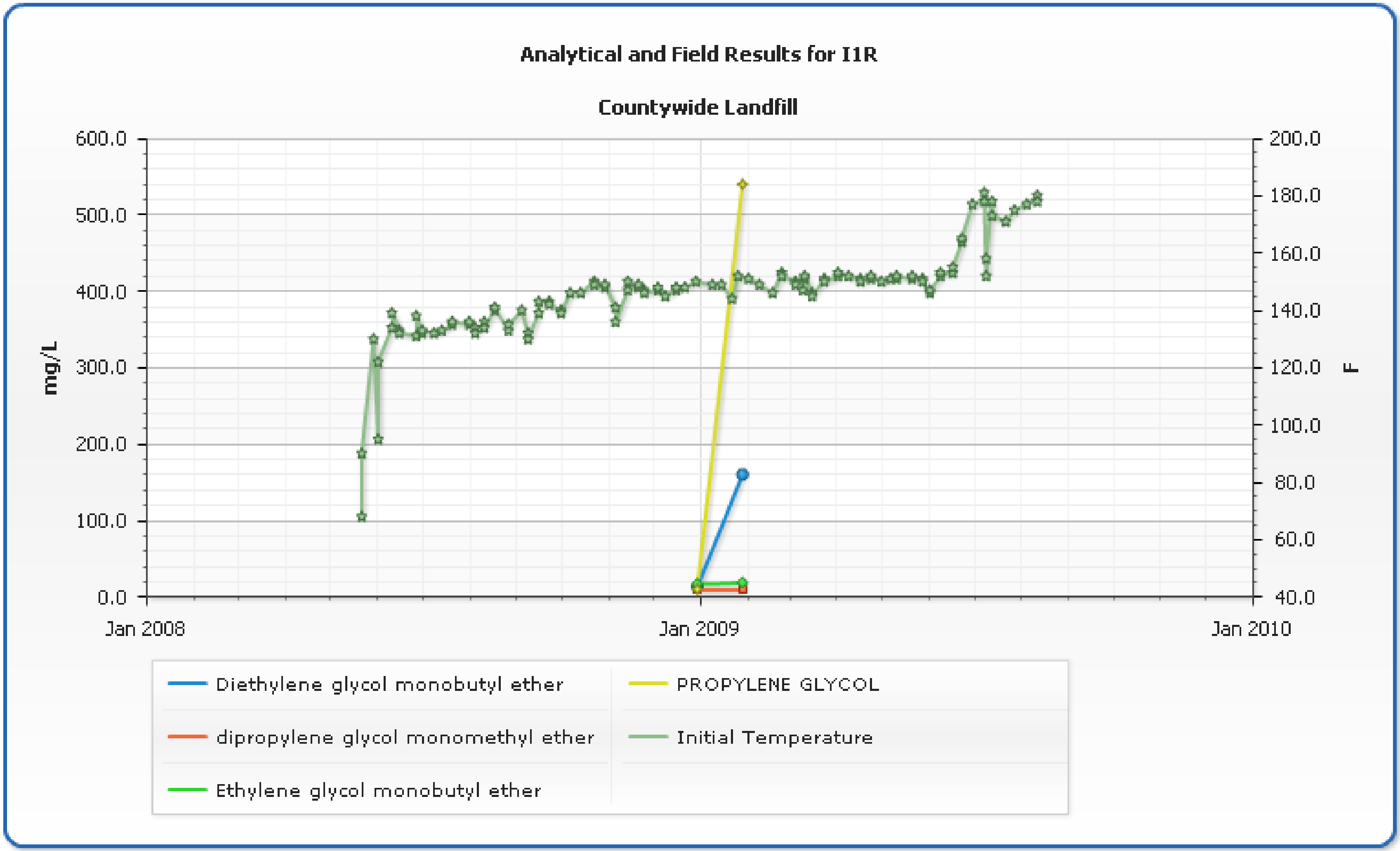


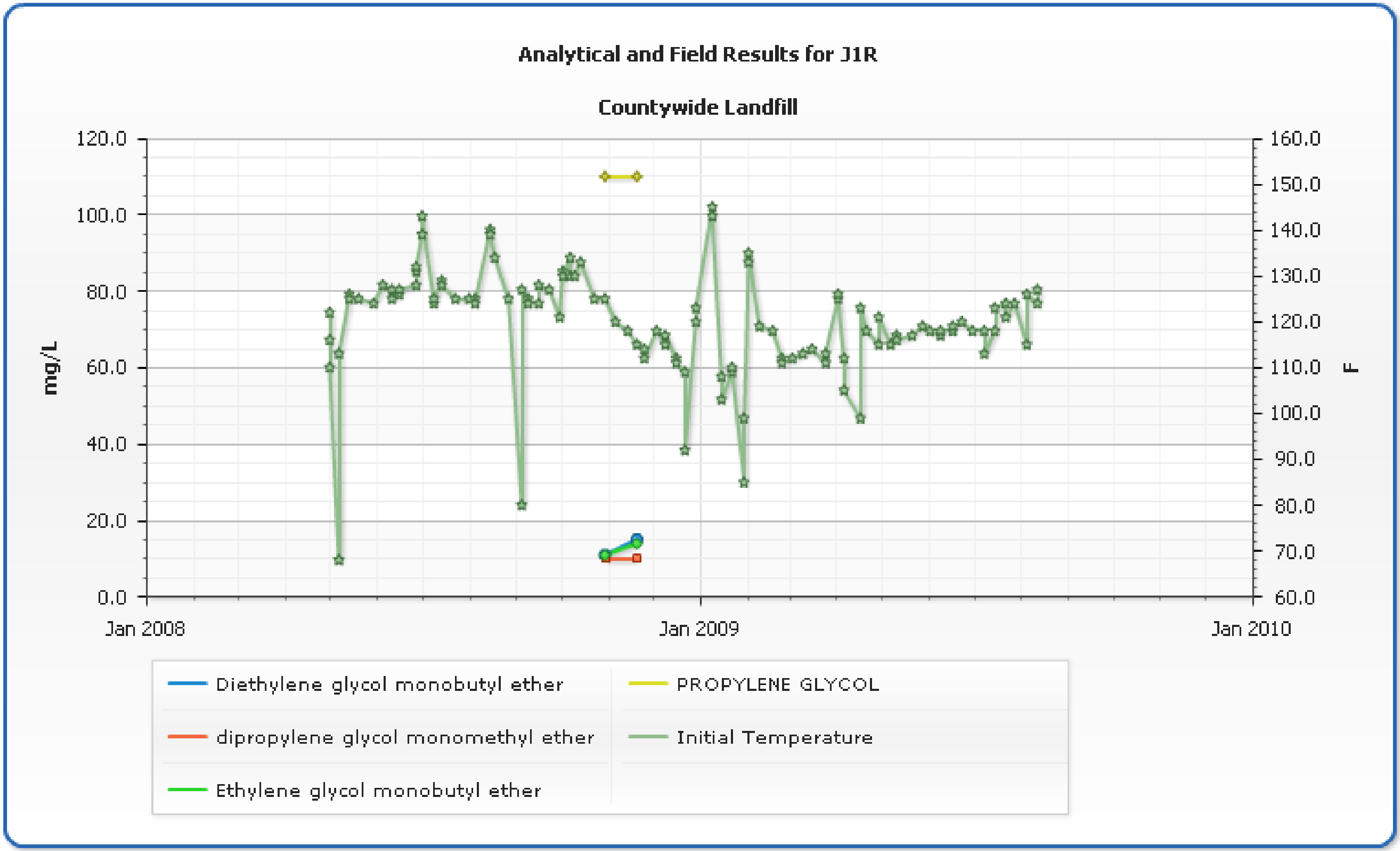
Analytical and Field Results for C2R
Countywide Landfill
mg/L
F
400.0
350.0
300.0
250.0
200.0
150.0
100.0
50.0
0.0
160.0
150.0
140.0
130.0
120.0
110.0
Jan 2007
Jan 2008
Jan 2009
Jan 2010
Diethylene glycol monobutyl ether
dipropylene glycol monomethyl ether
Ethylene glycol monobutyl ether
PROPYLENE GLYCOL
Initial Temperature


Analytical and Field Results for D1
Countywide Landfill
mg/L
900.00
800.00
700.00
600.00
500.00
400.00
300.00
200.00
100.00
0.00
160.0
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
F
Jan 2004
Jan 2005
Jan 2006
Jan 2007
Jan 2008
Jan 2009
Jan 2010
Jan 2011
Diethylene glycol monobutyl ether
PROPYLENE GLYCOL
dipropylene glycol monomethyl ether
Initial Temperature
Ethylene glycol monobutyl ether

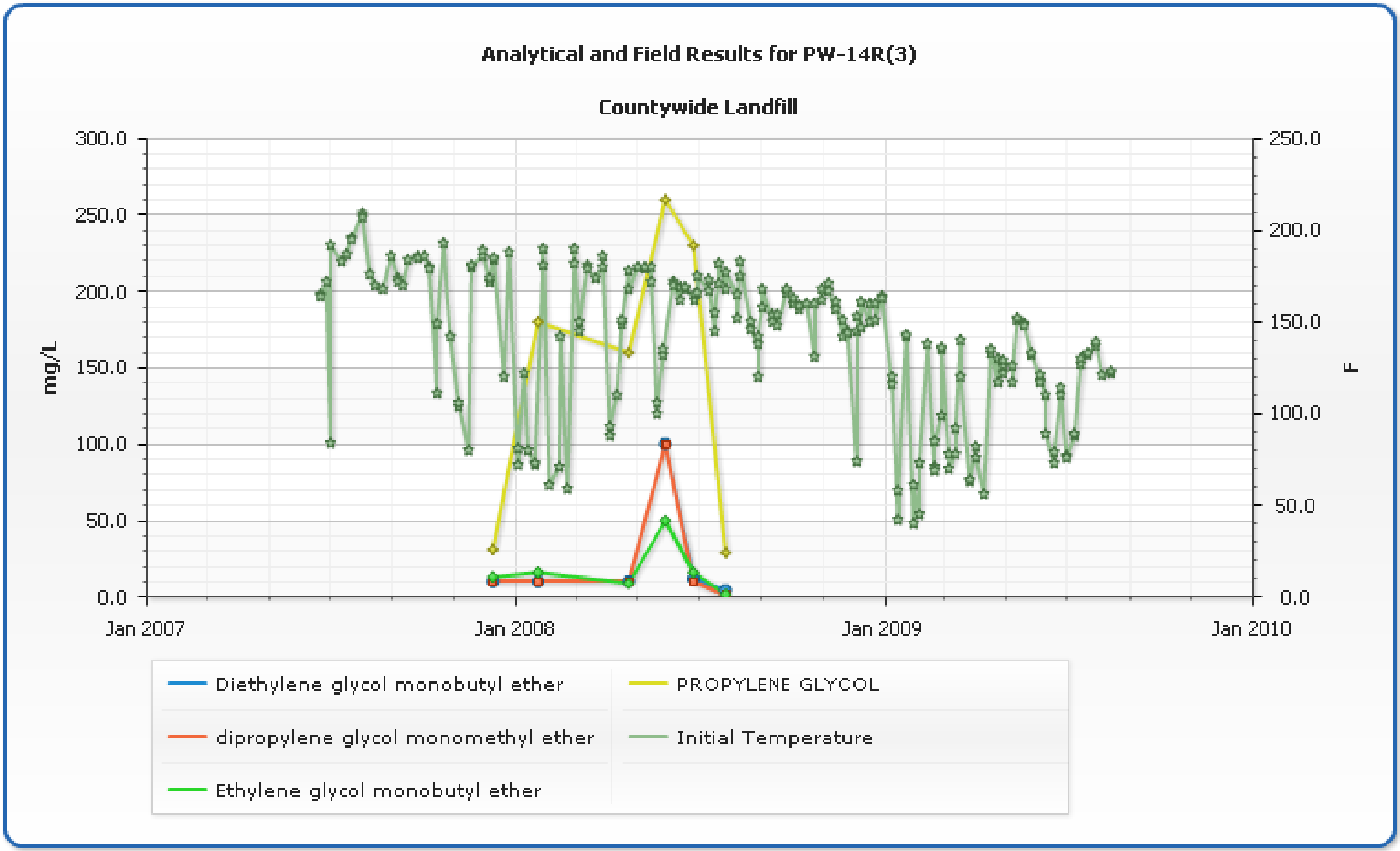

Analytical and Field Results for D2R
Countywide Landfill
mg/L
F
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
180.0
160.0
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
Jan 2007
Jan 2008
Jan 2009
Jan 2010
Diethylene glycol monobutyl ether
dipropylene glycol monomethyl ether
Ethylene glycol monobutyl ether
PROPYLENE GLYCOL
Initial Temperature

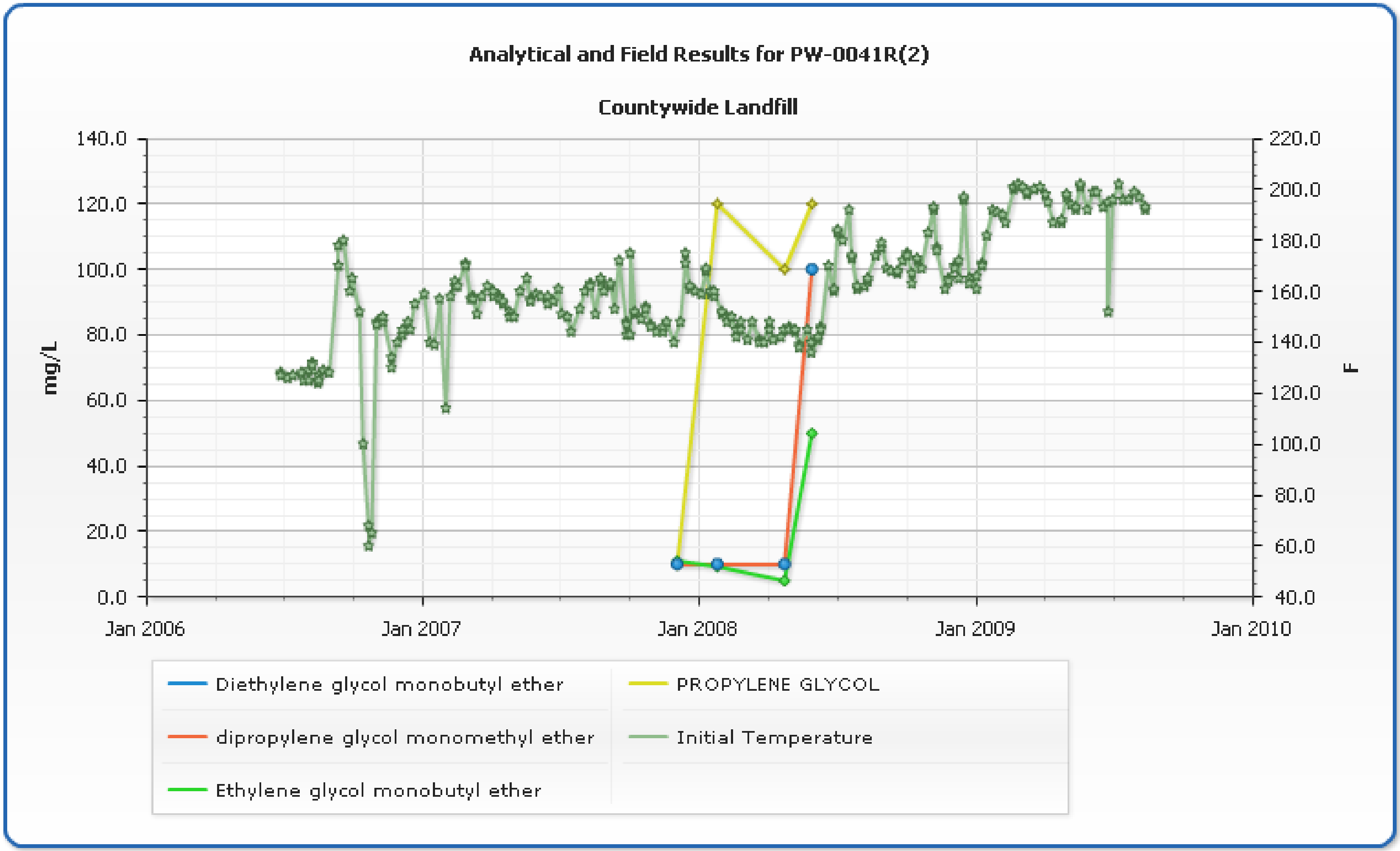

Analytical and Field Results for E1
Countywide Landfill
200.00
150.00
100.00
50.00
0.00
mg/L
160.0
140.0
120.0
100.0
80.0
60.0
40.0
F
Jan 2004
Jan 2005
Jan 2006
Jan 2007
Jan 2008
Jan 2009
Jan 2010
Jan 2011
Diethylene glycol monobutyl ether
dipropylene glycol monomethyl ether
Ethylene glycol monobutyl ether
PROPYLENE GLYCOL
Initial Temperature

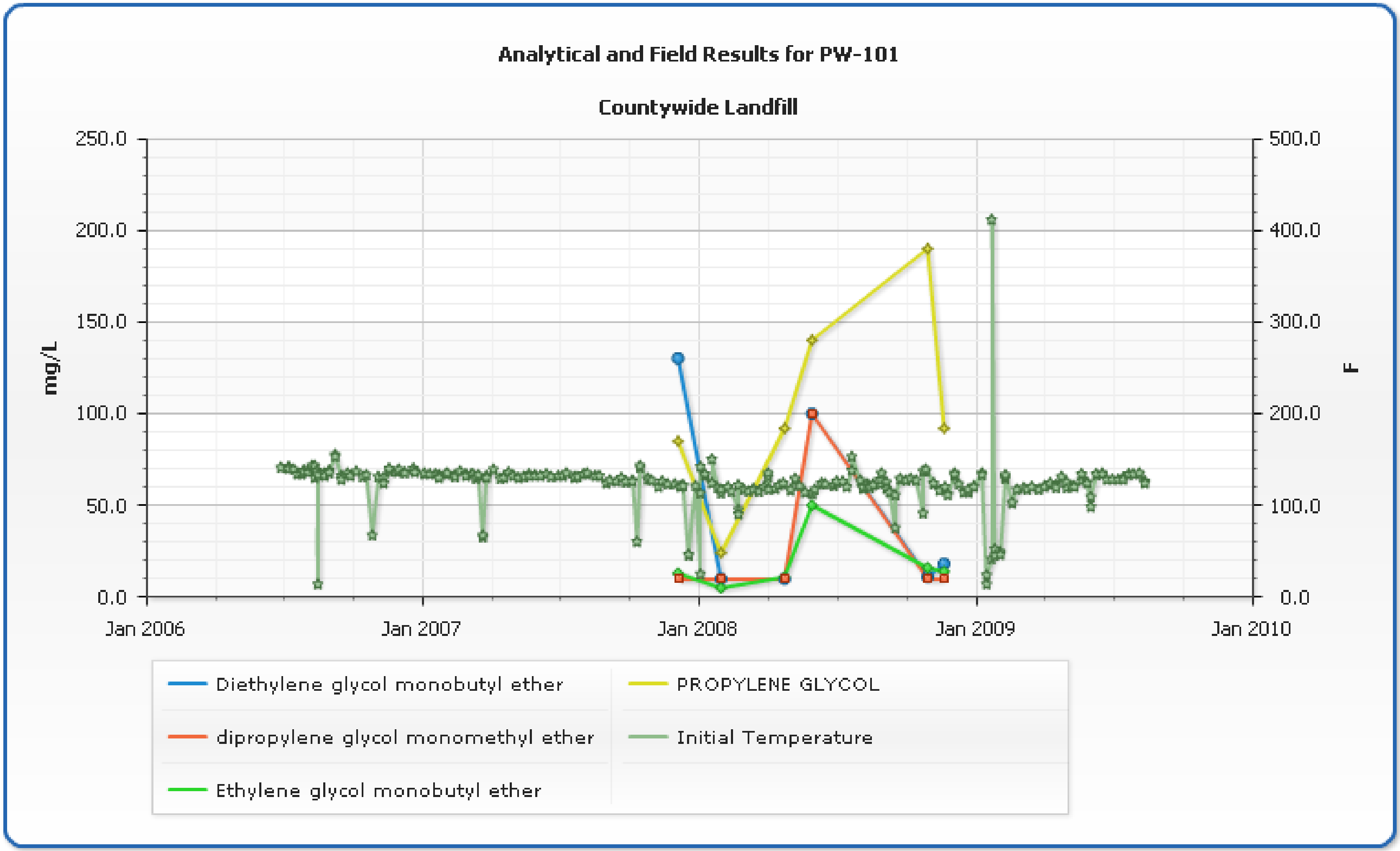

Analytical and Field Results for I1R
Countywide Landfill
mg/L
600.0
500.0
400.0
300.0
200.0
100.0
0.0
200.0
180.0
160.0
140.0
120.0
100.0
80.0
60.0
40.0
F
Jan 2008
Jan 2009
Jan 2010
Diethylene glycol monobutyl ether
dipropylene glycol monomethyl ether
Ethylene glycol monobutyl ether
PROPYLENE GLYCOL
Initial Temperature



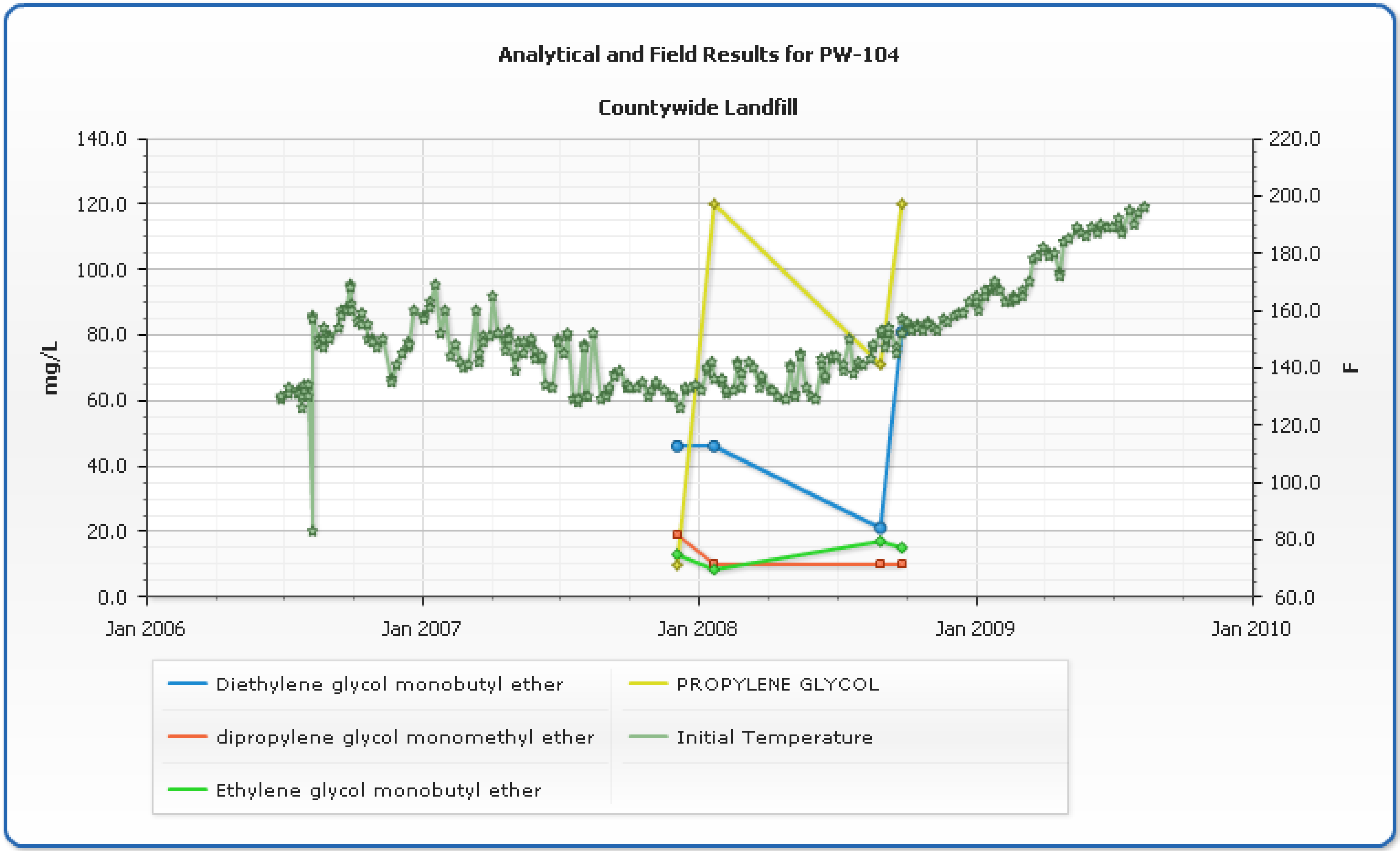
Analytical and Field Results for J1R
Countywide Landfill
mg/L
F
120.0
100.0
80.0
60.0
40.0
20.0
0.0
160.0
150.0
140.0
130.0
120.0
110.0
100.0
90.0
80.0
70.0
60.0
Jan 2008
Jan 2009
Jan 2010
Diethylene glycol monobutyl ether
dipropylene glycol monomethyl ether
Ethylene glycol monobutyl ether
PROPYLENE GLYCOL
Initial Temperature

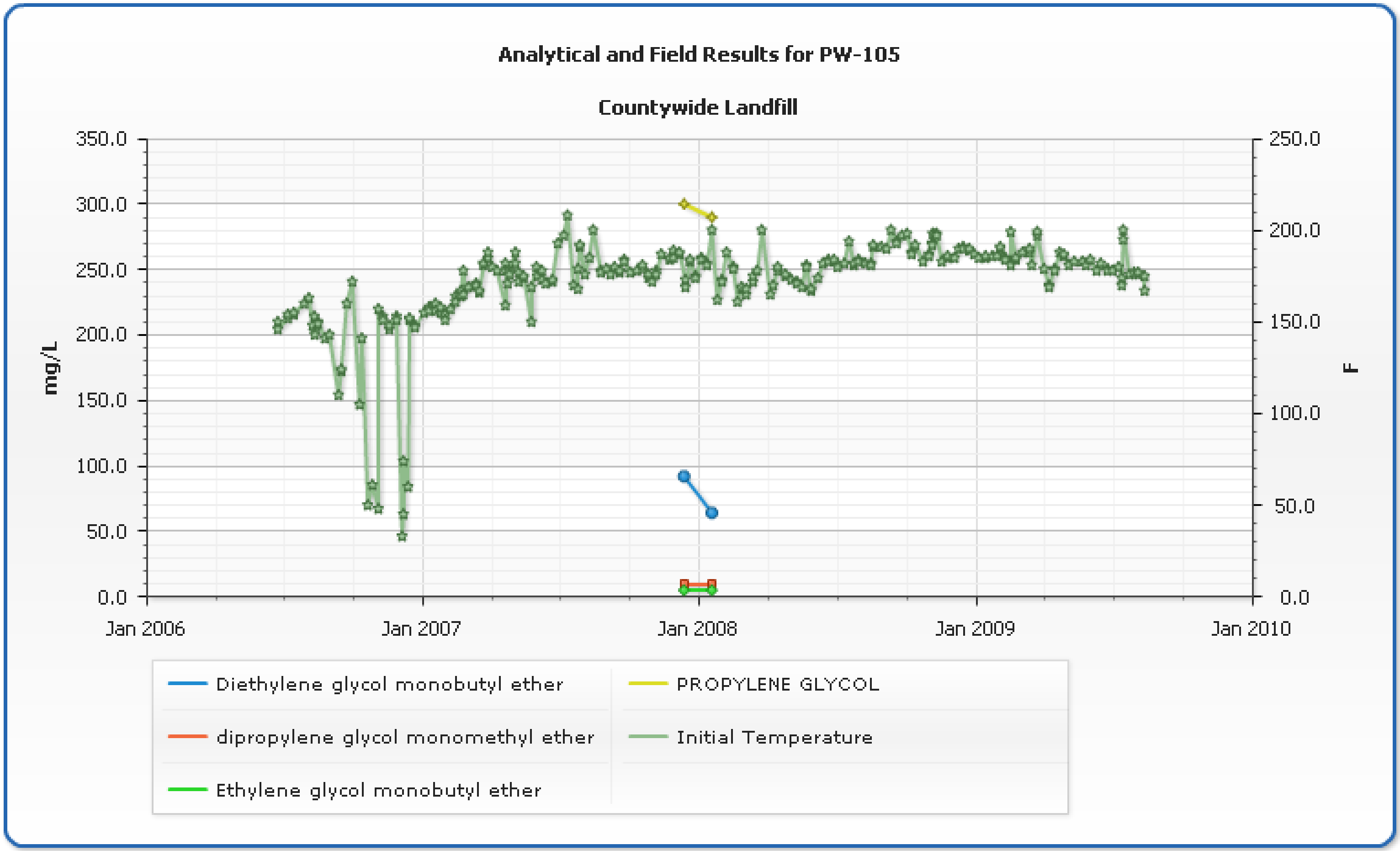

Analytical and Field Results for PW-14R(3)
Countywide Landfill
mg/L
F
300.0
250.0
200.0
150.0
100.0
50.0
0.0
Jan 2007
Jan 2008
Jan 2009
Jan 2010
Diethylene glycol monobutyl ether
dipropylene glycol monomethyl ether
Ethylene glycol monobutyl ether
PROPYLENE GLYCOL
Initial Temperature


Analytical and Field Results for PW-0041R(2)
Countywide Landfill
mg/L
F
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
220.0
200.0
180.0
160.0
140.0
120.0
100.0
80.0
60.0
40.0
Jan 2006
Jan 2007
Jan 2008
Jan 2009
Jan 2010
Diethylene glycol monobutyl ether
dipropylene glycol monomethyl ether
Ethylene glycol monobutyl ether
PROPYLENE GLYCOL
Initial Temperature

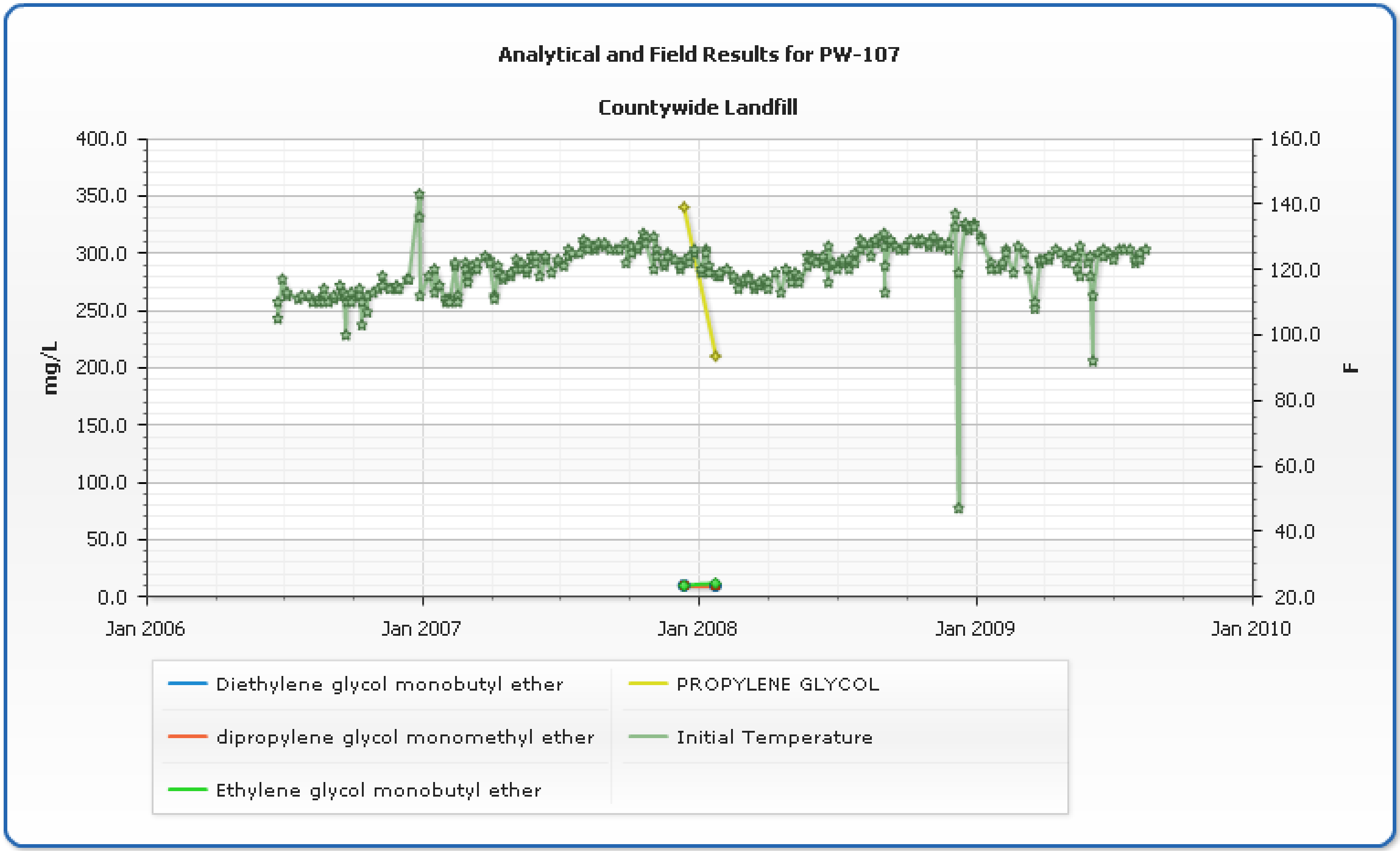


Analytical and Field Results for PW-101
Countywide Landfill
mg/L
F
250.0
200.0
150.0
100.0
50.0
0.0
500.0
400.0
300.0
200.0
100.0
0.0
Jan 2006
Jan 2007
Jan 2008
Jan 2009
Jan 2010
Diethylene glycol monobutyl ether
dipropylene glycol monomethyl ether
Ethylene glycol monobutyl ether
PROPYLENE GLYCOL
Initial Temperature

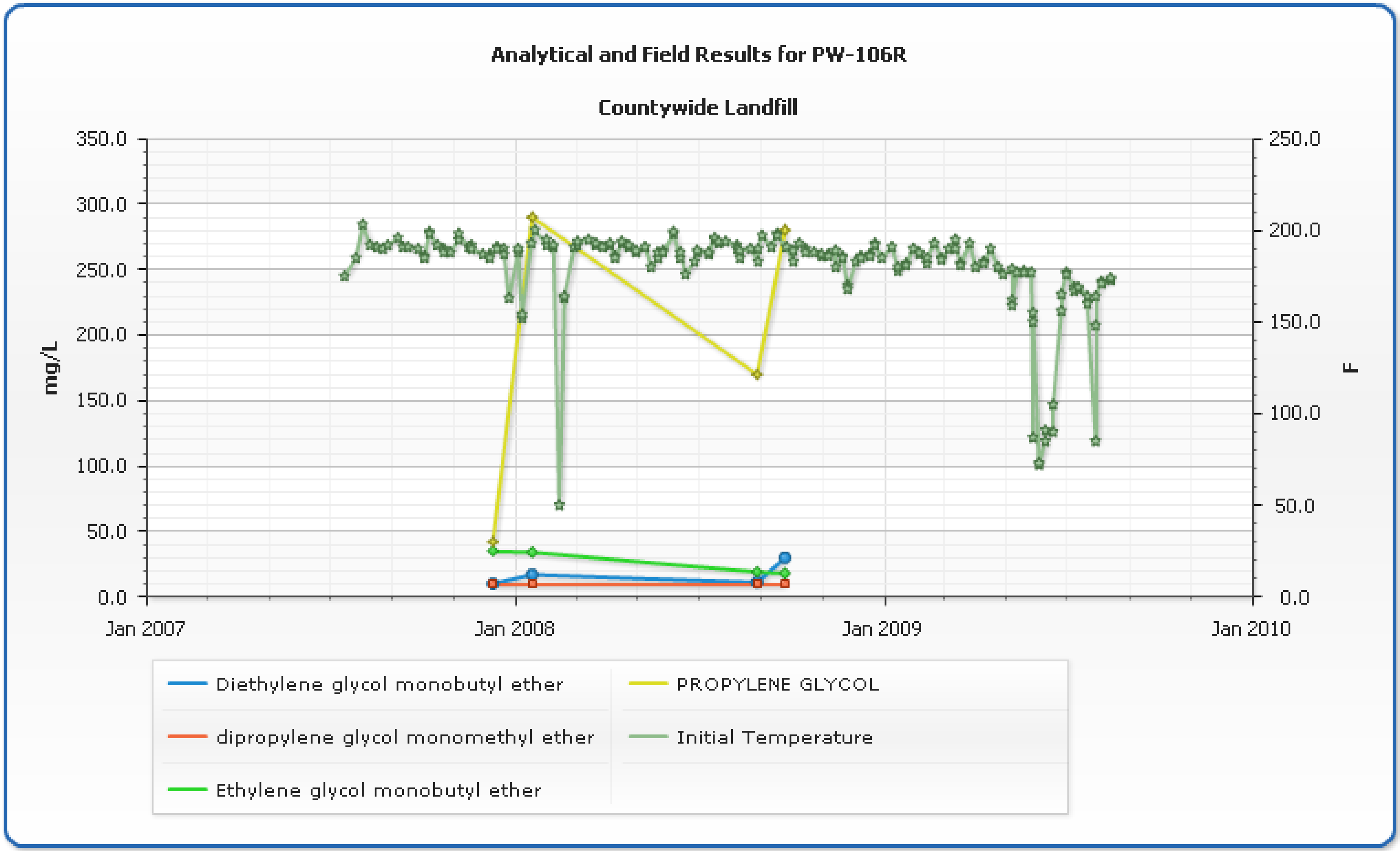

Analytical and Field Results for PW-104
Countywide Landfill
mg/L
F
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
220.0
200.0
180.0
160.0
140.0
120.0
100.0
80.0
60.0
Jan 2006
Jan 2007
Jan 2008
Jan 2009
Jan 2010
Diethylene glycol monobutyl ether
dipropylene glycol monomethyl ether
Ethylene glycol monobutyl ether
PROPYLENE GLYCOL
Initial Temperature



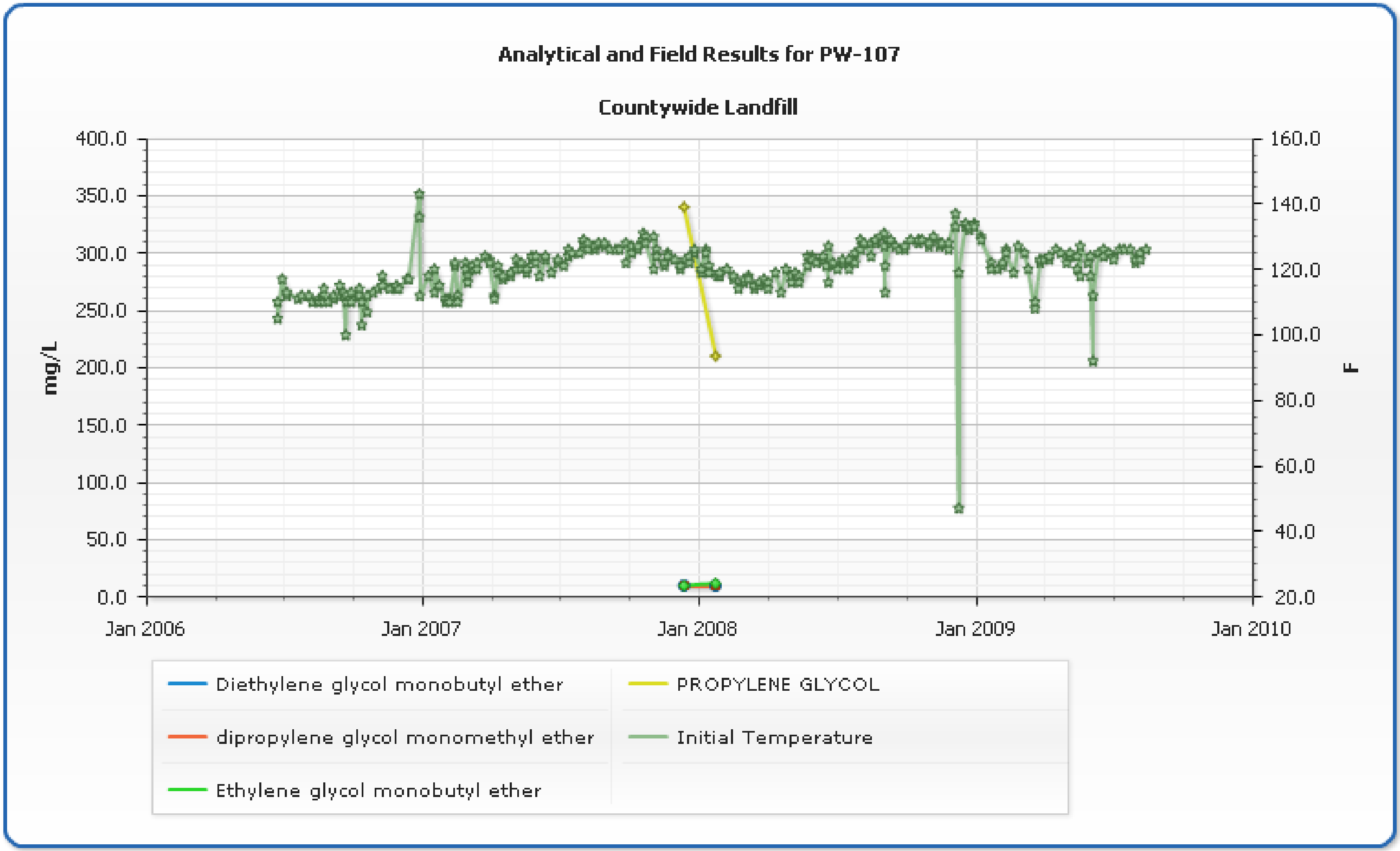
Analytical and Field Results for PW-105
Countywide Landfill
mg/L
F
350.0
300.0
250.0
200.0
150.0
100.0
50.0
0.0
250.0
200.0
150.0
100.0
50.0
0.0
Jan 2006
Jan 2007
Jan 2008
Jan 2009
Jan 2010
Diethylene glycol monobutyl ether
dipropylene glycol monomethyl ether
Ethylene glycol monobutyl ether
PROPYLENE GLYCOL
Initial Temperature

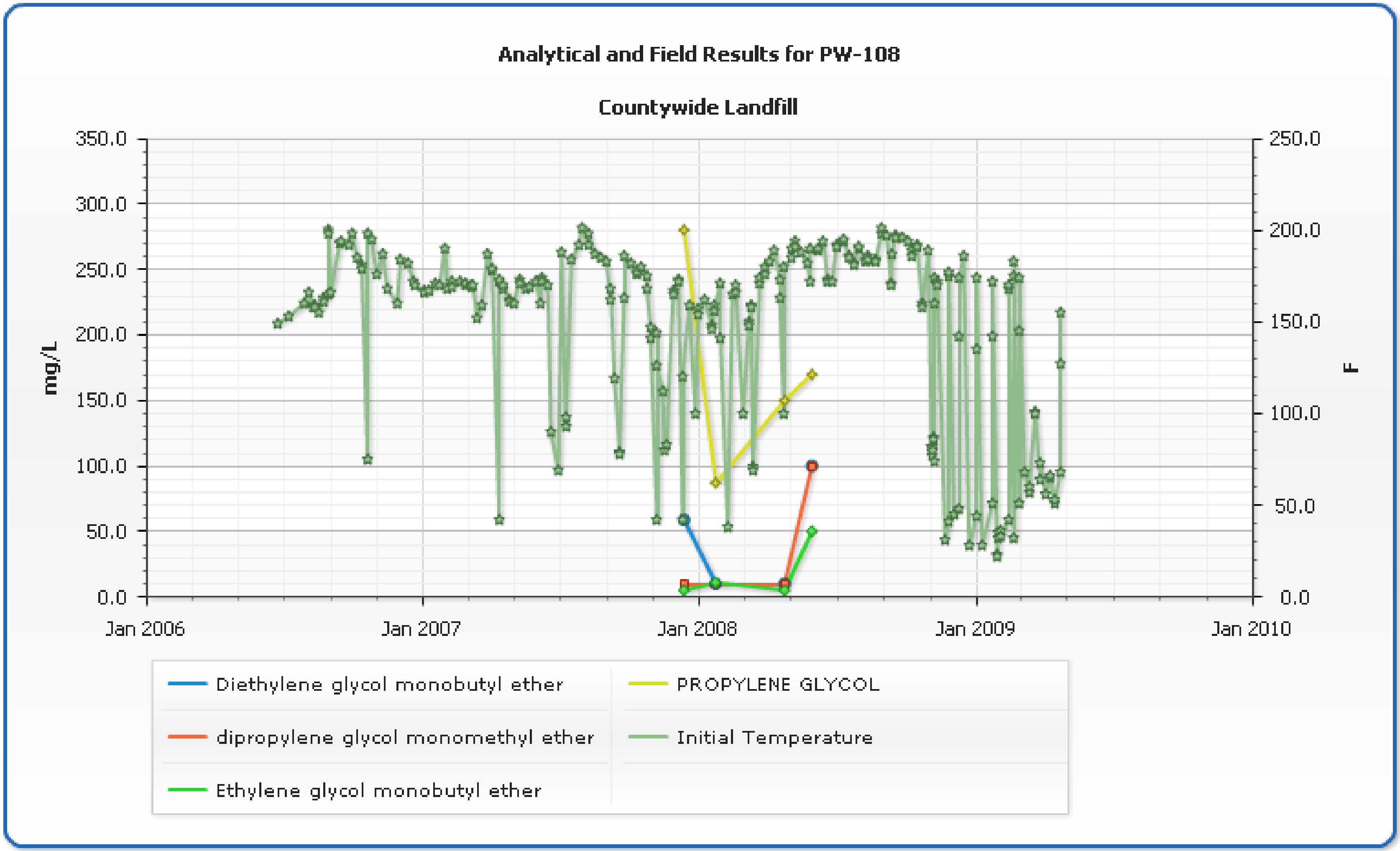


Analytical and Field Results for PW-107
Countywide Landfill
mg/L
F
400.0
350.0
300.0
250.0
200.0
150.0
100.0
50.0
0.0
160.0
140.0
120.0
100.0
80.0
60.0
40.0
20.0
Jan 2006
Jan 2007
Jan 2008
Jan 2009
Jan 2010
Diethylene glycol monobutyl ether
dipropylene glycol monomethyl ether
Ethylene glycol monobutyl ether
PROPYLENE GLYCOL
Initial Temperature

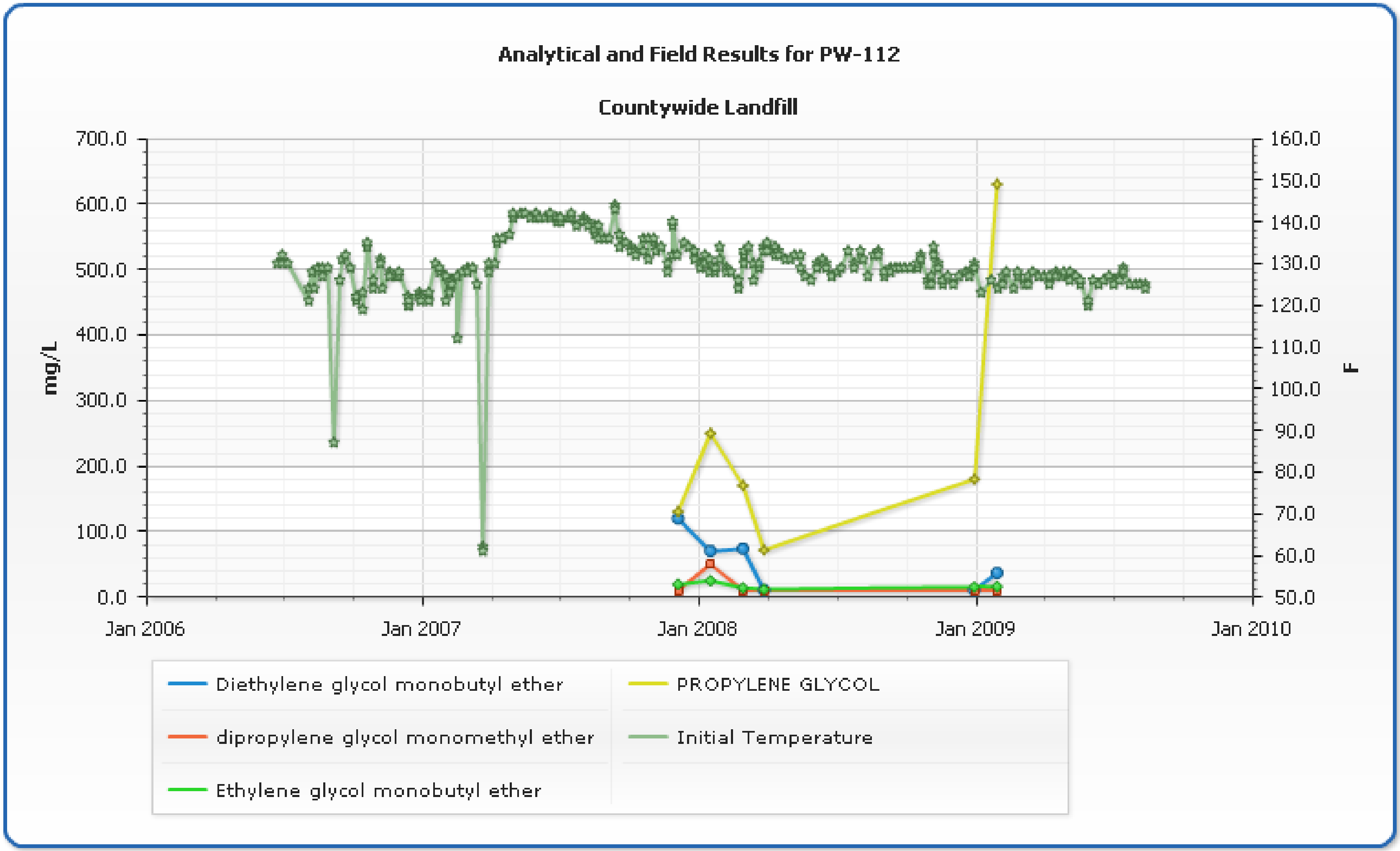


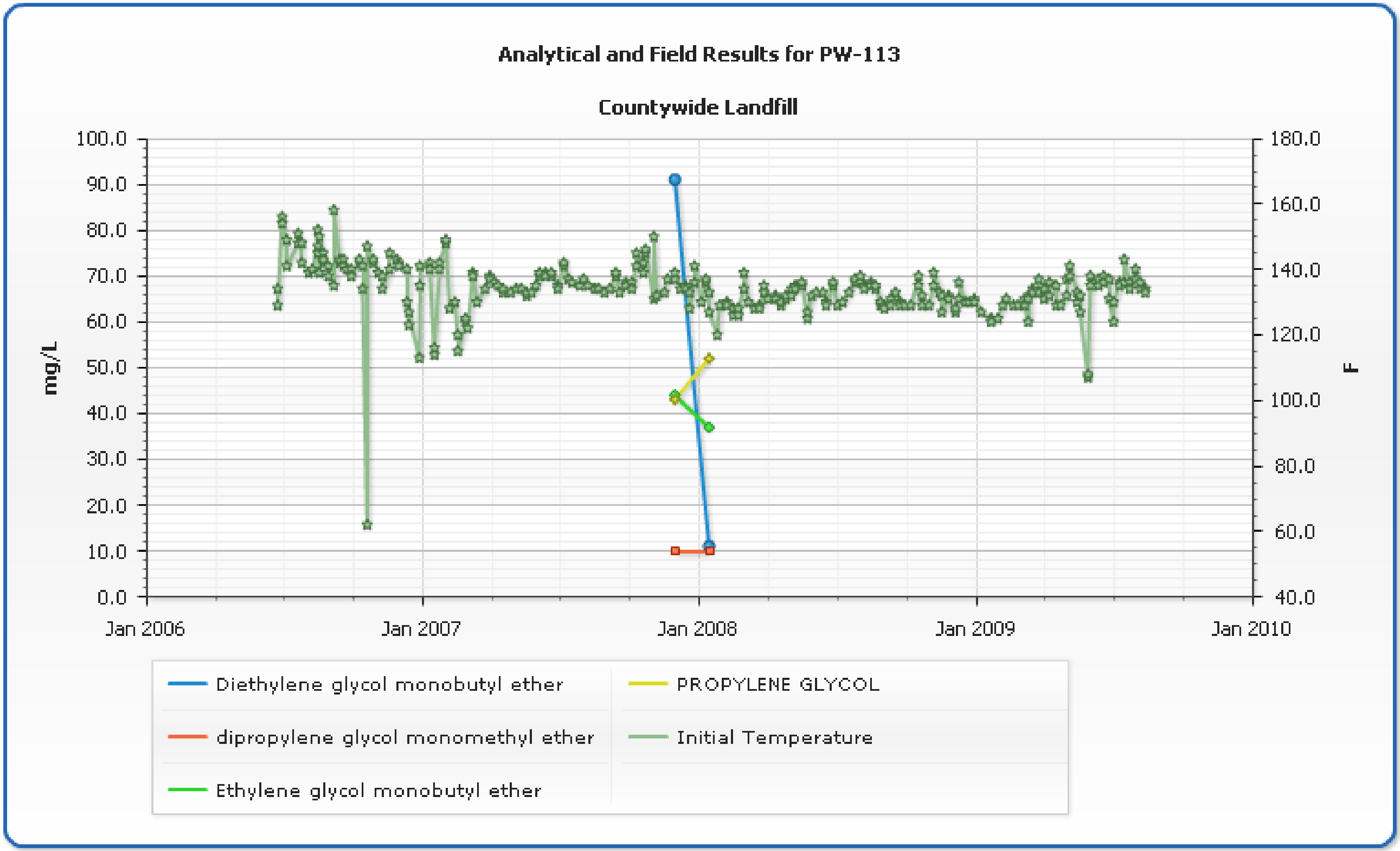
Analytical and Field Results for PW-106R
Countywide Landfill
mg/L
F
350.0
300.0
250.0
200.0
150.0
100.0
50.0
0.0
250.0
200.0
150.0
100.0
50.0
0.0
Jan 2007
Jan 2008
Jan 2009
Jan 2010
Diethylene glycol monobutyl ether
dipropylene glycol monomethyl ether
Ethylene glycol monobutyl ether
PROPYLENE GLYCOL
Initial Temperature


Analytical and Field Results for PW-107
Countywide Landfill
mg/L
F
400.0
350.0
300.0
250.0
200.0
150.0
100.0
50.0
0.0
160.0
140.0
120.0
100.0
80.0
60.0
40.0
20.0
Jan 2006
Jan 2007
Jan 2008
Jan 2009
Jan 2010
Diethylene glycol monobutyl ether
dipropylene glycol monomethyl ether
Ethylene glycol monobutyl ether
PROPYLENE GLYCOL
Initial Temperature

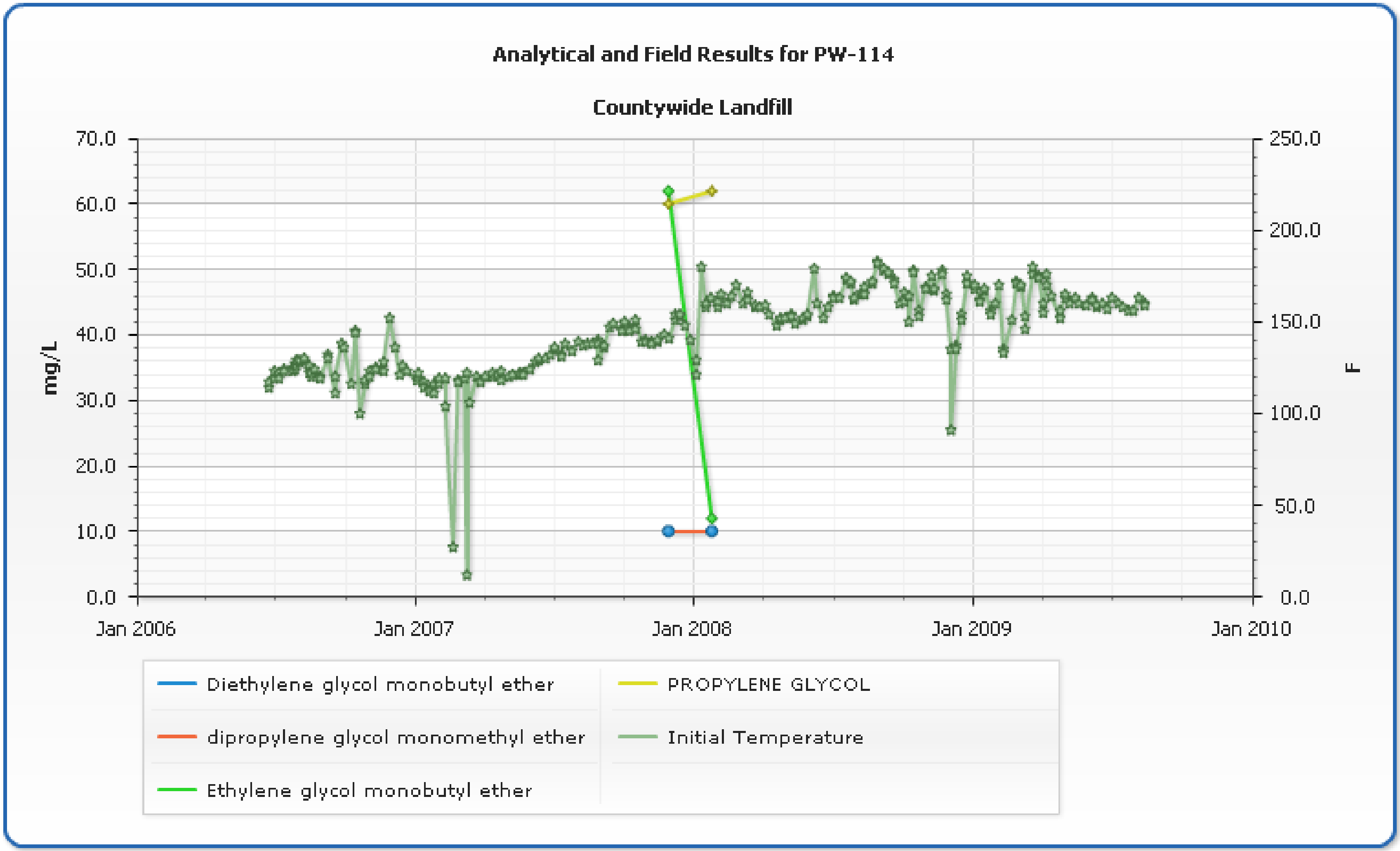


Analytical and Field Results for PW-108
Countywide Landfill
mg/L
F
350.0
300.0
250.0
200.0
150.0
100.0
50.0
0.0
250.0
200.0
150.0
100.0
50.0
0.0
Jan 2006
Jan 2007
Jan 2008
Jan 2009
Jan 2010
Diethylene glycol monobutyl ether
PROPYLENE GLYCOL
dipropylene glycol monomethyl ether
Initial Temperature
Ethylene glycol monobutyl ether

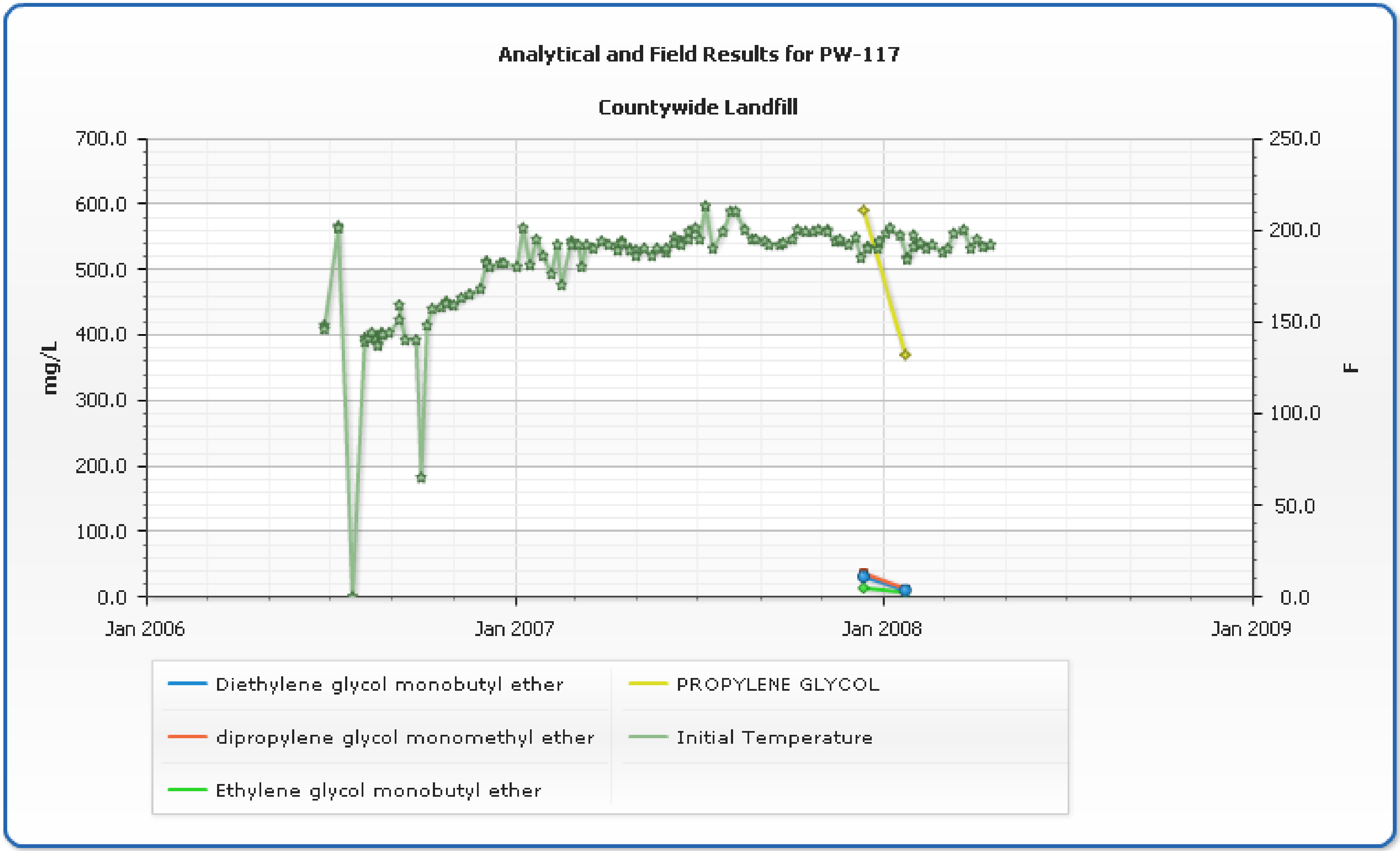

Analytical and Field Results for PW-112
Countywide Landfill
mg/L
F
700.0
600.0
500.0
400.0
300.0
200.0
100.0
0.0
160.0
150.0
140.0
130.0
120.0
110.0
100.0
90.0
80.0
70.0
60.0
50.0
Jan 2006
Jan 2007
Jan 2008
Jan 2009
Jan 2010
Diethylene glycol monobutyl ether
dipropylene glycol monomethyl ether
Ethylene glycol monobutyl ether
PROPYLENE GLYCOL
Initial Temperature



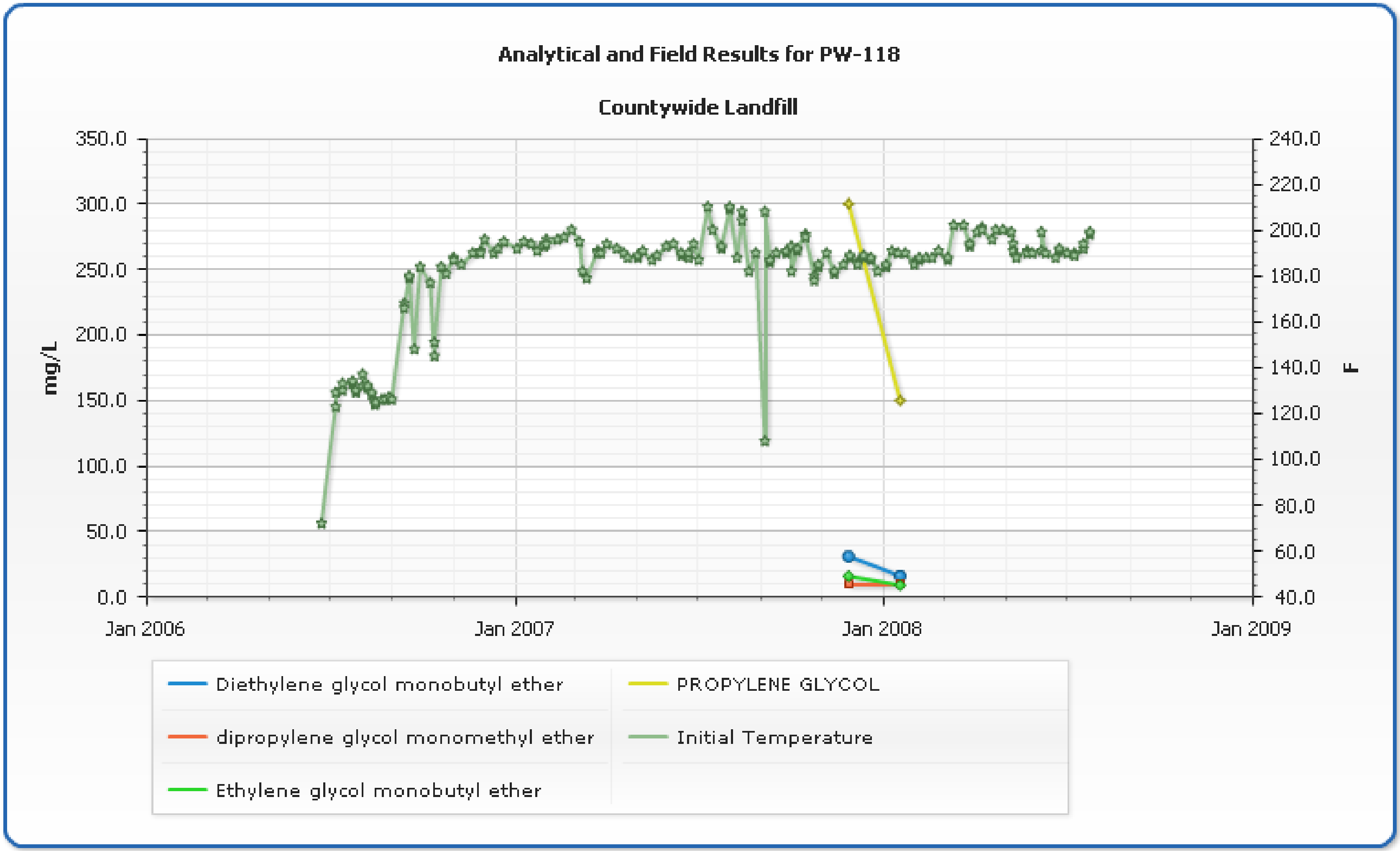
Analytical and Field Results for PW-113
Countywide Landfill
mg/L
F
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
180.0
160.0
140.0
120.0
100.0
80.0
60.0
40.0
Jan 2006
Jan 2007
Jan 2008
Jan 2009
Jan 2010
Diethylene glycol monobutyl ether
PROPYLENE GLYCOL
dipropylene glycol monomethyl ether
Initial Temperature
Ethylene glycol monobutyl ether

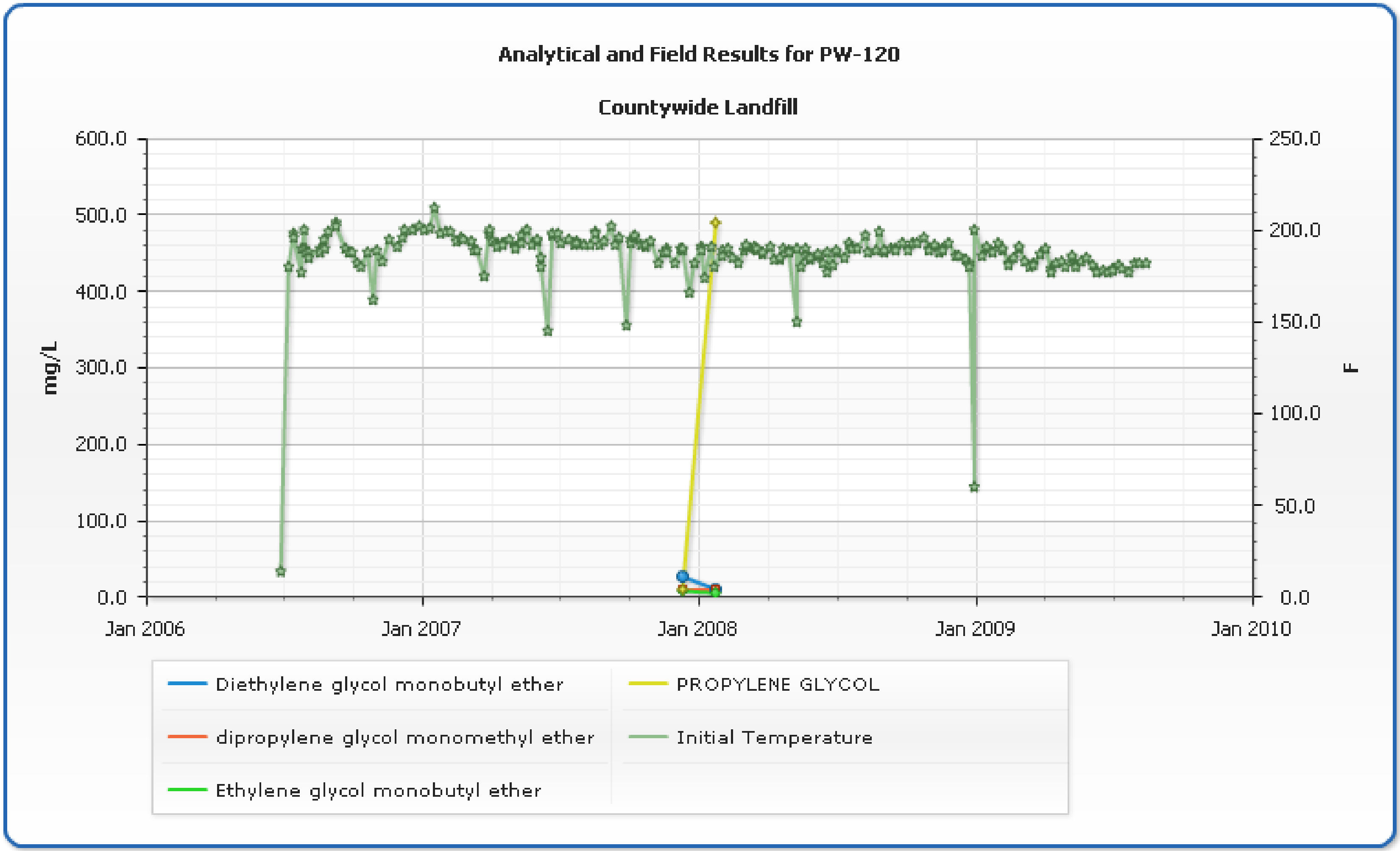


Analytical and Field Results for PW-114
Countywide Landfill
mg/L
F
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
250.0
200.0
150.0
100.0
50.0
0.0
Jan 2006
Jan 2007
Jan 2008
Jan 2009
Jan 2010
Diethylene glycol monobutyl ether
dipropylene glycol monomethyl ether
Ethylene glycol monobutyl ether
PROPYLENE GLYCOL
Initial Temperature

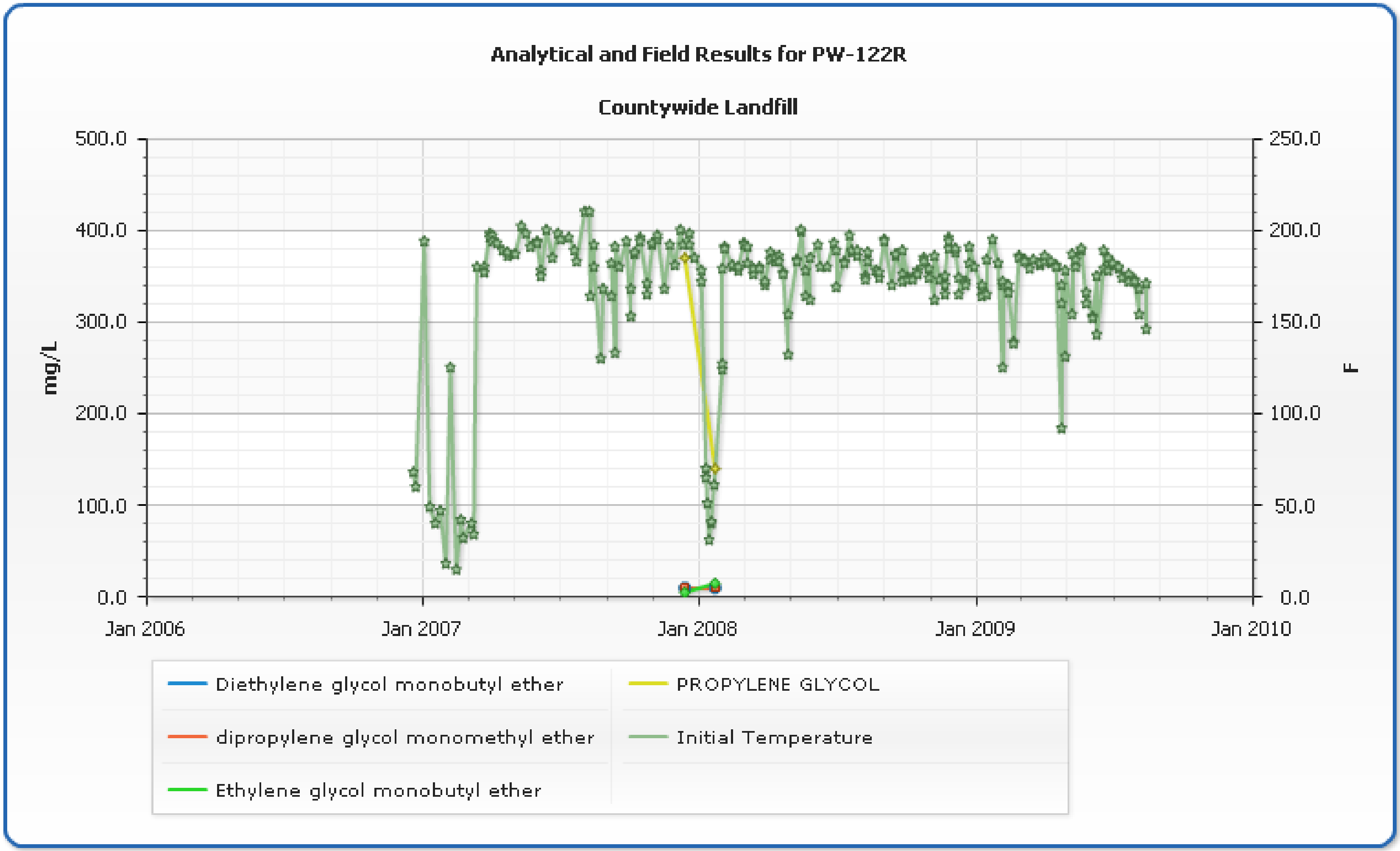


Analytical and Field Results for PW-117
Countywide Landfill
mg/L
F
700.0
600.0
500.0
400.0
300.0
200.0
100.0
0.0
250.0
200.0
150.0
100.0
50.0
0.0
Jan 2006
Jan 2007
Jan 2008
Jan 2009
Diethylene glycol monobutyl ether
dipropylene glycol monomethyl ether
Ethylene glycol monobutyl ether
PROPYLENE GLYCOL
Initial Temperature

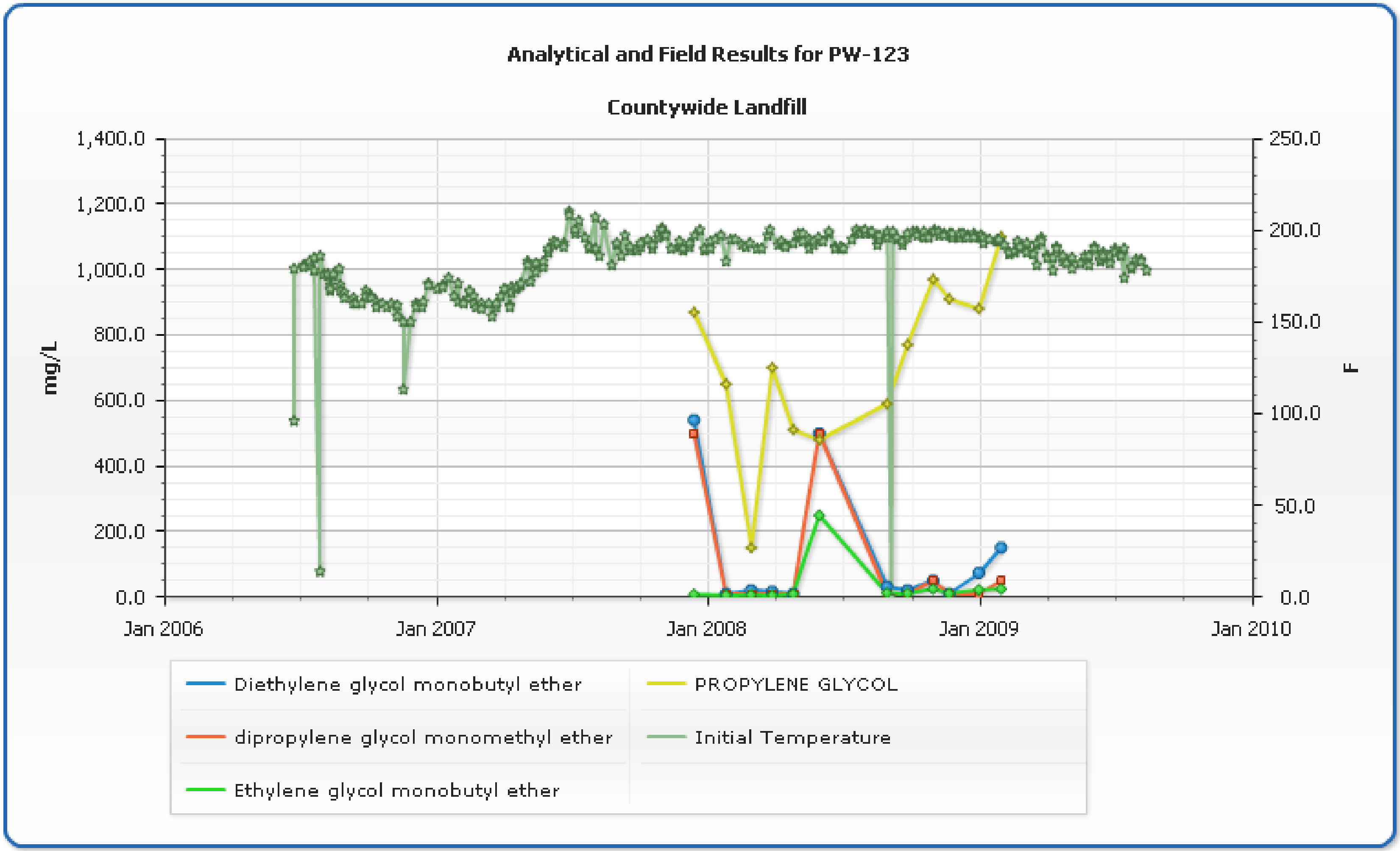

Analytical and Field Results for PW-118
Countywide Landfill
mg/L
F
350.0
300.0
250.0
200.0
150.0
100.0
50.0
0.0
240.0
220.0
200.0
180.0
160.0
140.0
120.0
100.0
80.0
60.0
40.0
Jan 2006
Jan 2007
Jan 2008
Jan 2009
Diethylene glycol monobutyl ether
dipropylene glycol monomethyl ether
Ethylene glycol monobutyl ether
PROPYLENE GLYCOL
Initial Temperature



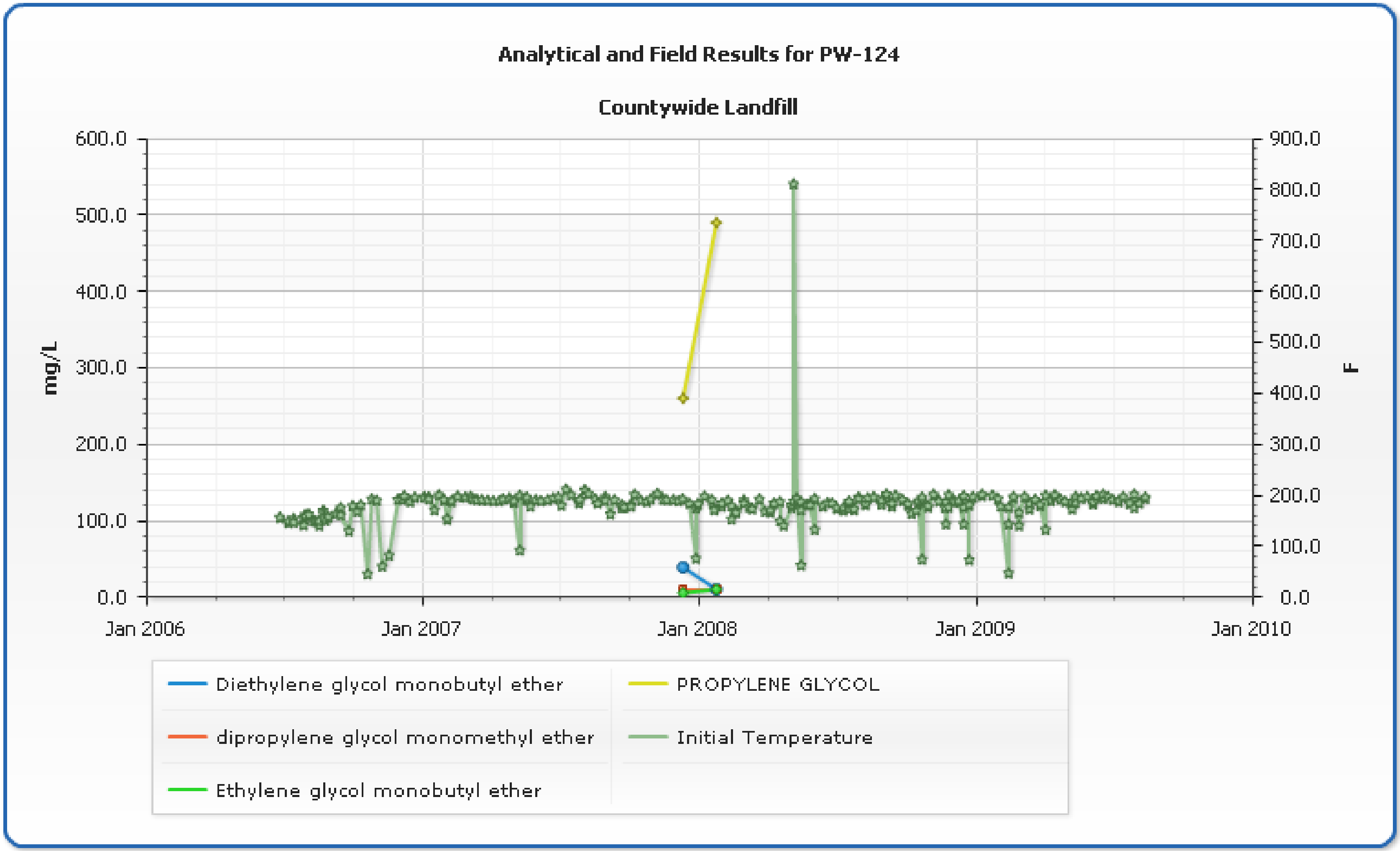
Analytical and Field Results for PW-120
Countywide Landfill
mg/L
F
600.0
500.0
400.0
300.0
200.0
100.0
0.0
250.0
200.0
150.0
100.0
50.0
0.0
Jan 2006
Jan 2007
Jan 2008
Jan 2009
Jan 2010
Diethylene glycol monobutyl ether
PROPYLENE GLYCOL
dipropylene glycol monomethyl ether
Initial Temperature
Ethylene glycol monobutyl ether



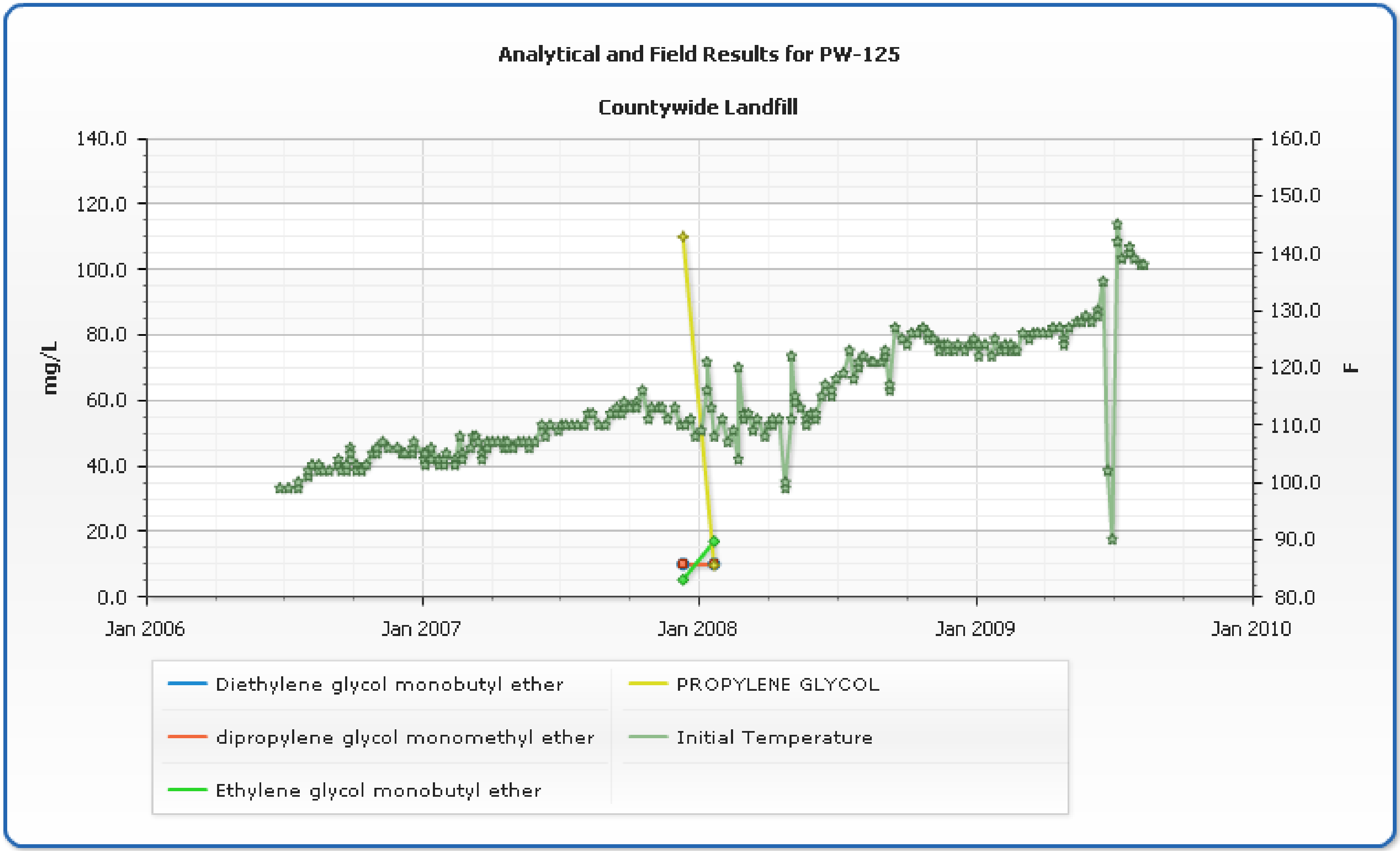
Analytical and Field Results for PW-122R
Countywide Landfill
mg/L
F
500.0
400.0
300.0
200.0
100.0
0.0
250.0
200.0
150.0
100.0
50.0
0.0
Jan 2006
Jan 2007
Jan 2008
Jan 2009
Jan 2010
Diethylene glycol monobutyl ether
PROPYLENE GLYCOL
dipropylene glycol monomethyl ether
Initial Temperature
Ethylene glycol monobutyl ether



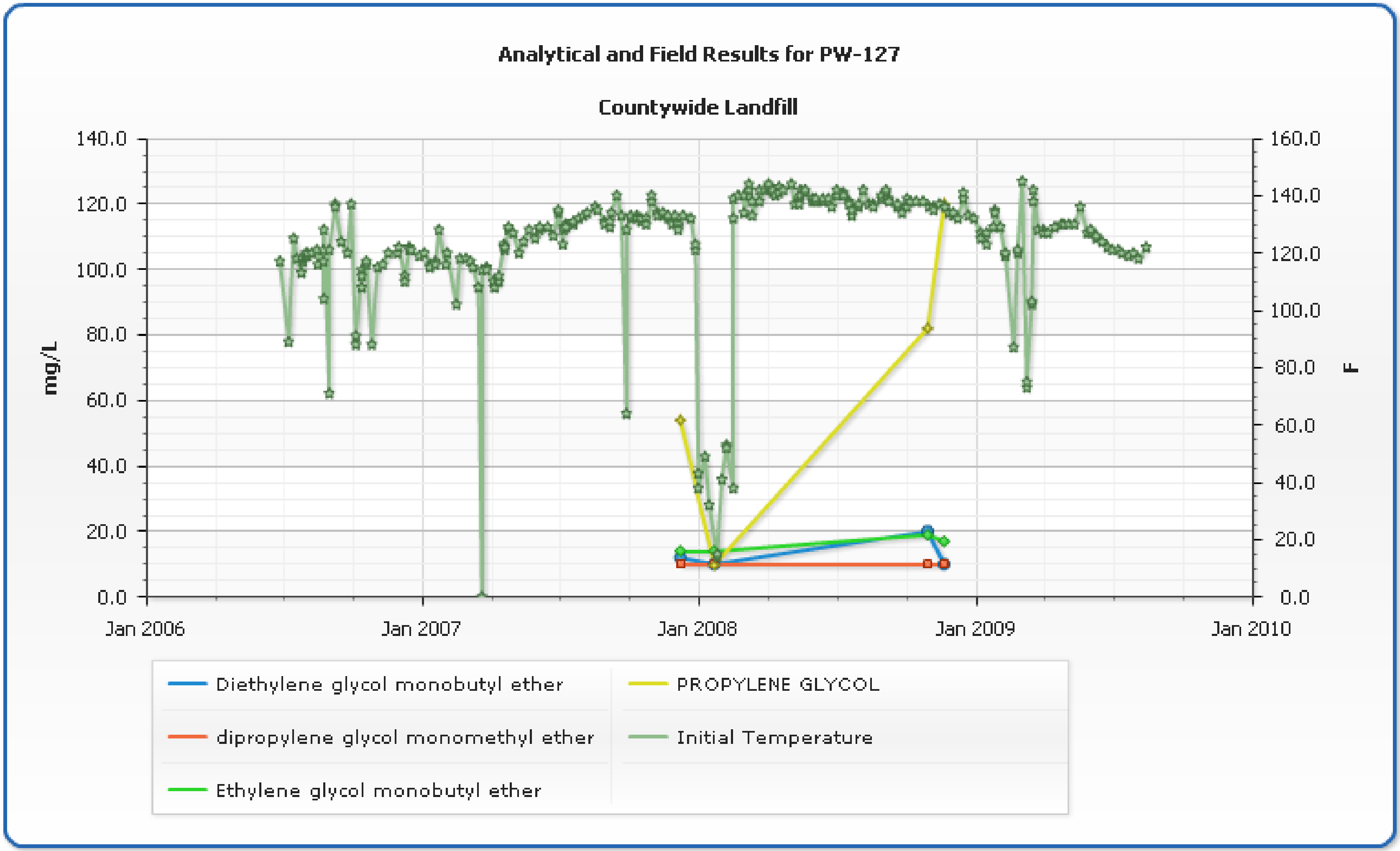
Analytical and Field Results for PW-123
Countywide Landfill
mg/L
F
1,400.0
1,200.0
1,000.0
800.0
600.0
400.0
200.0
0.0
250.0
200.0
150.0
100.0
50.0
0.0
Jan 2006
Jan 2007
Jan 2008
Jan 2009
Jan 2010
Diethylene glycol monobutyl ether
dipropylene glycol monomethyl ether
Ethylene glycol monobutyl ether
PROPYLENE GLYCOL
Initial Temperature

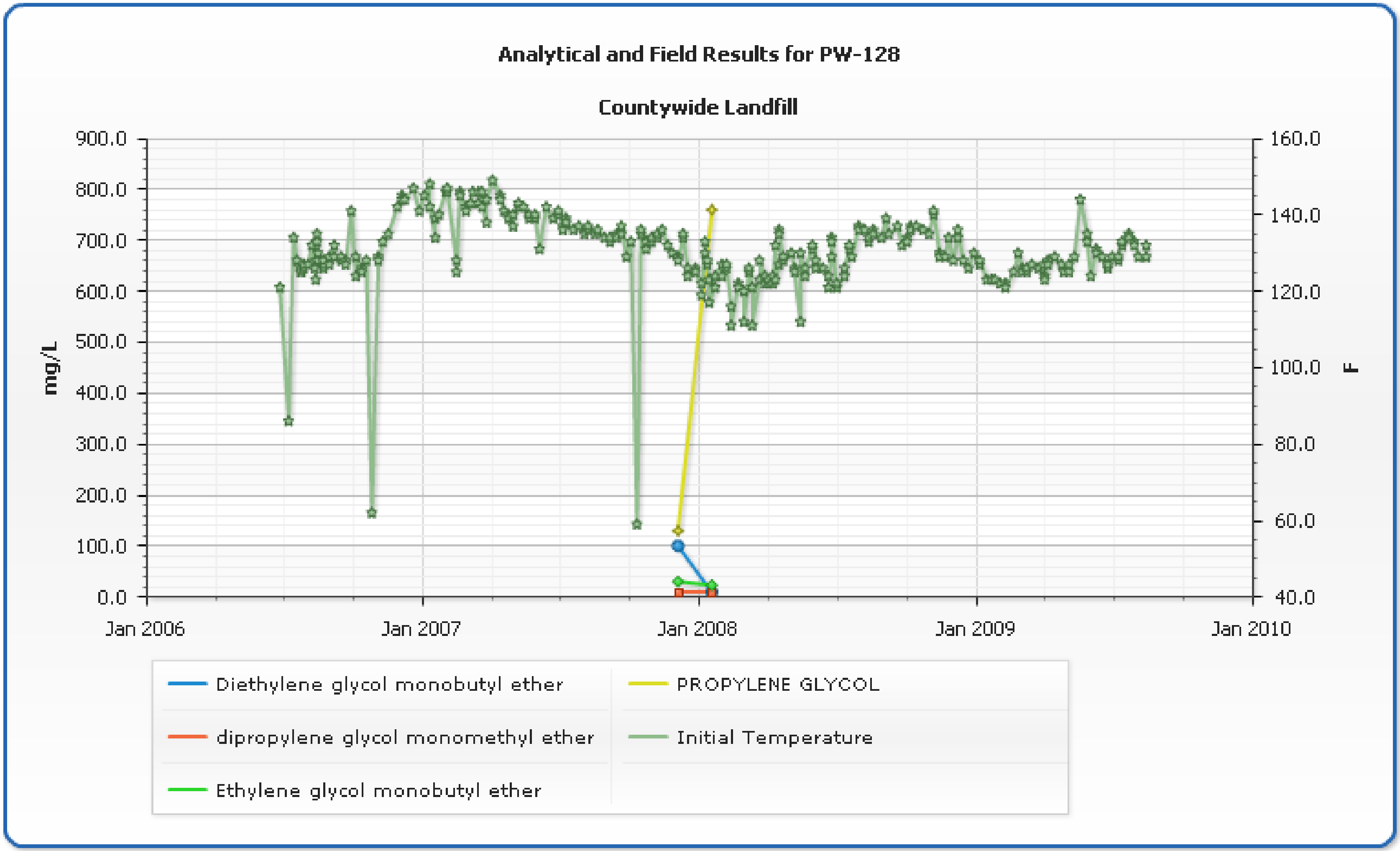


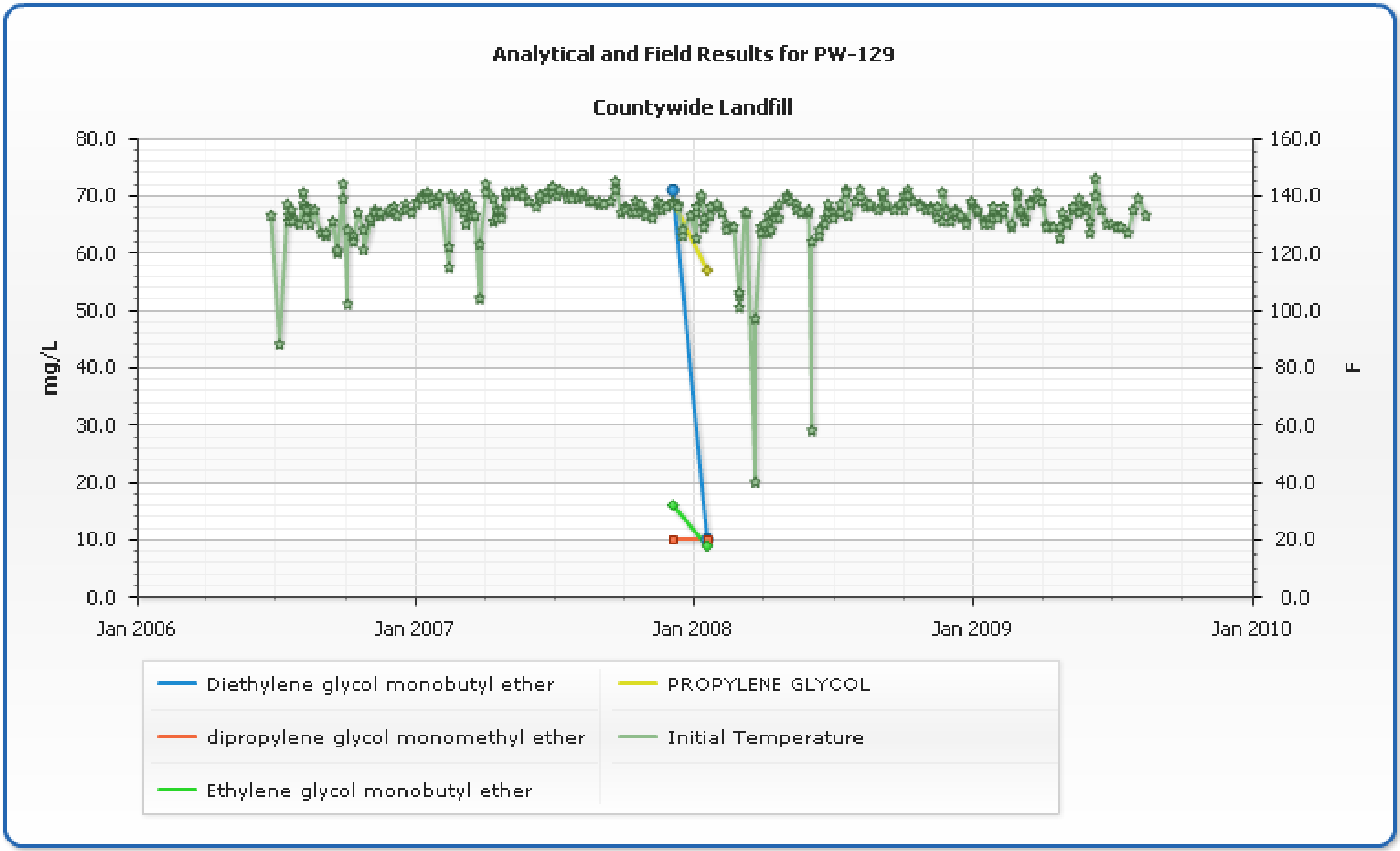
Analytical and Field Results for PW-124
Countywide Landfill
mg/L
F
600.0
500.0
400.0
300.0
200.0
100.0
0.0
900.0
800.0
700.0
600.0
500.0
400.0
300.0
200.0
100.0
0.0
Jan 2006
Jan 2007
Jan 2008
Jan 2009
Jan 2010
Diethylene glycol monobutyl ether
dipropylene glycol monomethyl ether
Ethylene glycol monobutyl ether
PROPYLENE GLYCOL
Initial Temperature



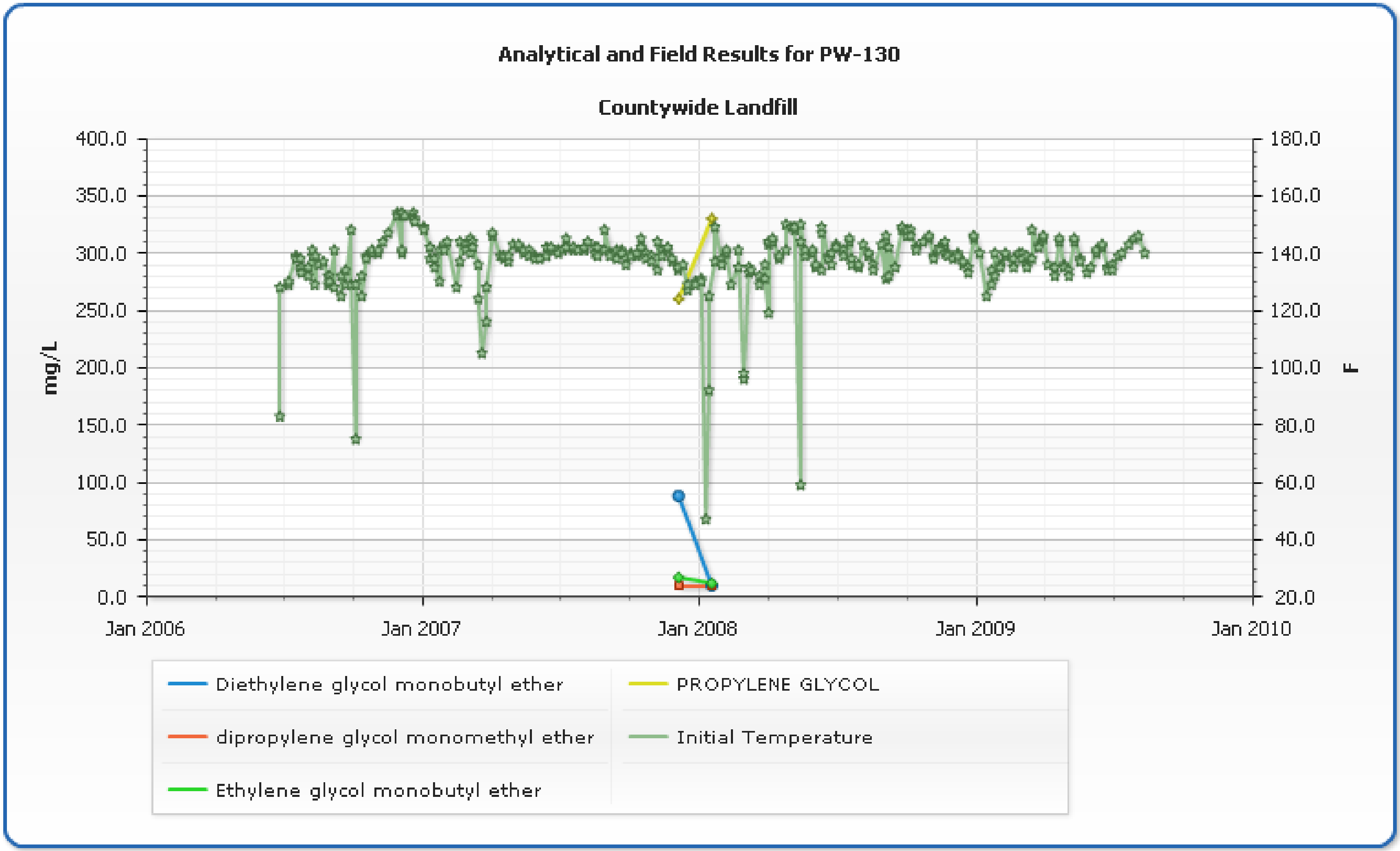
Analytical and Field Results for PW-125
Countywide Landfill
mg/L
F
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
160.0
150.0
140.0
130.0
120.0
110.0
100.0
90.0
80.0
Jan 2006
Jan 2007
Jan 2008
Jan 2009
Jan 2010
Diethylene glycol monobutyl ether
dipropylene glycol monomethyl ether
Ethylene glycol monobutyl ether
PROPYLENE GLYCOL
Initial Temperature


Analytical and Field Results for PW-127
Countywide Landfill
mg/L
F
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
160.0
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
Jan 2006
Jan 2007
Jan 2008
Jan 2009
Jan 2010
Diethylene glycol monobutyl ether
dipropylene glycol monomethyl ether
Ethylene glycol monobutyl ether
PROPYLENE GLYCOL
Initial Temperature

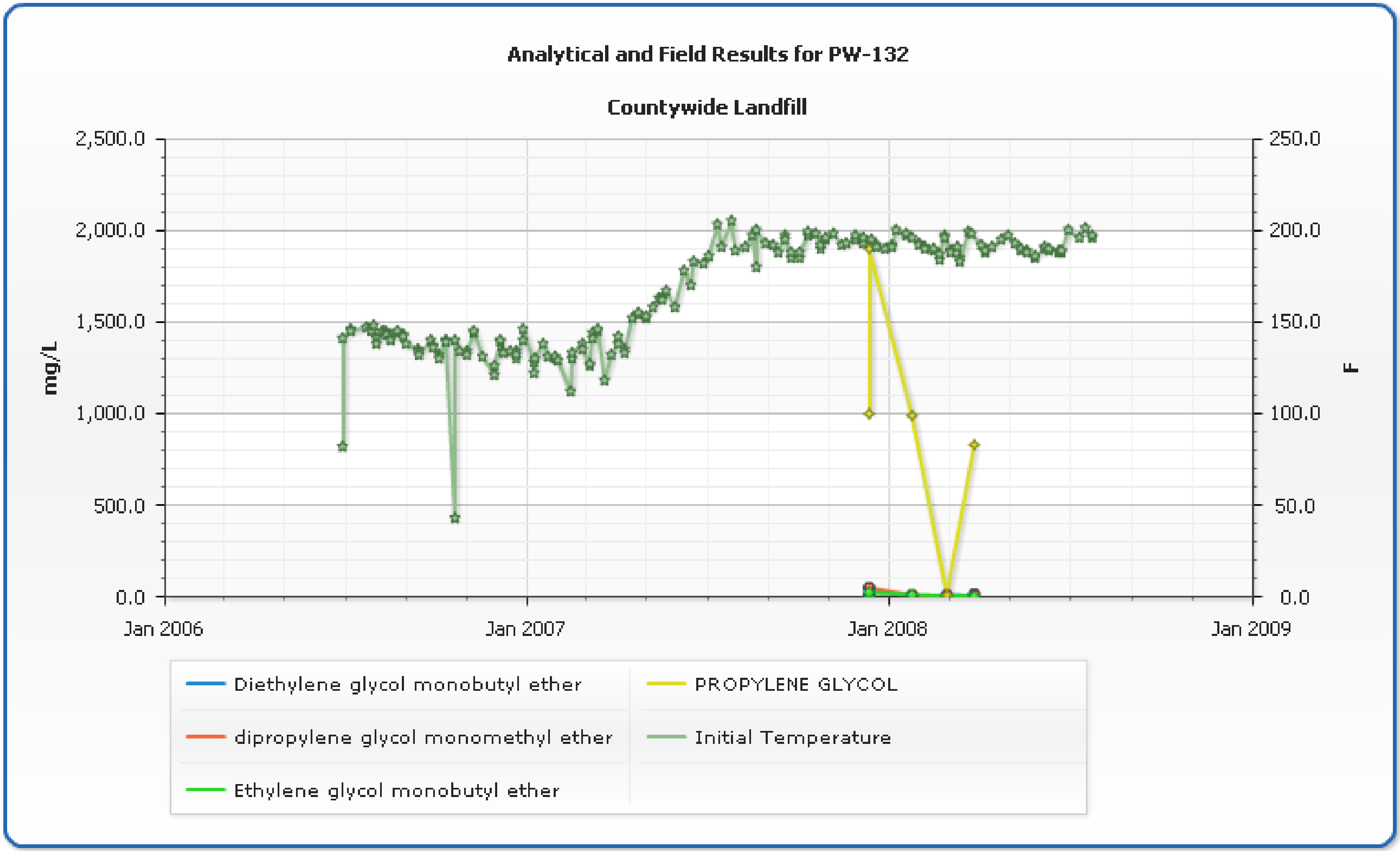

Analytical and Field Results for PW-128
Countywide Landfill
mg/L
F
900.0
800.0
700.0
600.0
500.0
400.0
300.0
200.0
100.0
0.0
160.0
140.0
120.0
100.0
80.0
60.0
40.0
Jan 2006
Jan 2007
Jan 2008
Jan 2009
Jan 2010
Diethylene glycol monobutyl ether
dipropylene glycol monomethyl ether
Ethylene glycol monobutyl ether
PROPYLENE GLYCOL
Initial Temperature



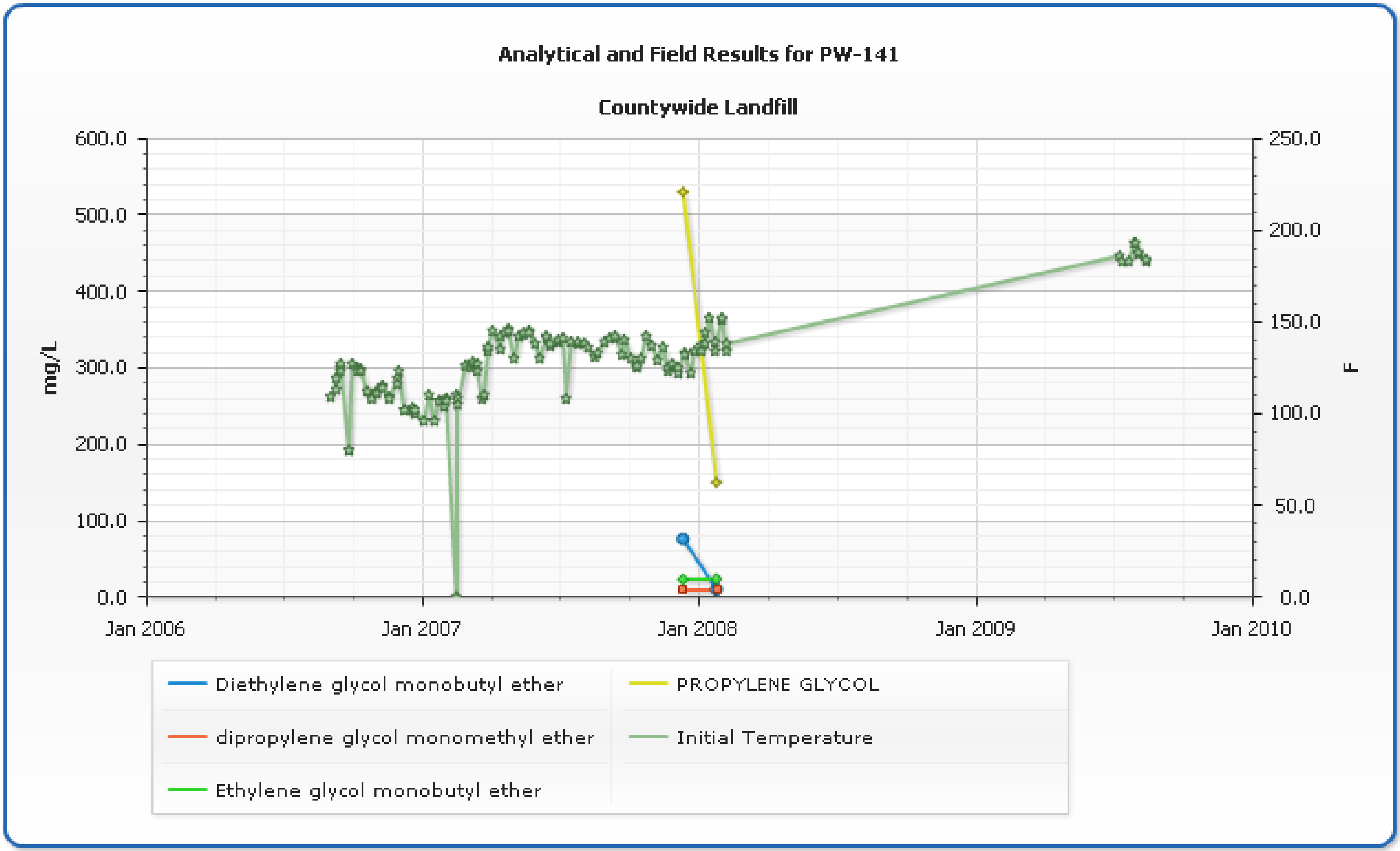
Analytical and Field Results for PW-129
Countywide Landfill
mg/L
F
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
160.0
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
Jan 2006
Jan 2007
Jan 2008
Jan 2009
Jan 2010
Diethylene glycol monobutyl ether
dipropylene glycol monomethyl ether
Ethylene glycol monobutyl ether
PROPYLENE GLYCOL
Initial Temperature

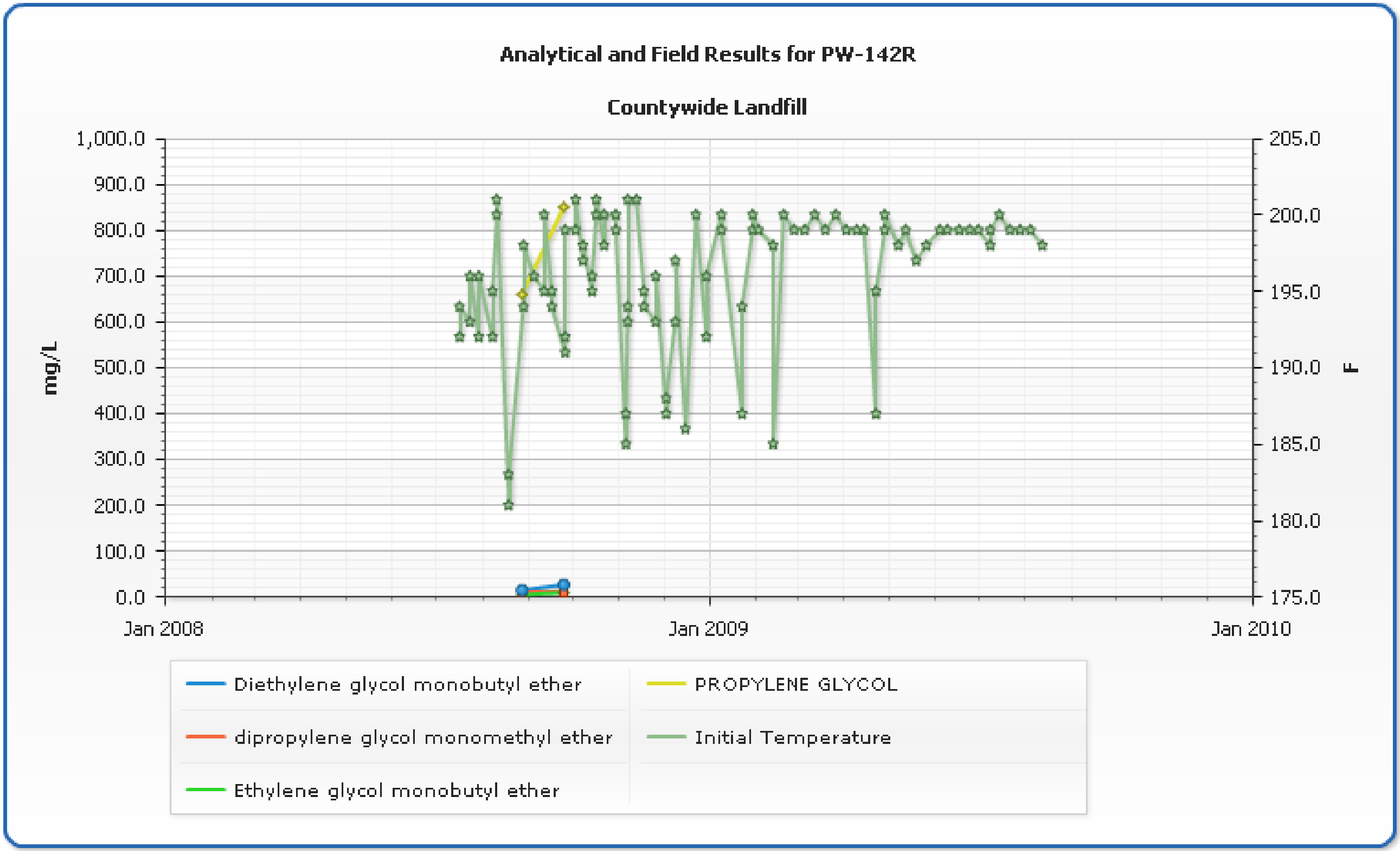


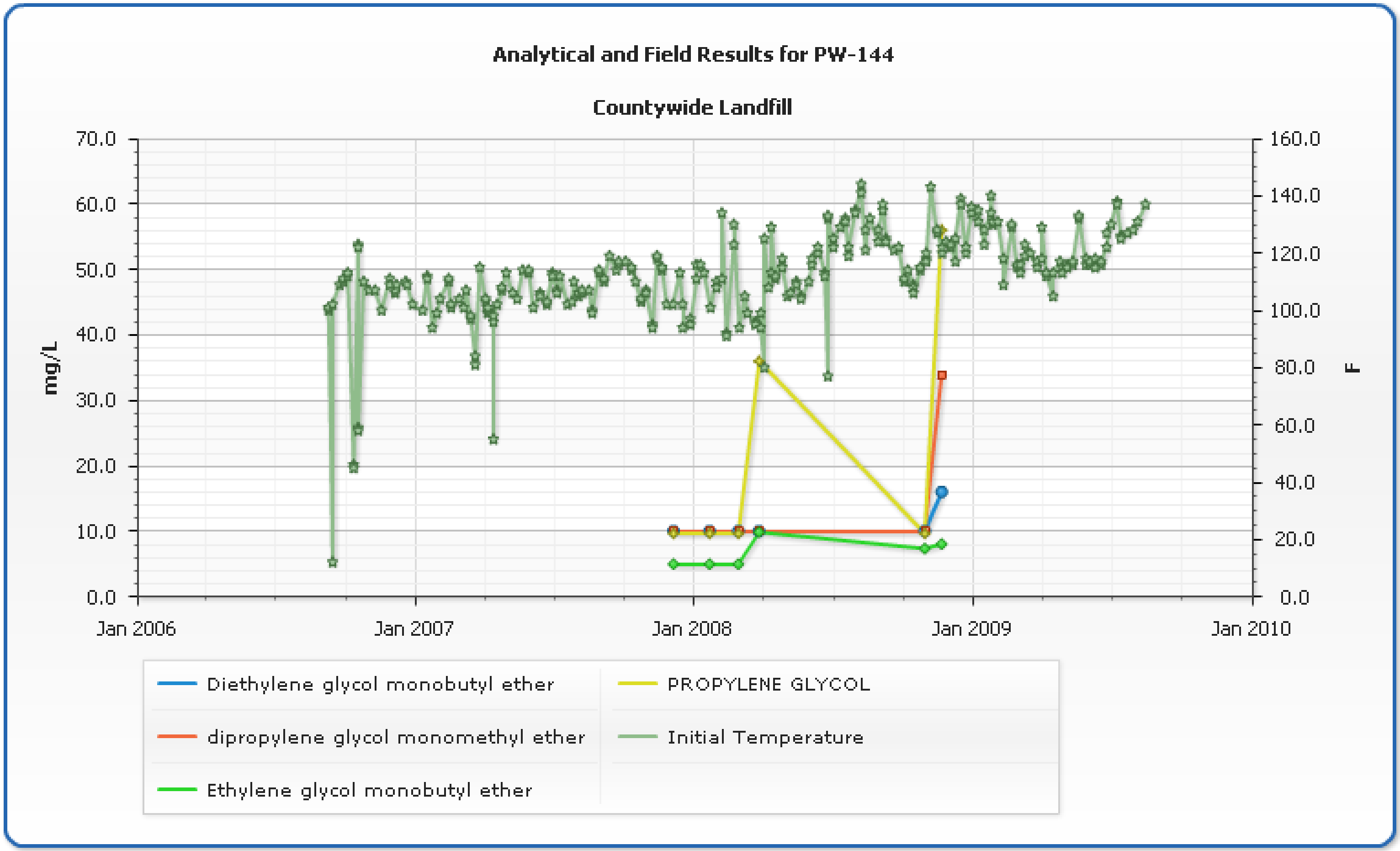
Analytical and Field Results for PW-130
Countywide Landfill
mg/L
F
400.0
350.0
300.0
250.0
200.0
150.0
100.0
50.0
0.0
180.0
160.0
140.0
120.0
100.0
80.0
60.0
40.0
20.0
Jan 2006
Jan 2007
Jan 2008
Jan 2009
Jan 2010
Diethylene glycol monobutyl ether
PROPYLENE GLYCOL
dipropylene glycol monomethyl ether
Initial Temperature
Ethylene glycol monobutyl ether



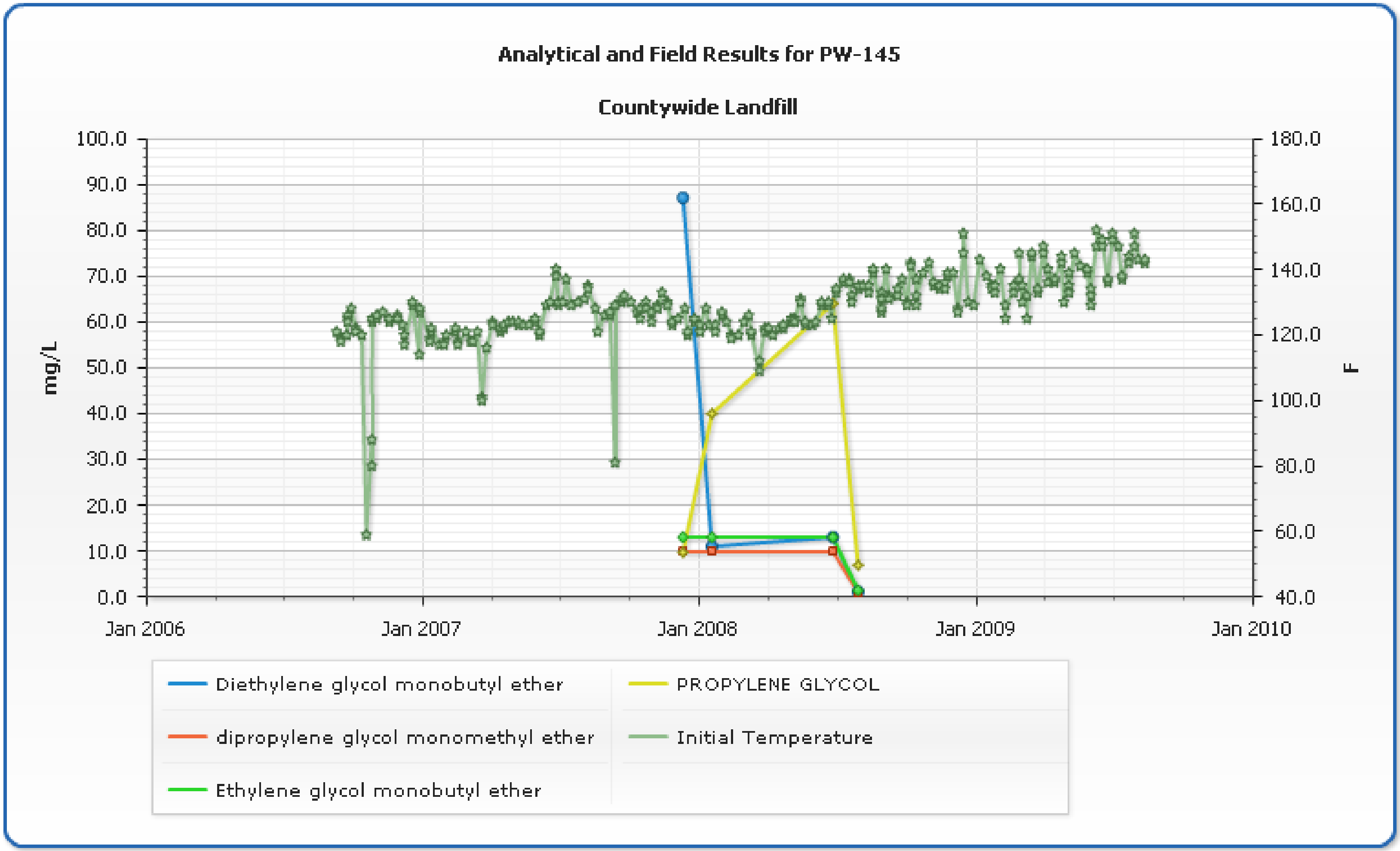
Analytical and Field Results for PW-132
Countywide Landfill
mg/L
F
2,500.0
2,000.0
1,500.0
1,000.0
500.0
0.0
250.0
200.0
150.0
100.0
50.0
0.0
Jan 2006
Jan 2007
Jan 2008
Jan 2009
Diethylene glycol monobutyl ether
dipropylene glycol monomethyl ether
Ethylene glycol monobutyl ether
PROPYLENE GLYCOL
Initial Temperature


Analytical and Field Results for PW-141
Countywide Landfill
mg/L
600.0
500.0
400.0
300.0
200.0
100.0
0.0
250.0
200.0
150.0
100.0
50.0
0.0
F
Jan 2006
Jan 2007
Jan 2008
Jan 2009
Jan 2010
Diethylene glycol monobutyl ether
dipropylene glycol monomethyl ether
Ethylene glycol monobutyl ether
PROPYLENE GLYCOL
Initial Temperature

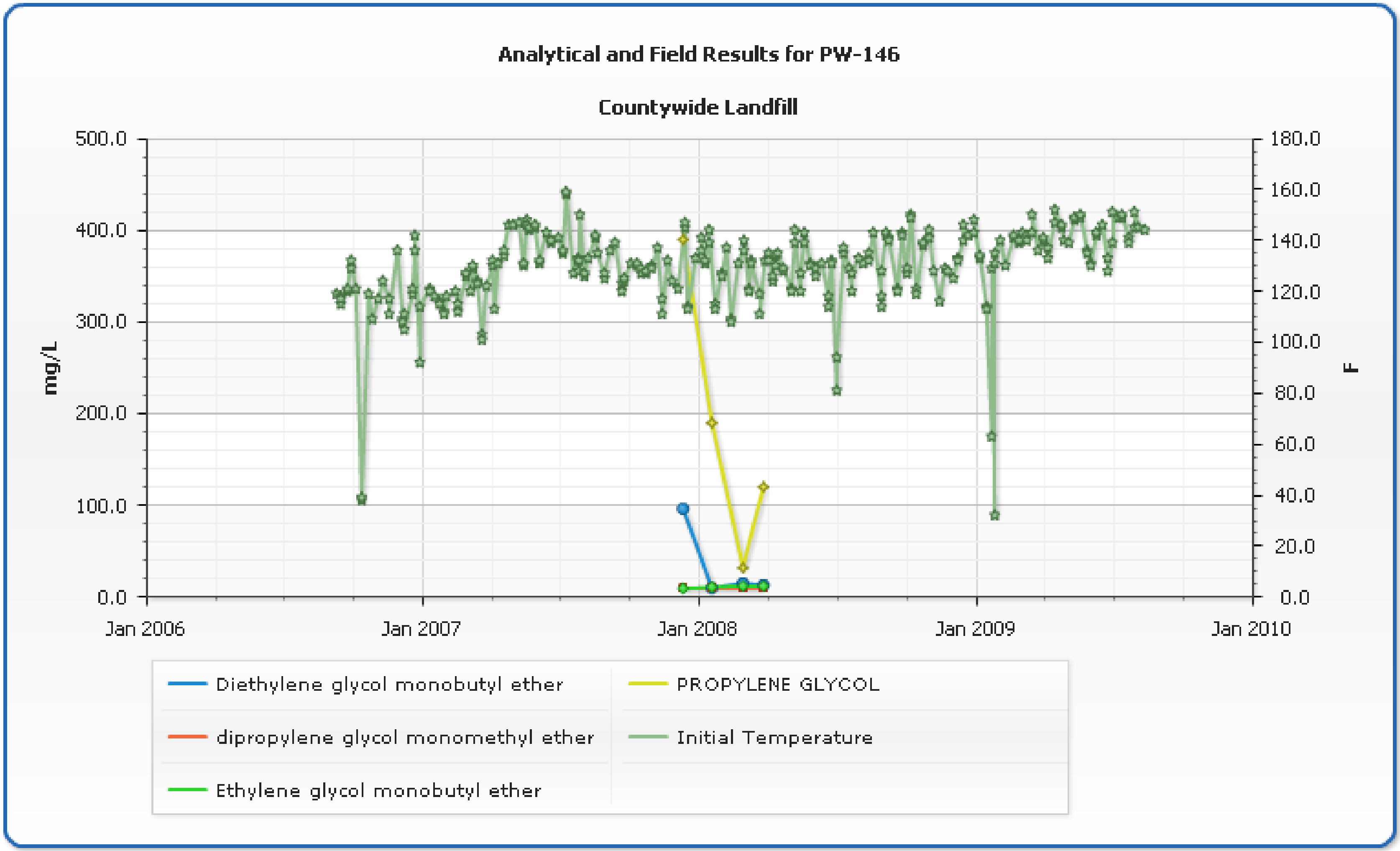

Analytical and Field Results for PW-142R
Countywide Landfill
mg/L
F
1,000.0
900.0
800.0
700.0
600.0
500.0
400.0
300.0
200.0
100.0
0.0
205.0
200.0
195.0
190.0
185.0
180.0
175.0
Jan 2008
Jan 2009
Jan 2010
Diethylene glycol monobutyl ether
dipropylene glycol monomethyl ether
Ethylene glycol monobutyl ether
PROPYLENE GLYCOL
Initial Temperature



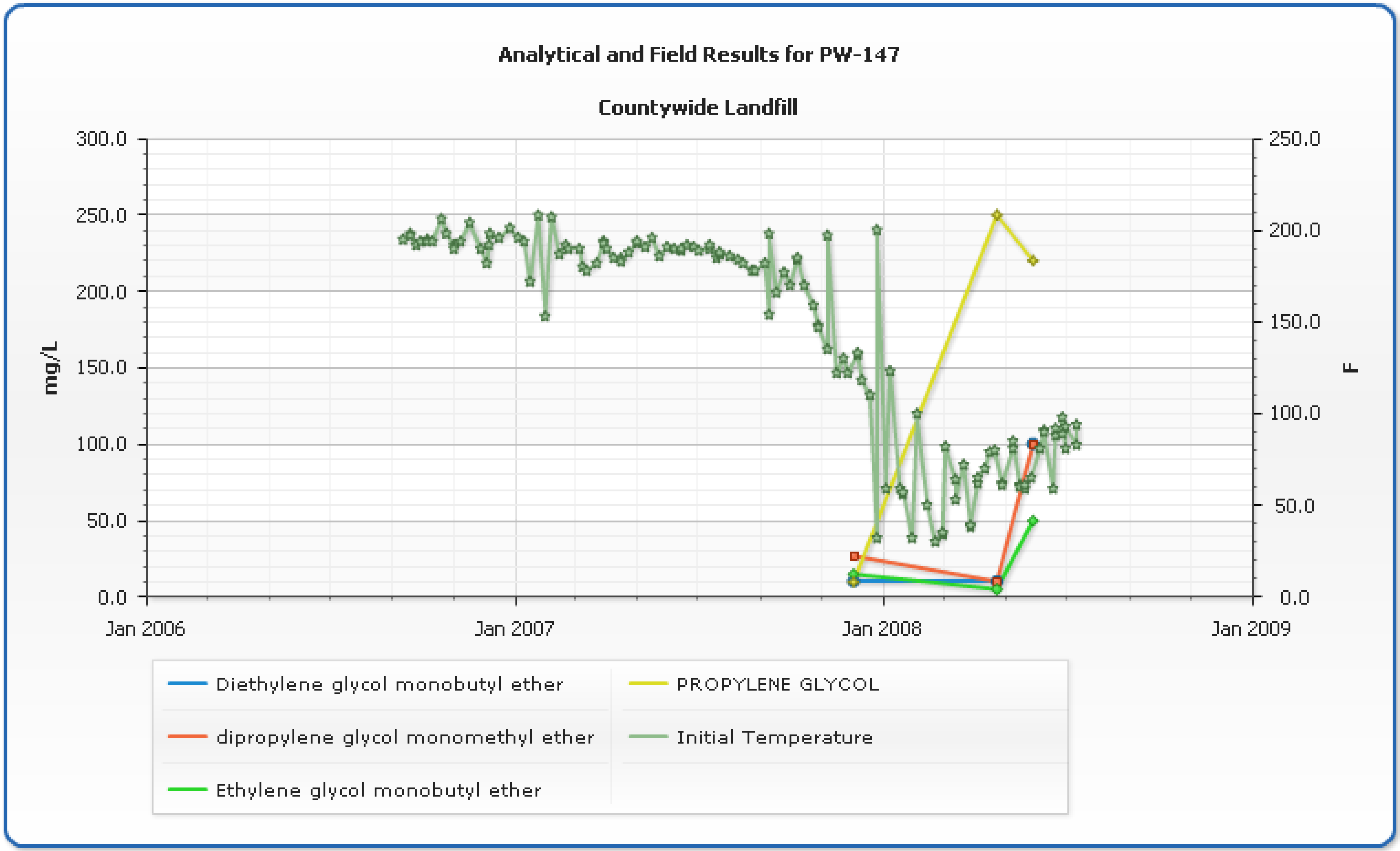
Analytical and Field Results for PW-144
Countywide Landfill
mg/L
F
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
160.0
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
Jan 2006
Jan 2007
Jan 2008
Jan 2009
Jan 2010
Diethylene glycol monobutyl ether
dipropylene glycol monomethyl ether
Ethylene glycol monobutyl ether
PROPYLENE GLYCOL
Initial Temperature



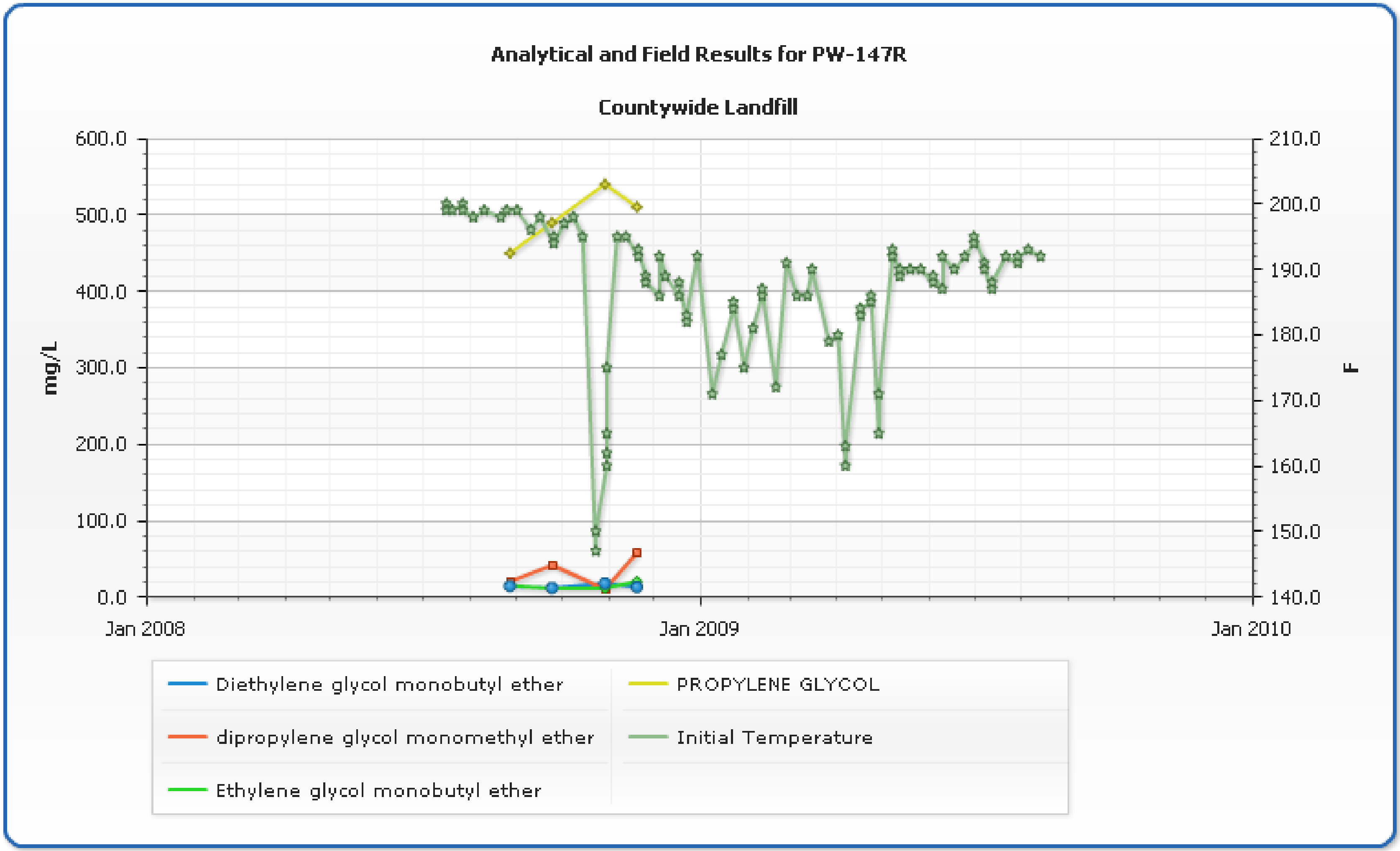
Analytical and Field Results for PW-145
Countywide Landfill
mg/L
F
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
180.0
160.0
140.0
120.0
100.0
80.0
60.0
40.0
Jan 2006
Jan 2007
Jan 2008
Jan 2009
Jan 2010
Diethylene glycol monobutyl ether
PROPYLENE GLYCOL
dipropylene glycol monomethyl ether
Initial Temperature
Ethylene glycol monobutyl ether

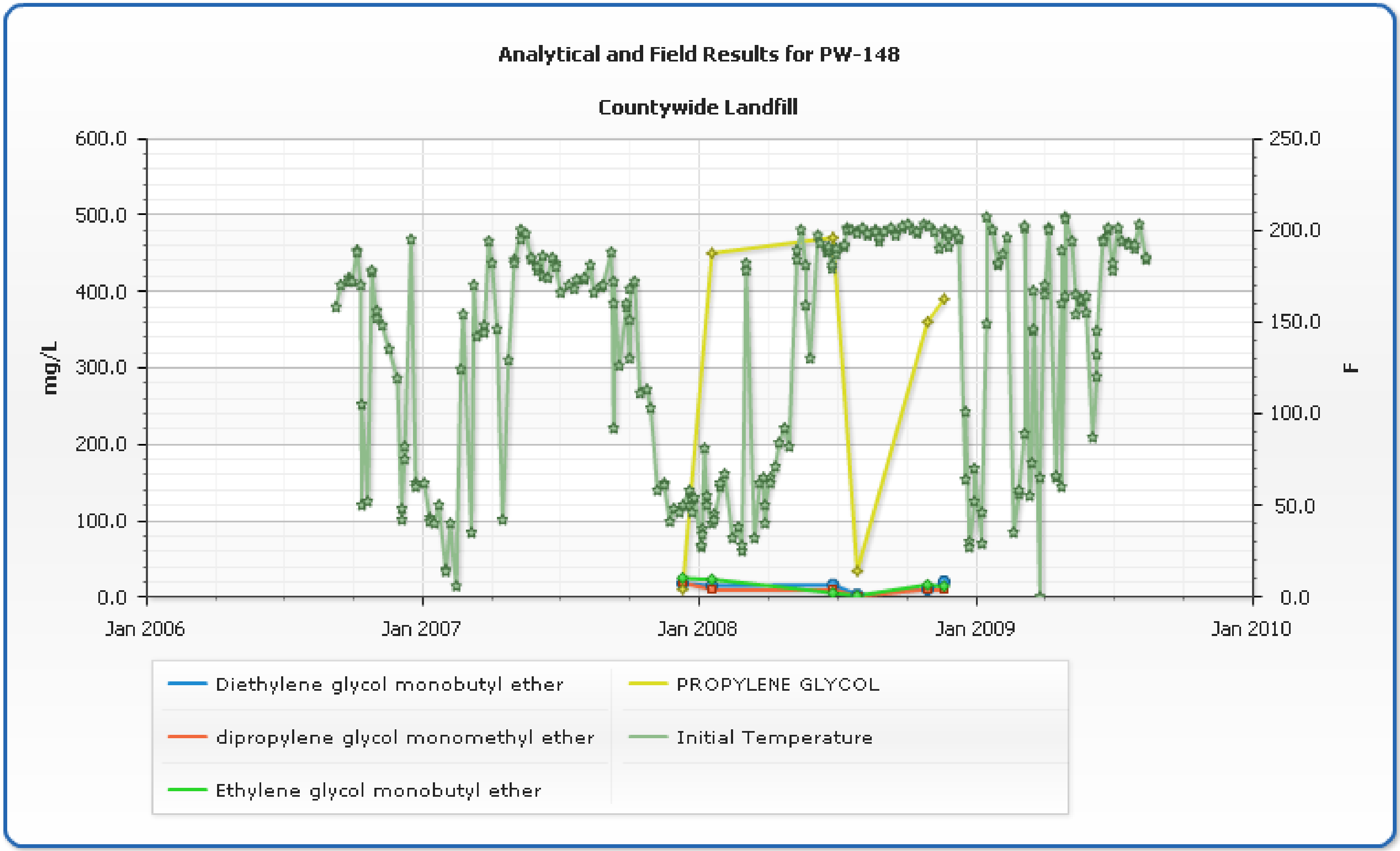


Analytical and Field Results for PW-146
Countywide Landfill
mg/L
F
500.0
400.0
300.0
200.0
100.0
0.0
180.0
160.0
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
Jan 2006
Jan 2007
Jan 2008
Jan 2009
Jan 2010
Diethylene glycol monobutyl ether
dipropylene glycol monomethyl ether
Ethylene glycol monobutyl ether
PROPYLENE GLYCOL
Initial Temperature

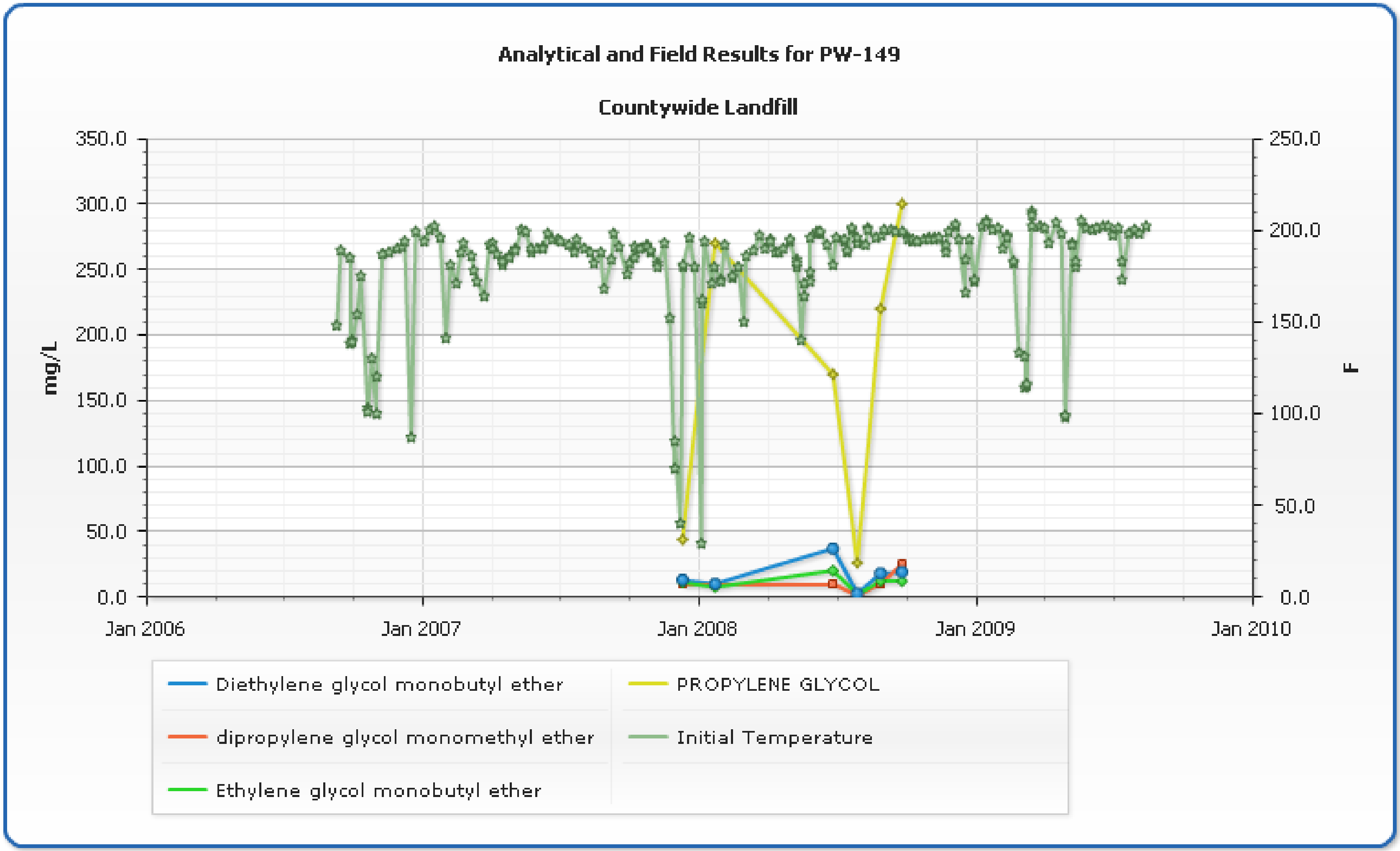


Analytical and Field Results for PW-147
Countywide Landfill
mg/L
F
300.0
250.0
200.0
150.0
100.0
50.0
0.0
250.0
200.0
150.0
100.0
50.0
0.0
Jan 2006
Jan 2007
Jan 2008
Jan 2009
Diethylene glycol monobutyl ether
dipropylene glycol monomethyl ether
Ethylene glycol monobutyl ether
PROPYLENE GLYCOL
Initial Temperature

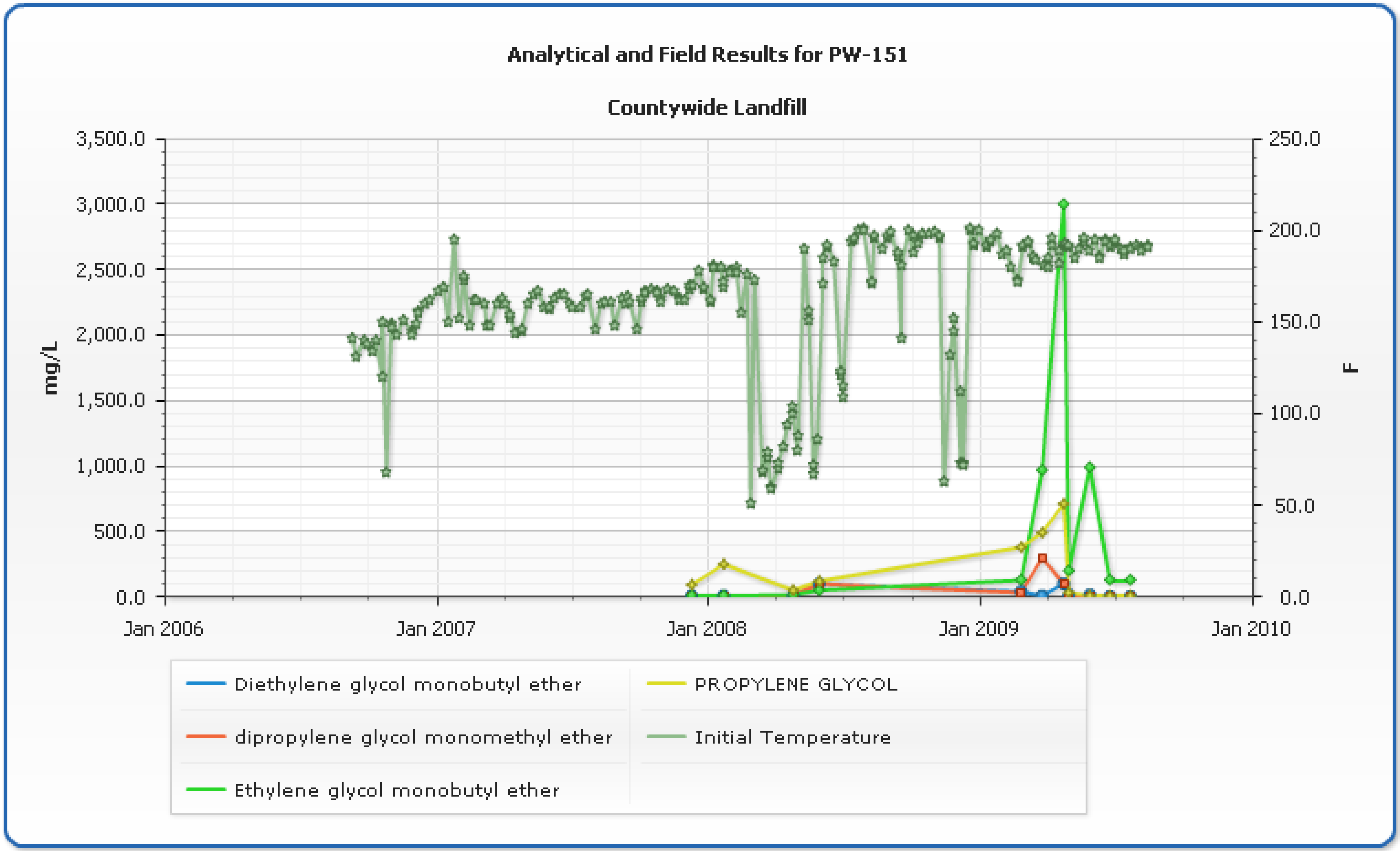

Analytical and Field Results for PW-147R
Countywide Landfill
mg/L
600.0
500.0
400.0
300.0
200.0
100.0
0.0
F
210.0
200.0
190.0
180.0
170.0
160.0
150.0
140.0
Jan 2008
Jan 2009
Jan 2010
Diethylene glycol monobutyl ether
PROPYLENE GLYCOL
dipropylene glycol monomethyl ether
Initial Temperature
Ethylene glycol monobutyl ether



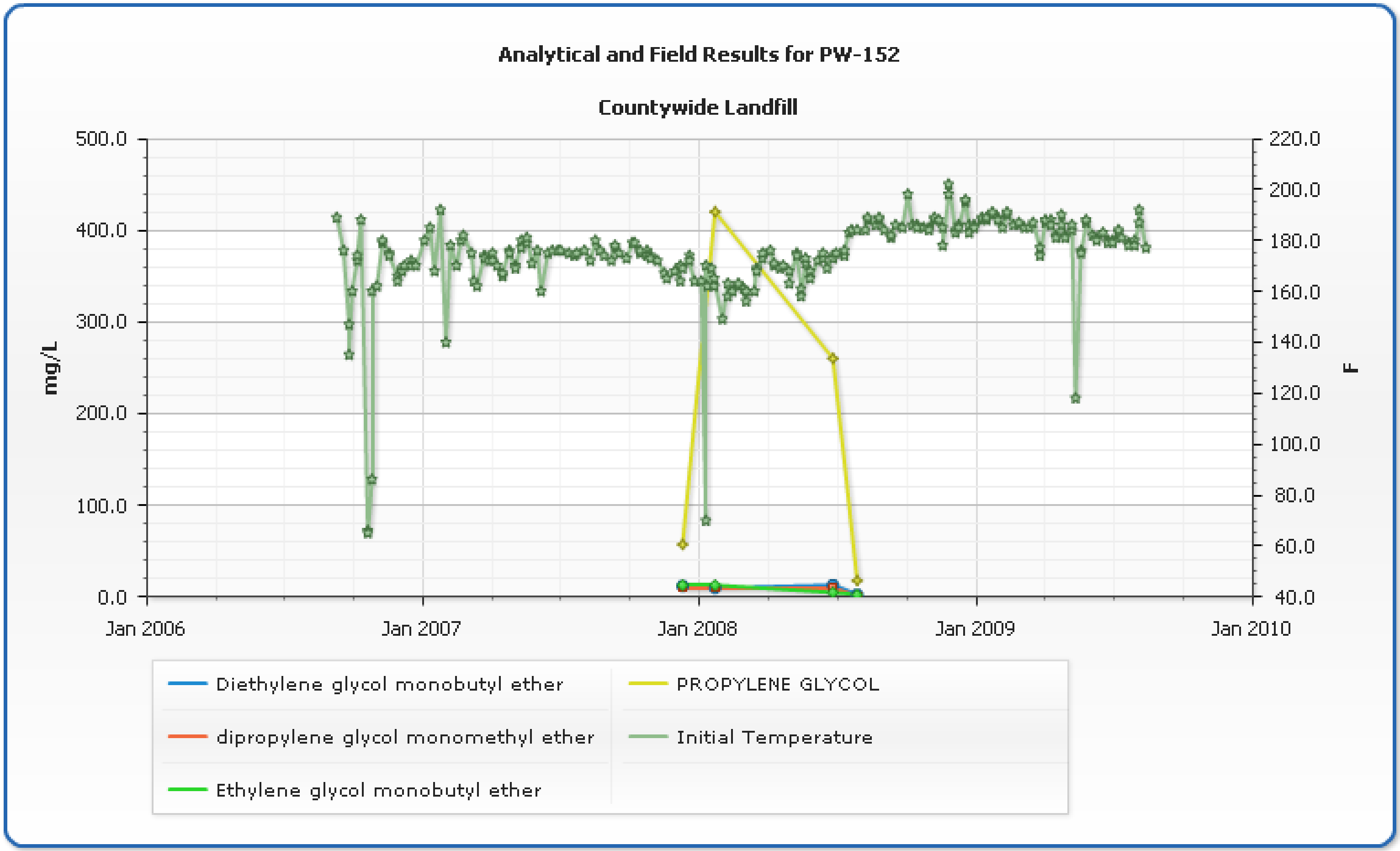
Analytical and Field Results for PW-148
Countywide Landfill
mg/L
F
600.0
500.0
400.0
300.0
200.0
100.0
0.0
250.0
200.0
150.0
100.0
50.0
0.0
Jan 2006
Jan 2007
Jan 2008
Jan 2009
Jan 2010
Diethylene glycol monobutyl ether
dipropylene glycol monomethyl ether
Ethylene glycol monobutyl ether
PROPYLENE GLYCOL
Initial Temperature



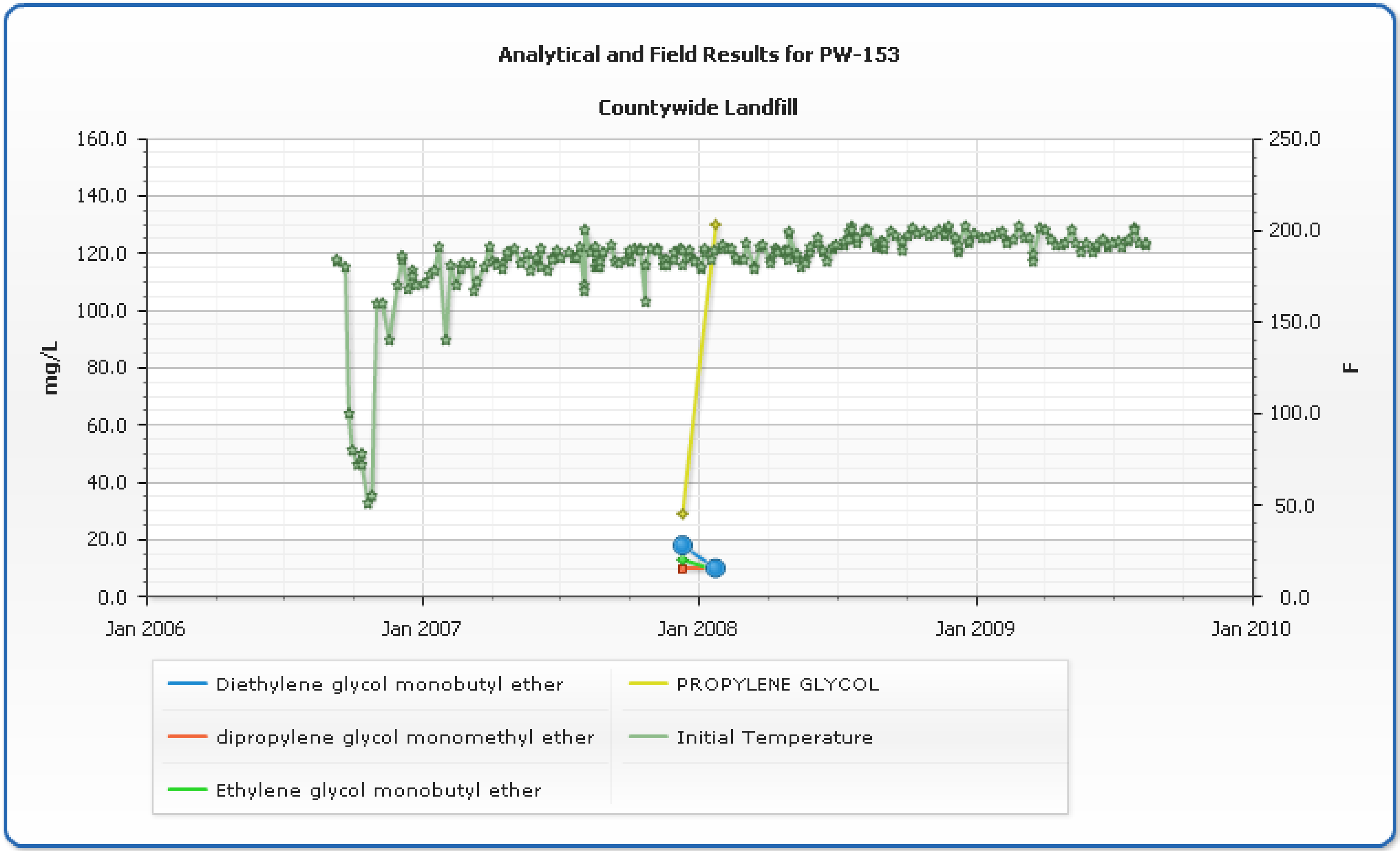
Analytical and Field Results for PW-149
Countywide Landfill
mg/L
F
350.0
300.0
250.0
200.0
150.0
100.0
50.0
0.0
250.0
200.0
150.0
100.0
50.0
0.0
Jan 2006
Jan 2007
Jan 2008
Jan 2009
Jan 2010
Diethylene glycol monobutyl ether
dipropylene glycol monomethyl ether
Ethylene glycol monobutyl ether
PROPYLENE GLYCOL
Initial Temperature

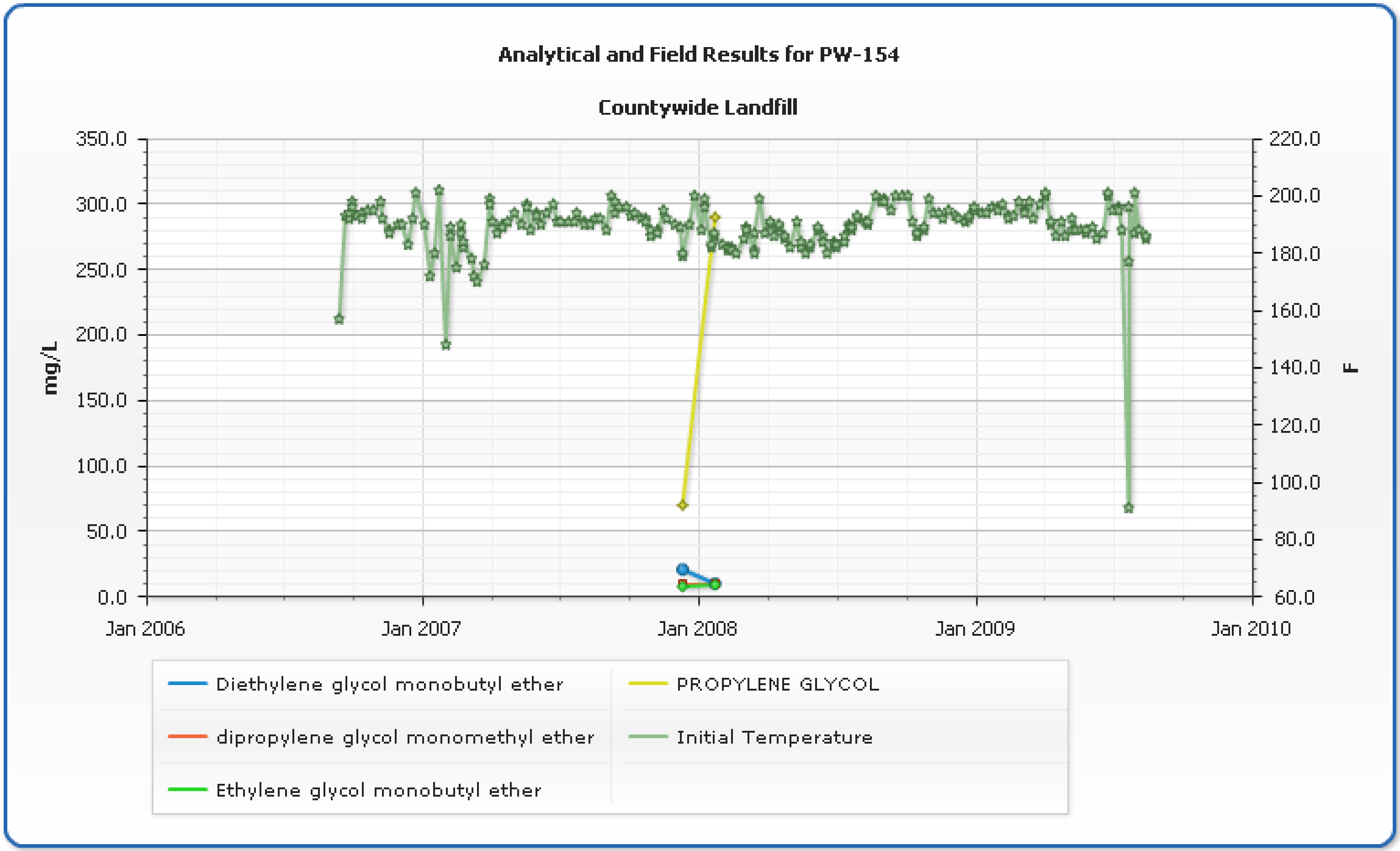


Analytical and Field Results for PW-151
Countywide Landfill
mg/L
3,500.0
3,000.0
2,500.0
2,000.0
1,500.0
1,000.0
500.0
0.0
250.0
200.0
150.0
100.0
50.0
0.0
F
Jan 2006
Jan 2007
Jan 2008
Jan 2009
Jan 2010
Diethylene glycol monobutyl ether
dipropylene glycol monomethyl ether
Ethylene glycol monobutyl ether
PROPYLENE GLYCOL
Initial Temperature

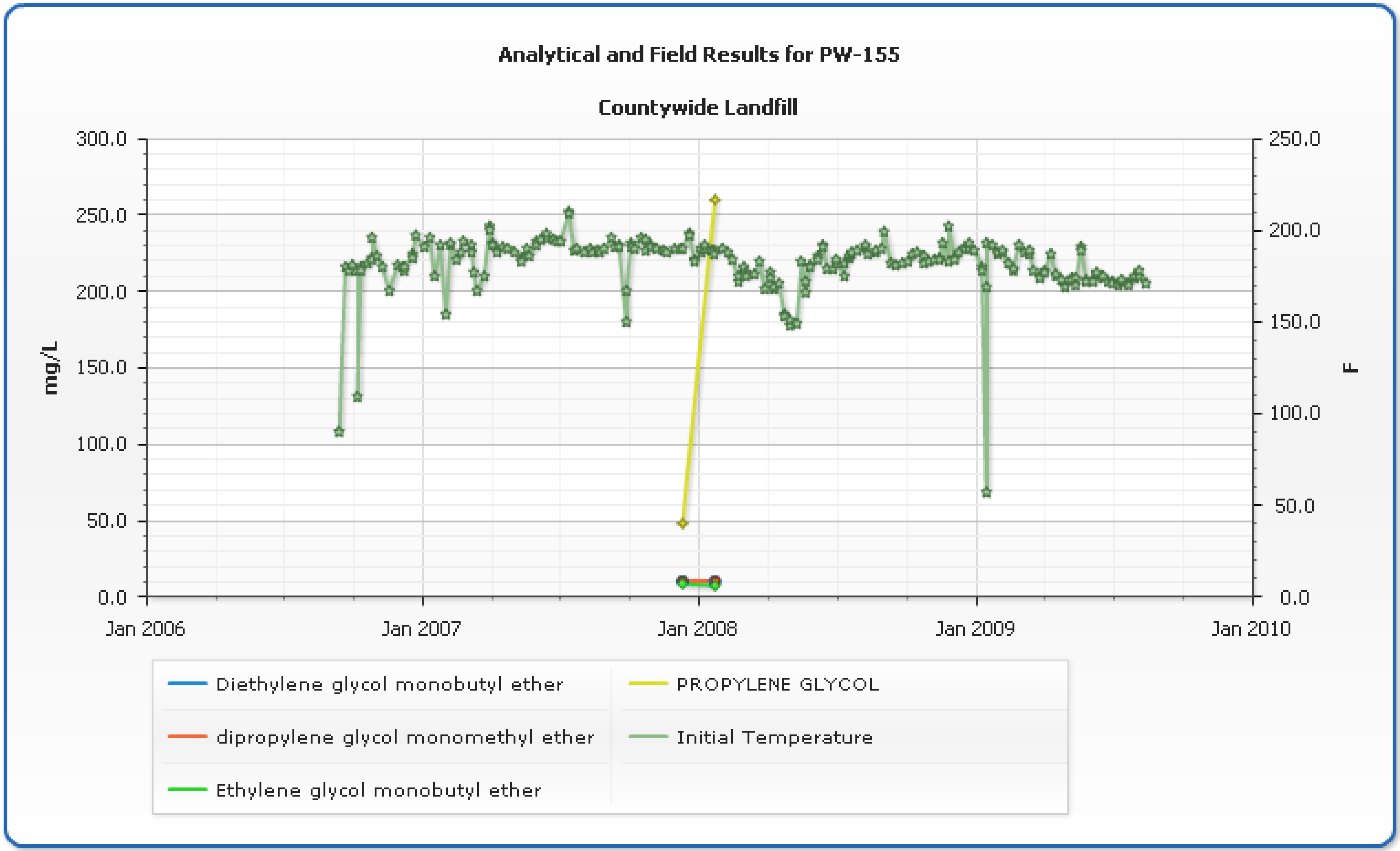


Analytical and Field Results for PW-152
Countywide Landfill
mg/L
F
500.0
400.0
300.0
200.0
100.0
0.0
220.0
200.0
180.0
160.0
140.0
120.0
100.0
80.0
60.0
40.0
Jan 2006
Jan 2007
Jan 2008
Jan 2009
Jan 2010
Diethylene glycol monobutyl ether
dipropylene glycol monomethyl ether
Ethylene glycol monobutyl ether
PROPYLENE GLYCOL
Initial Temperature

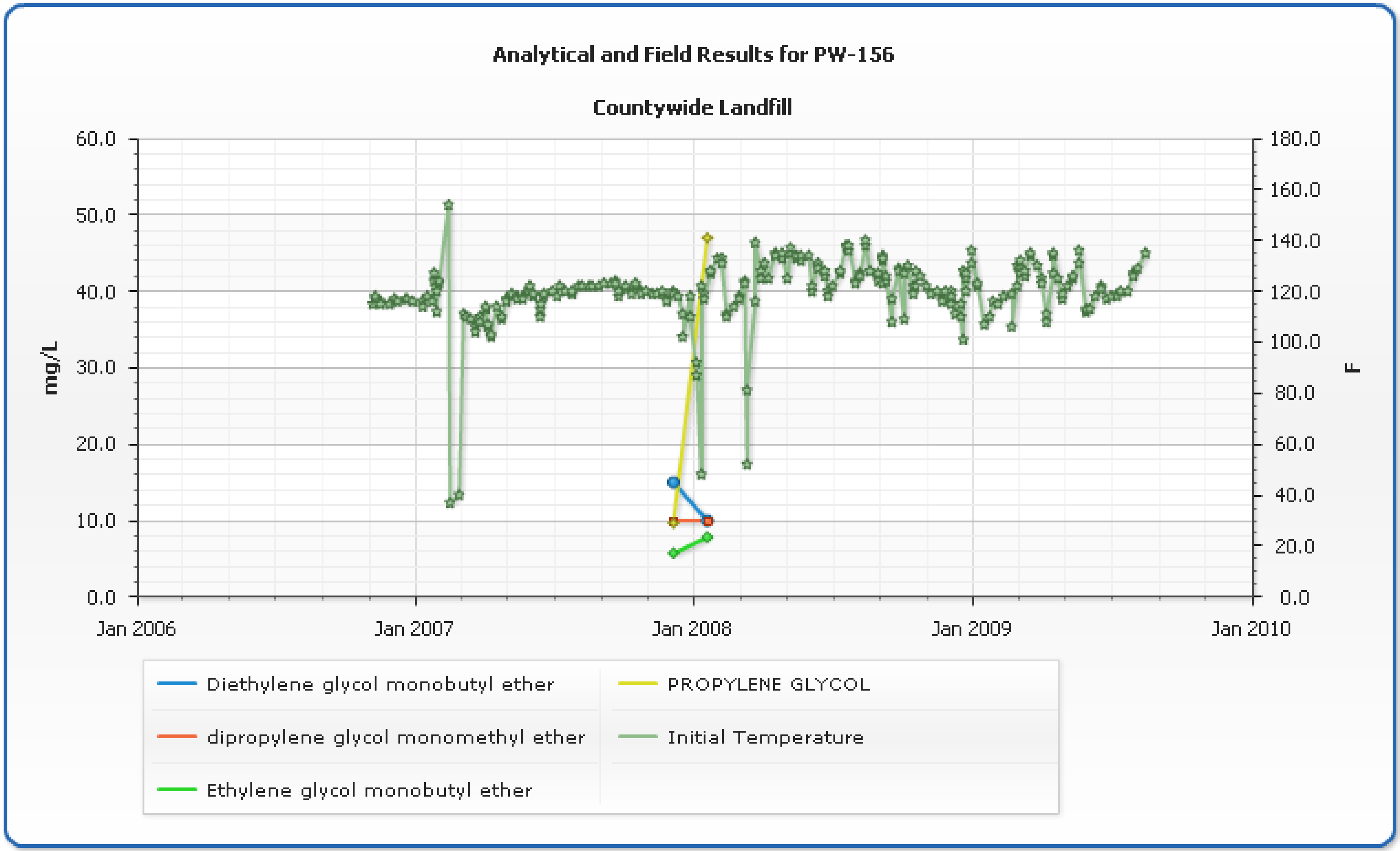

Analytical and Field Results for PW-153
Countywide Landfill
mg/L
F
160.0
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
250.0
200.0
150.0
100.0
50.0
0.0
Jan 2006
Jan 2007
Jan 2008
Jan 2009
Jan 2010
Diethylene glycol monobutyl ether
dipropylene glycol monomethyl ether
Ethylene glycol monobutyl ether
PROPYLENE GLYCOL
Initial Temperature

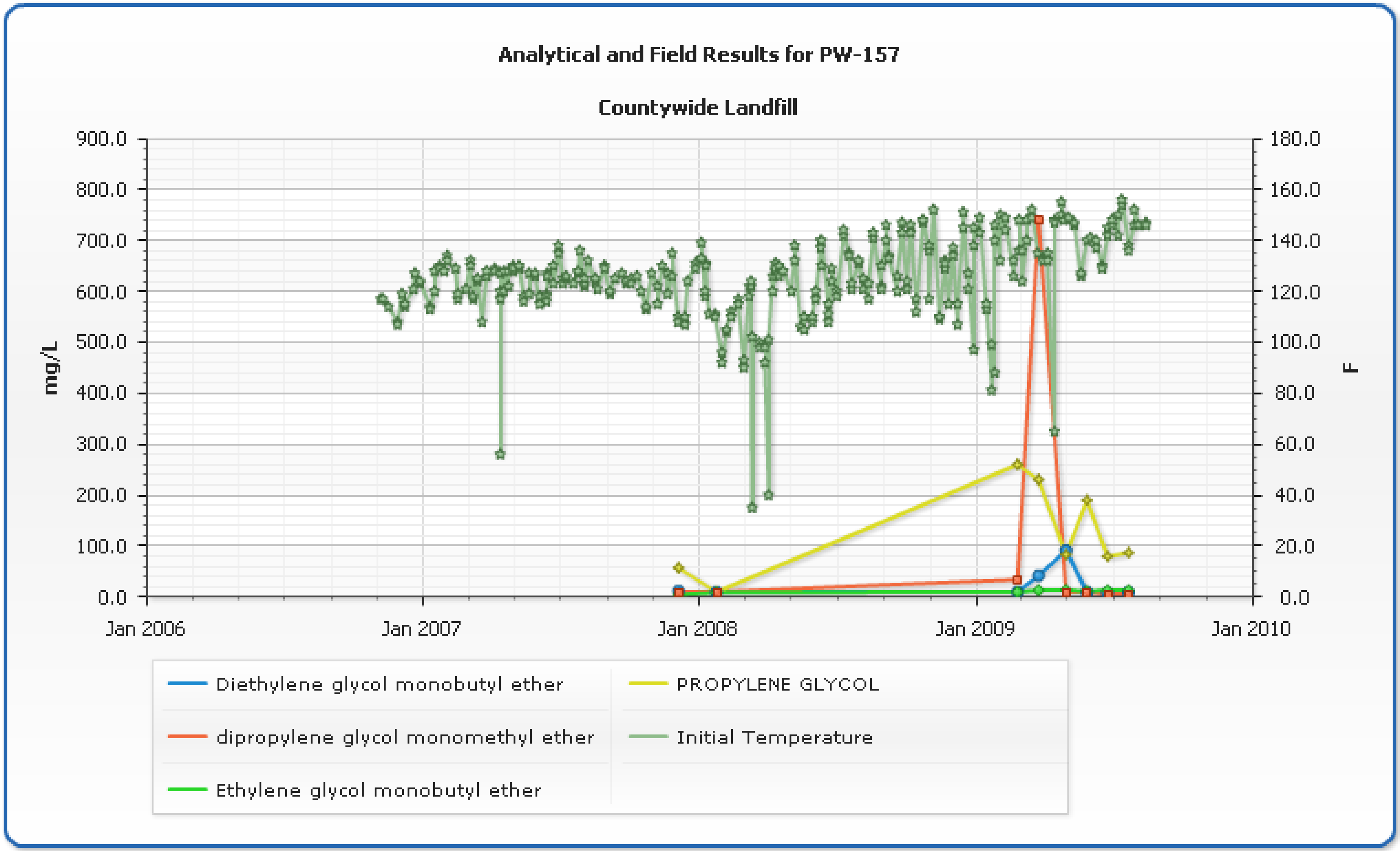


Analytical and Field Results for PW-154
Countywide Landfill
mg/L
F
350.0
300.0
250.0
200.0
150.0
100.0
50.0
0.0
220.0
200.0
180.0
160.0
140.0
120.0
100.0
80.0
60.0
Jan 2006
Jan 2007
Jan 2008
Jan 2009
Jan 2010
Diethylene glycol monobutyl ether
dipropylene glycol monomethyl ether
Ethylene glycol monobutyl ether
PROPYLENE GLYCOL
Initial Temperature

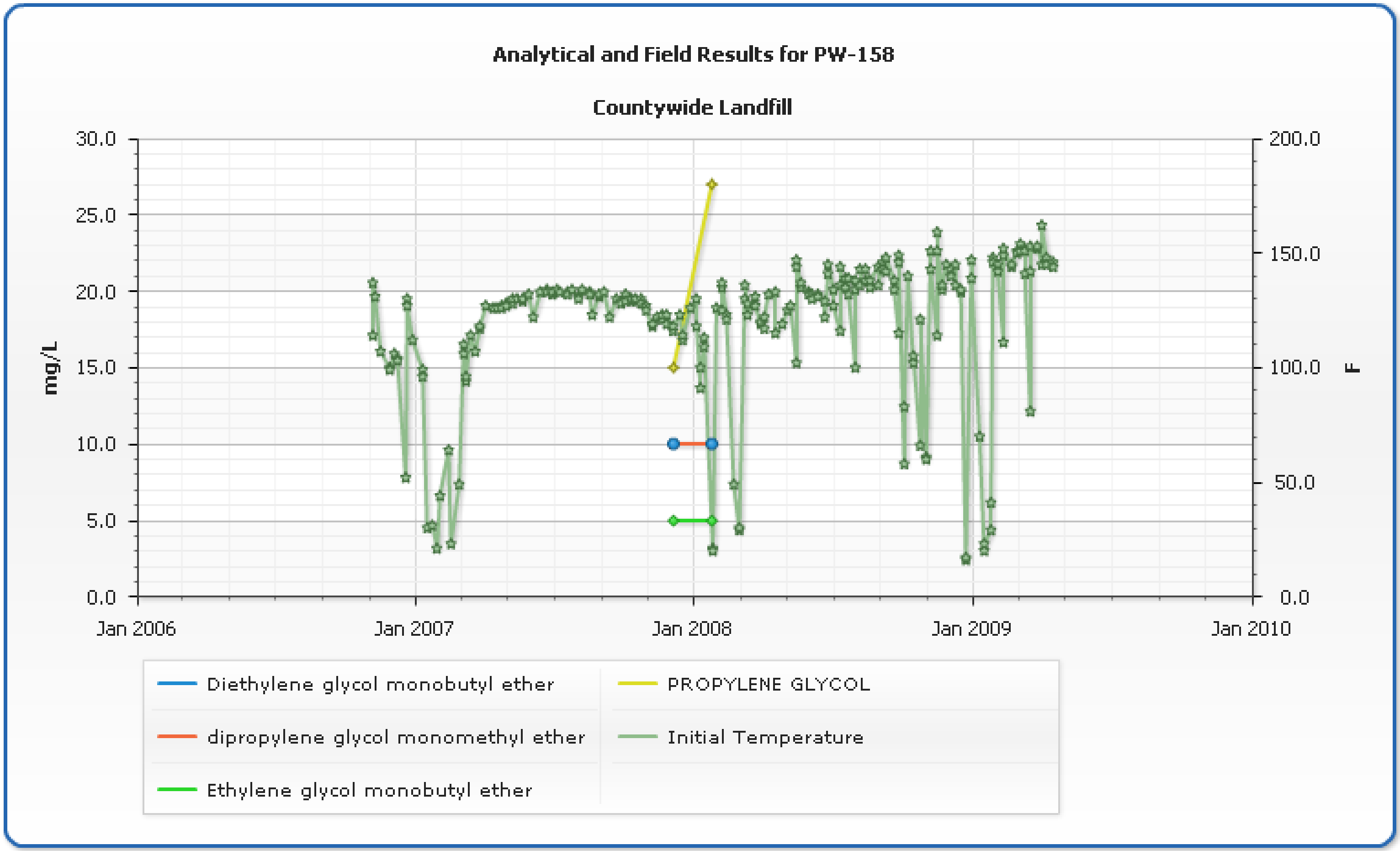


Analytical and Field Results for PW-155
Countywide Landfill
mg/L
F
300.0
250.0
200.0
150.0
100.0
50.0
0.0
250.0
200.0
150.0
100.0
50.0
0.0
Jan 2006
Jan 2007
Jan 2008
Jan 2009
Jan 2010
Diethylene glycol monobutyl ether
dipropylene glycol monomethyl ether
Ethylene glycol monobutyl ether
PROPYLENE GLYCOL
Initial Temperature

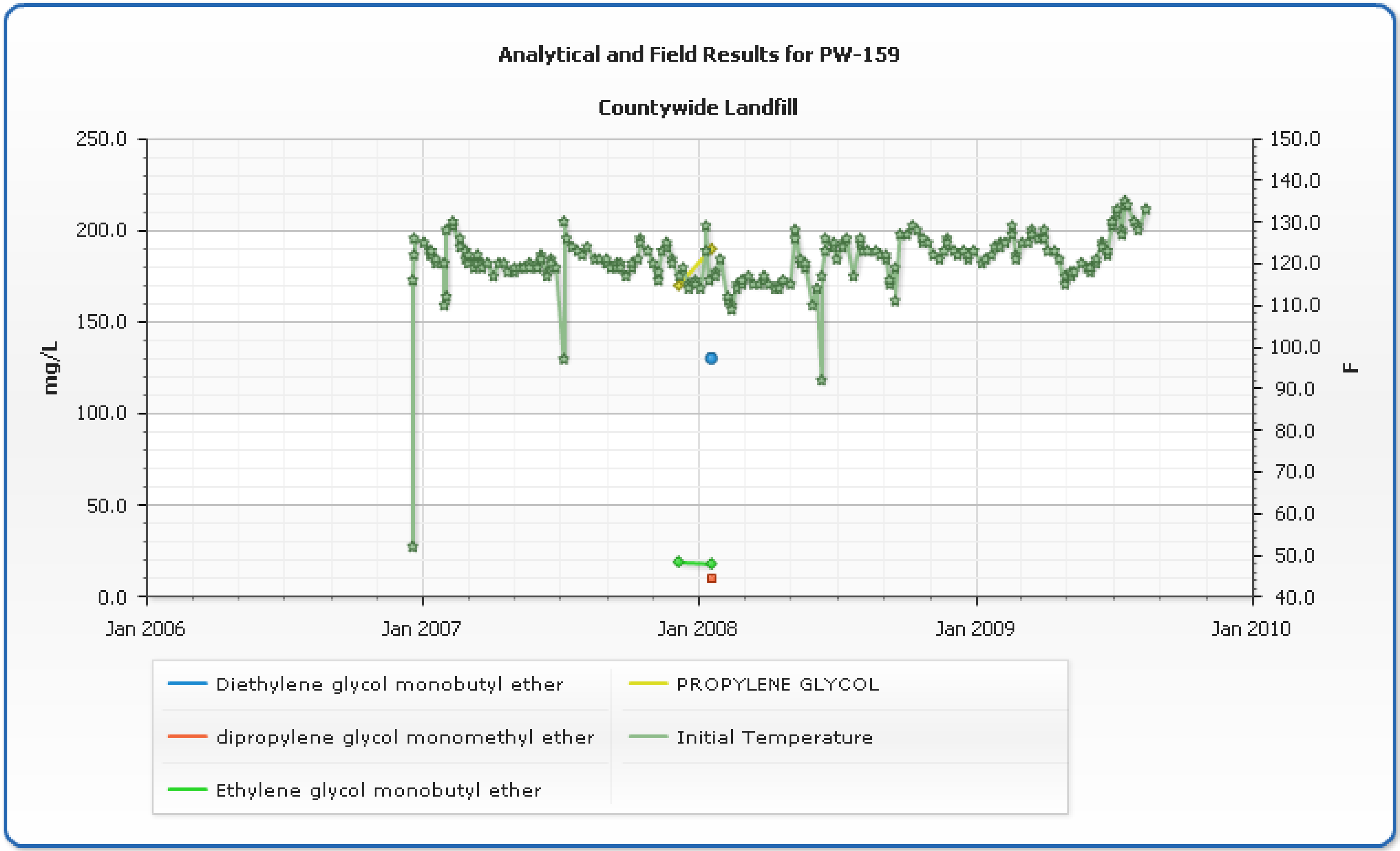

Analytical and Field Results for PW-156
Countywide Landfill
mg/L
F
60.0
50.0
40.0
30.0
20.0
10.0
0.0
180.0
160.0
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
Jan 2006
Jan 2007
Jan 2008
Jan 2009
Jan 2010
Diethylene glycol monobutyl ether
dipropylene glycol monomethyl ether
Ethylene glycol monobutyl ether
PROPYLENE GLYCOL
Initial Temperature



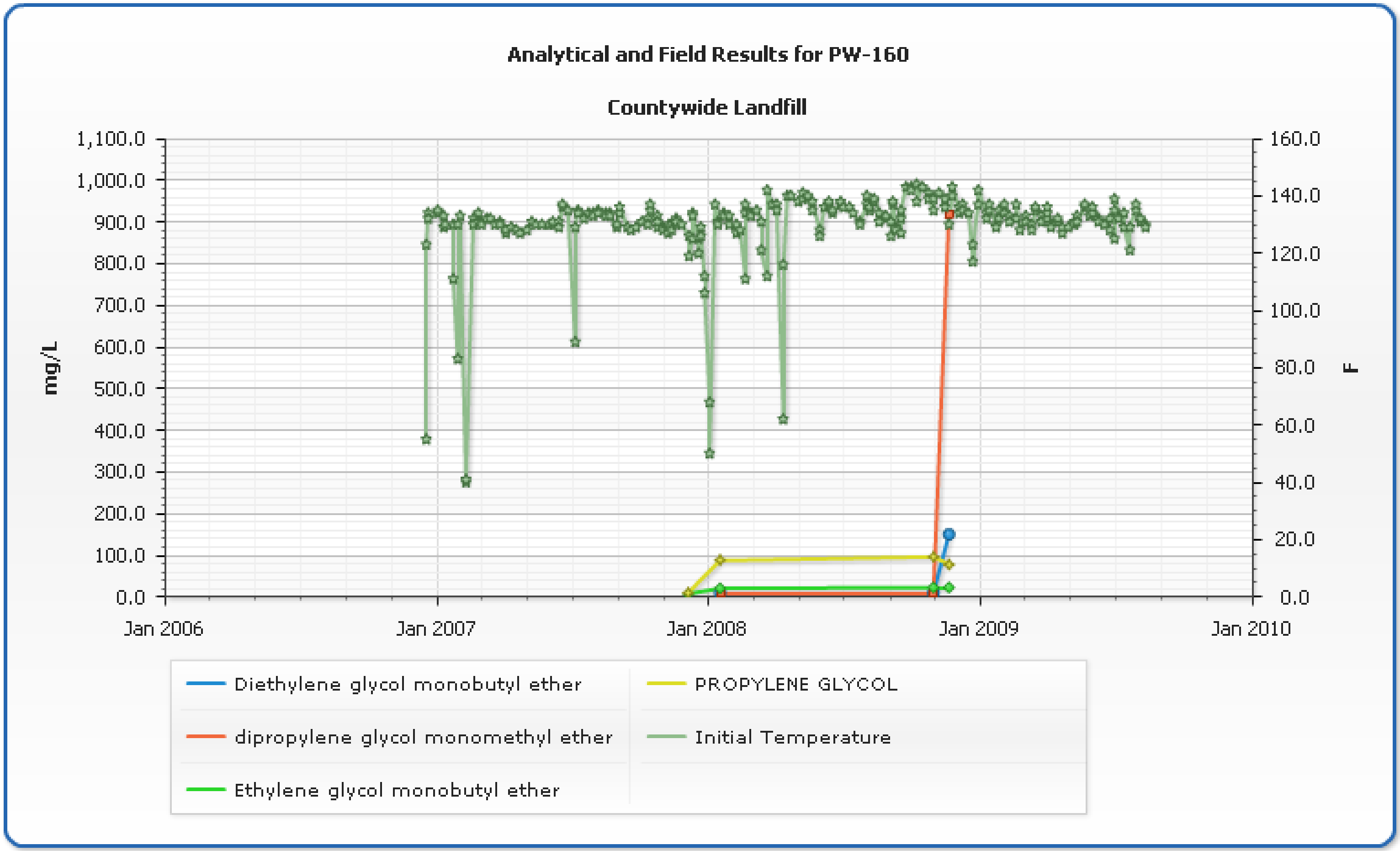
Analytical and Field Results for PW-157
Countywide Landfill
mg/L
F
900.0
800.0
700.0
600.0
500.0
400.0
300.0
200.0
100.0
0.0
180.0
160.0
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
Jan 2006
Jan 2007
Jan 2008
Jan 2009
Jan 2010
Diethylene glycol monobutyl ether
PROPYLENE GLYCOL
dipropylene glycol monomethyl ether
Initial Temperature
Ethylene glycol monobutyl ether



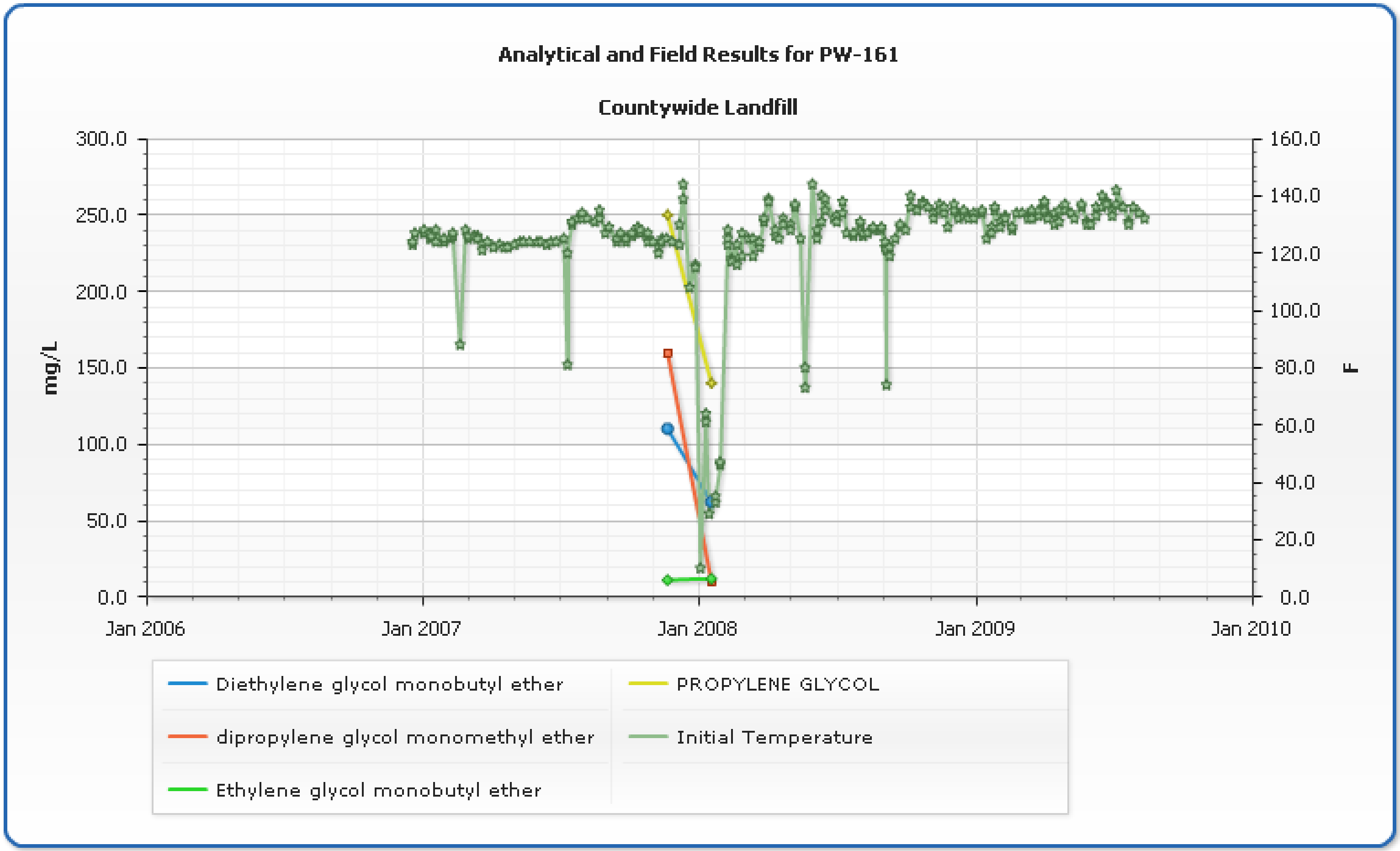
Analytical and Field Results for PW-158
Countywide Landfill
mg/L
F
30.0
25.0
20.0
15.0
10.0
5.0
0.0
200.0
150.0
100.0
50.0
0.0
Jan 2006
Jan 2007
Jan 2008
Jan 2009
Jan 2010
Diethylene glycol monobutyl ether
dipropylene glycol monomethyl ether
Ethylene glycol monobutyl ether
PROPYLENE GLYCOL
Initial Temperature



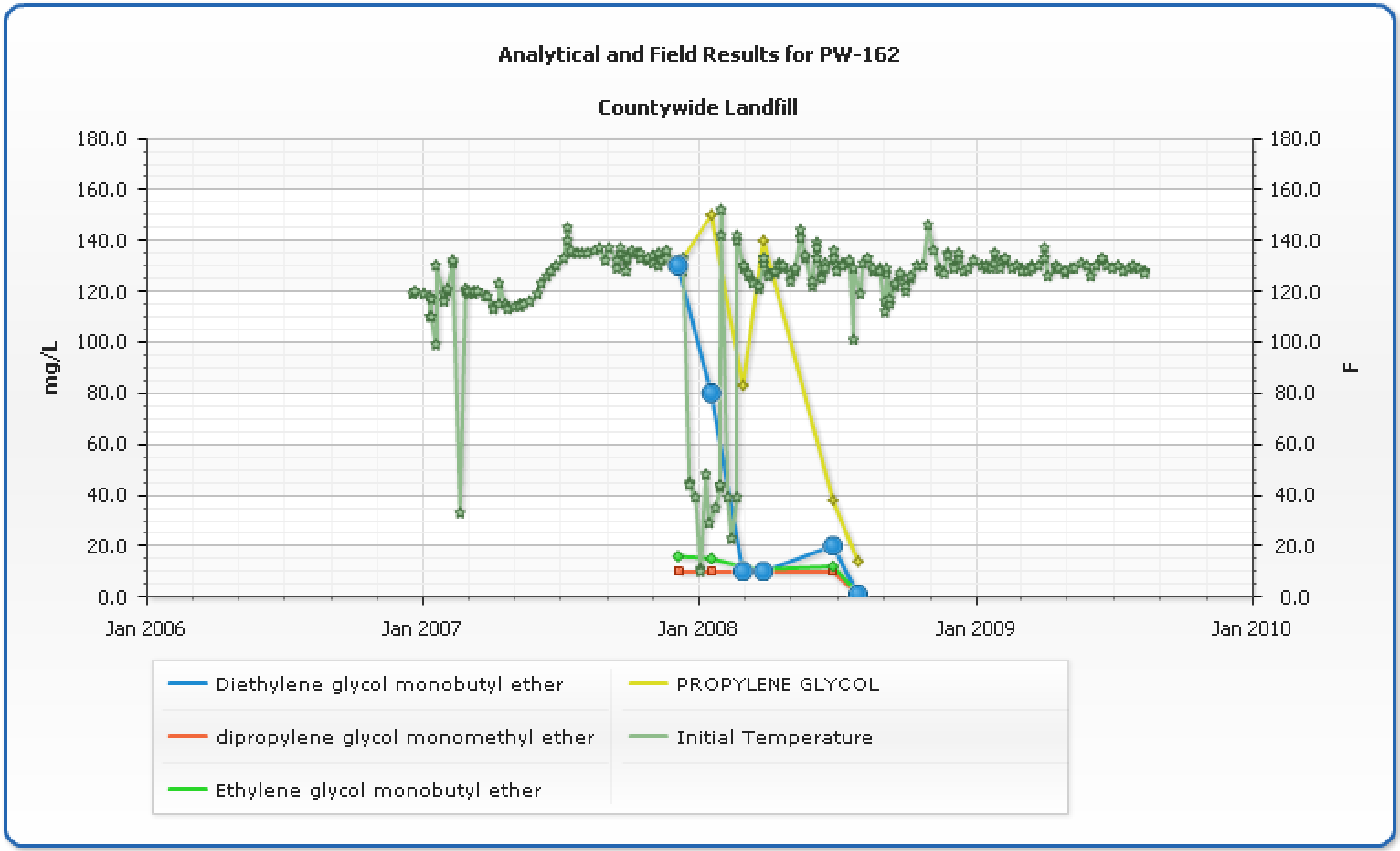
Analytical and Field Results for PW-159
Countywide Landfill
mg/L
F
250.0
200.0
150.0
100.0
50.0
0.0
150.0
140.0
130.0
120.0
110.0
100.0
90.0
80.0
70.0
60.0
50.0
40.0
Jan 2006
Jan 2007
Jan 2008
Jan 2009
Jan 2010
Diethylene glycol monobutyl ether
PROPYLENE GLYCOL
dipropylene glycol monomethyl ether
Initial Temperature
Ethylene glycol monobutyl ether



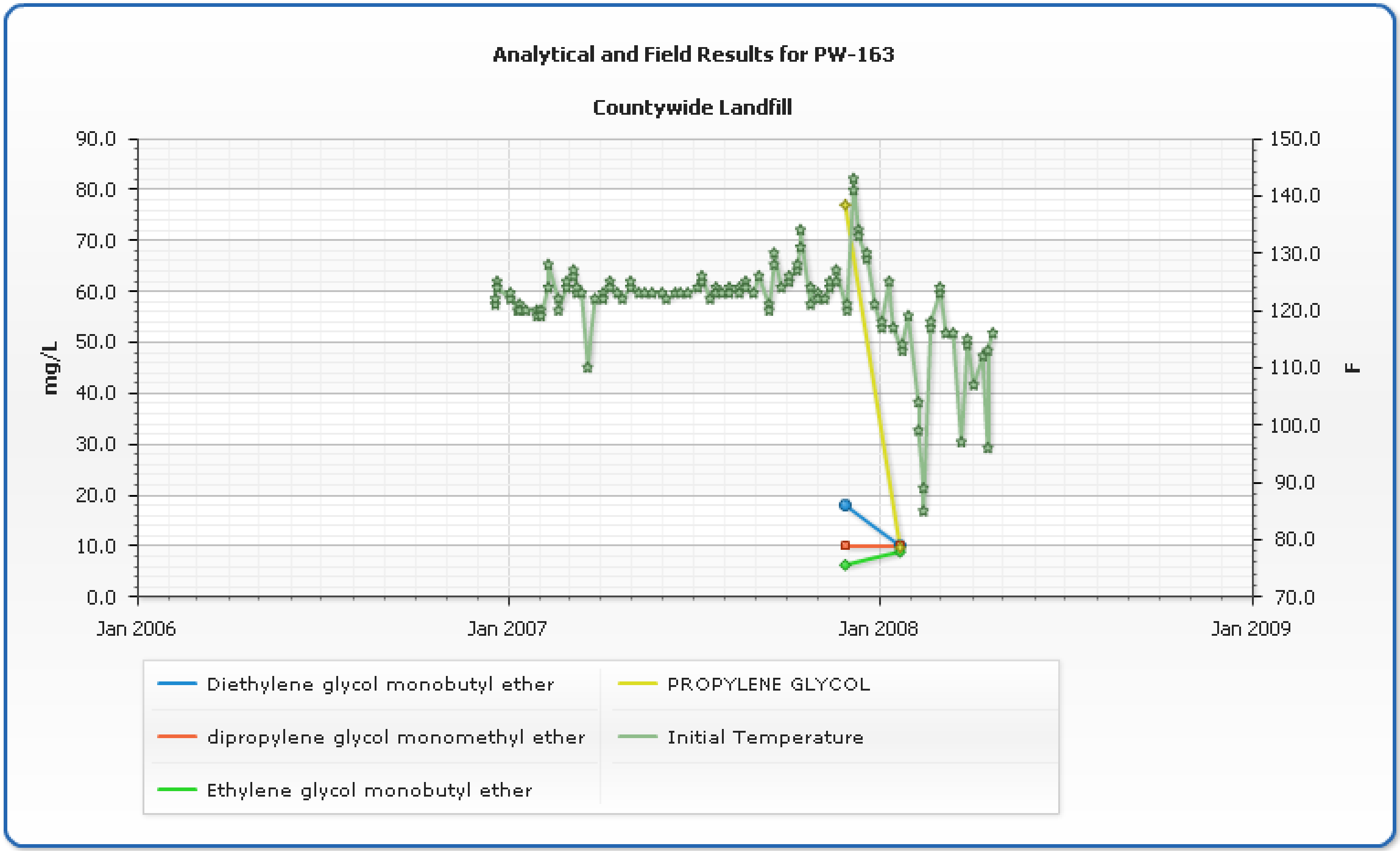
Analytical and Field Results for PW-160
Countywide Landfill
mg/L
F
1,100.0
1,000.0
900.0
800.0
700.0
600.0
500.0
400.0
300.0
200.0
100.0
0.0
160.0
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
Jan 2006
Jan 2007
Jan 2008
Jan 2009
Jan 2010
Diethylene glycol monobutyl ether
dipropylene glycol monomethyl ether
Ethylene glycol monobutyl ether
PROPYLENE GLYCOL
Initial Temperature

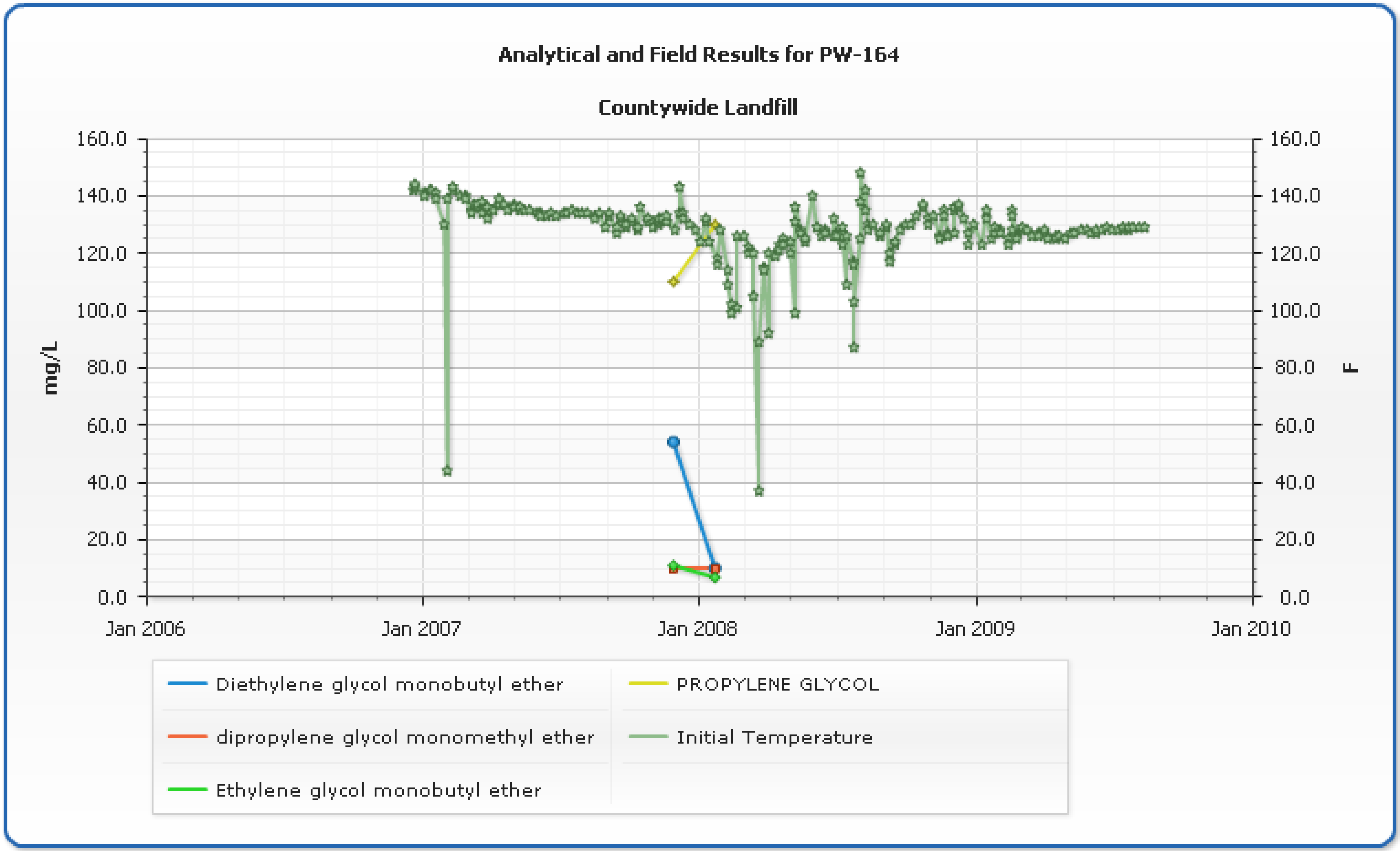


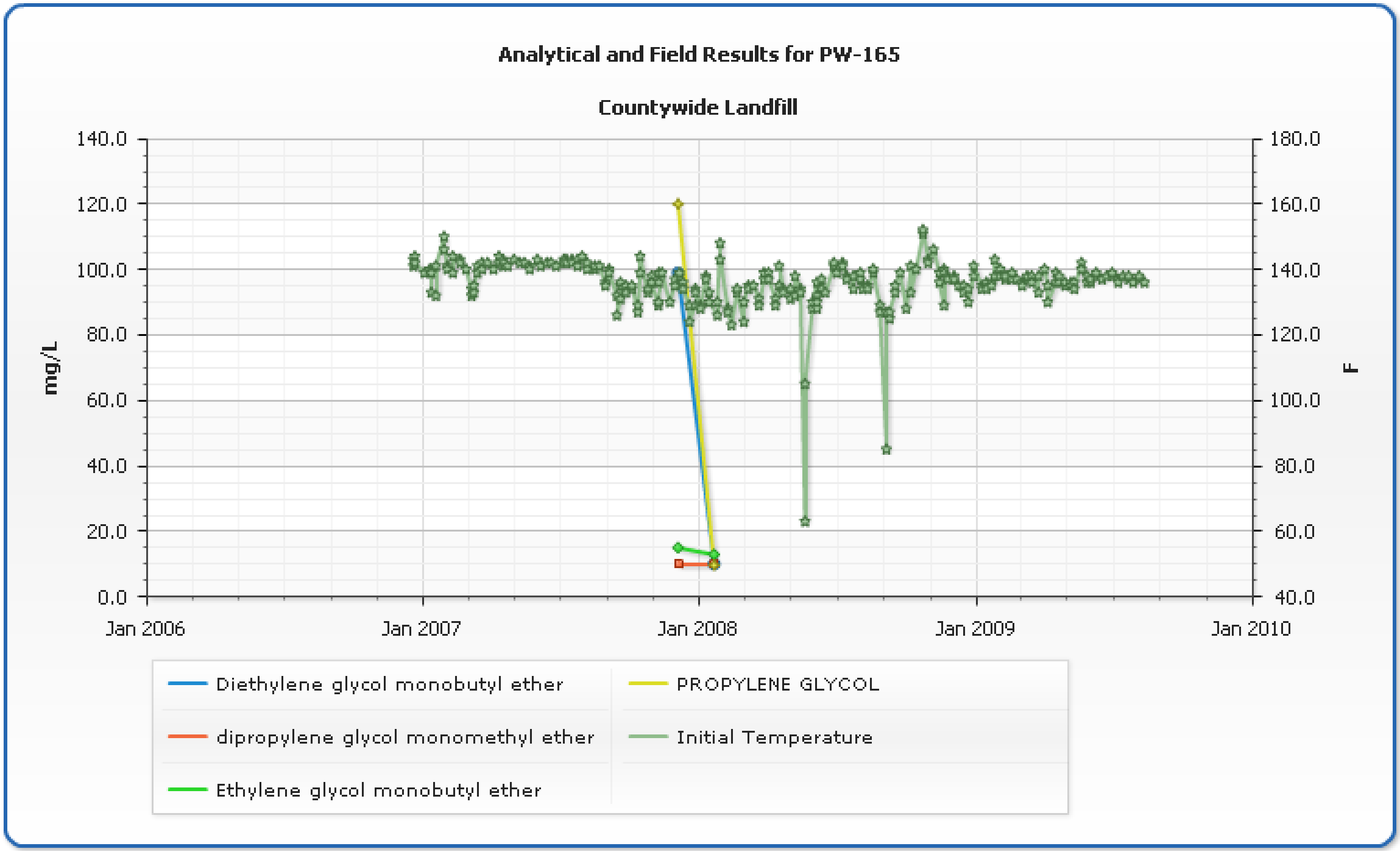
Analytical and Field Results for PW-161
Countywide Landfill
mg/L
F
300.0
250.0
200.0
150.0
100.0
50.0
0.0
160.0
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
Jan 2006
Jan 2007
Jan 2008
Jan 2009
Jan 2010
Diethylene glycol monobutyl ether
dipropylene glycol monomethyl ether
Ethylene glycol monobutyl ether
PROPYLENE GLYCOL
Initial Temperature

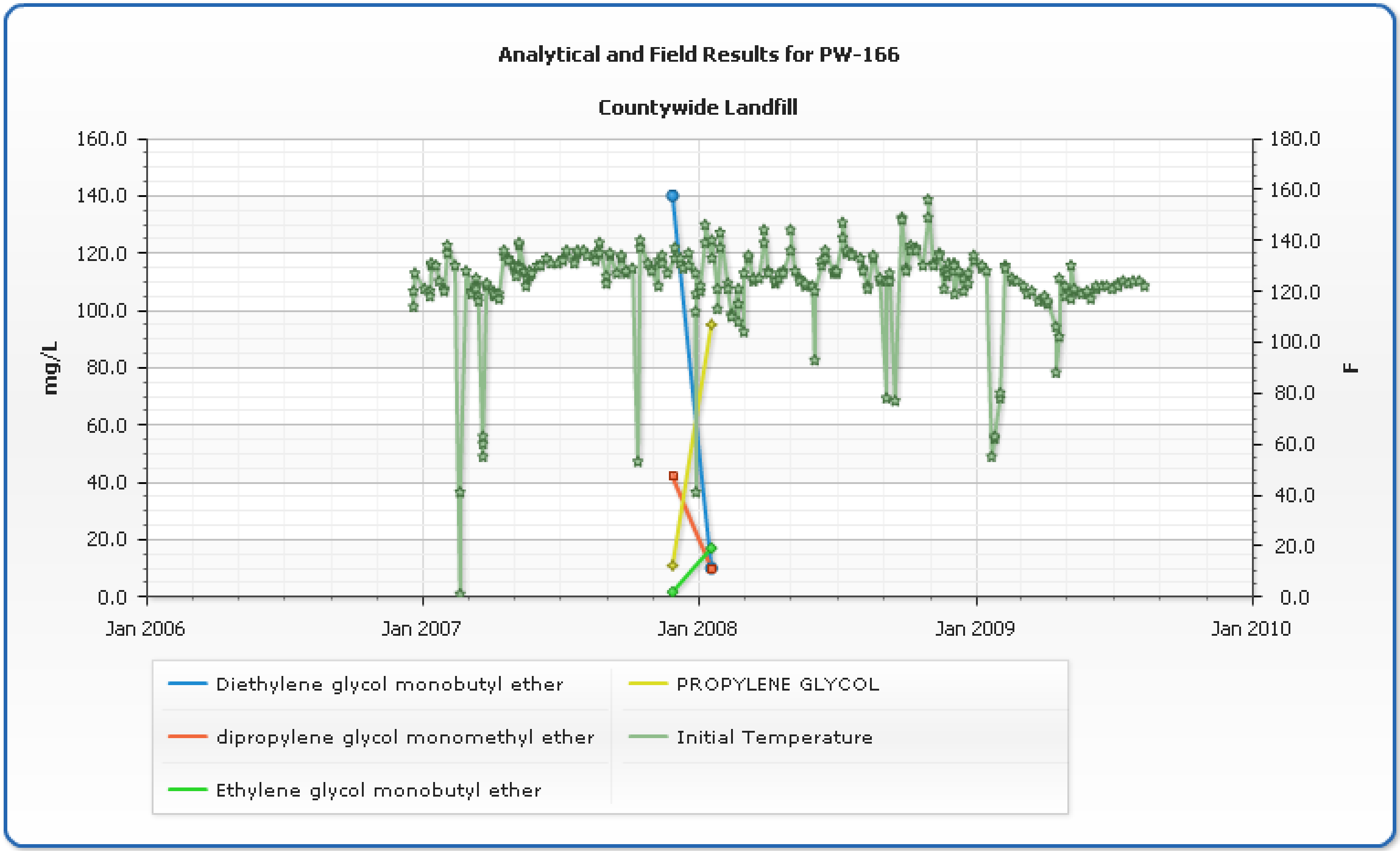


Analytical and Field Results for PW-162
Countywide Landfill
mg/L
F
180.0
160.0
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
Jan 2006
Jan 2007
Jan 2008
Jan 2009
Jan 2010
Diethylene glycol monobutyl ether
dipropylene glycol monomethyl ether
Ethylene glycol monobutyl ether
PROPYLENE GLYCOL
Initial Temperature

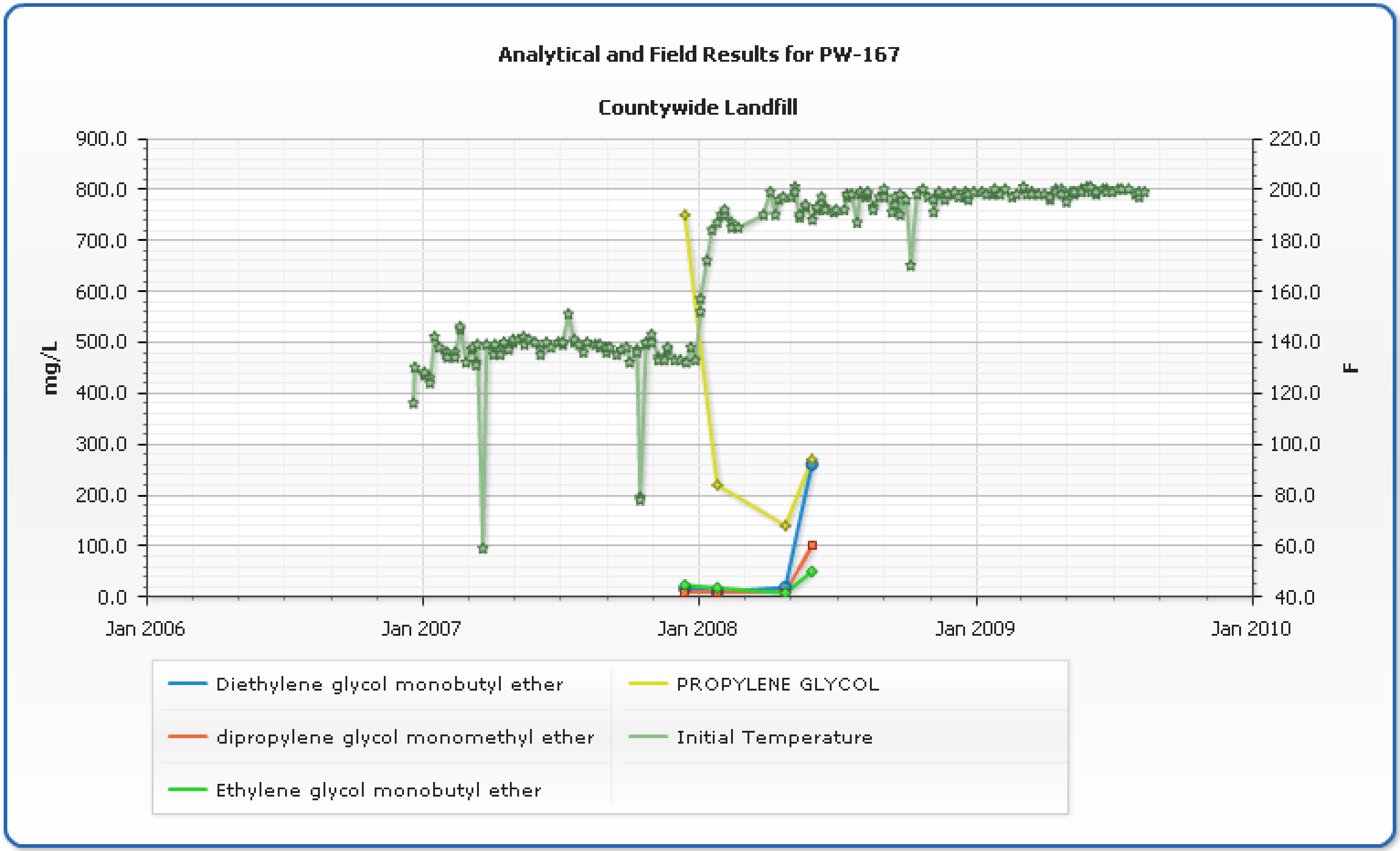

Analytical and Field Results for PW-163
Countywide Landfill
mg/L
F
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
150.0
140.0
130.0
120.0
110.0
100.0
90.0
80.0
70.0
Jan 2006
Jan 2007
Jan 2008
Jan 2009
Diethylene glycol monobutyl ether
PROPYLENE GLYCOL
dipropylene glycol monomethyl ether
Initial Temperature
Ethylene glycol monobutyl ether

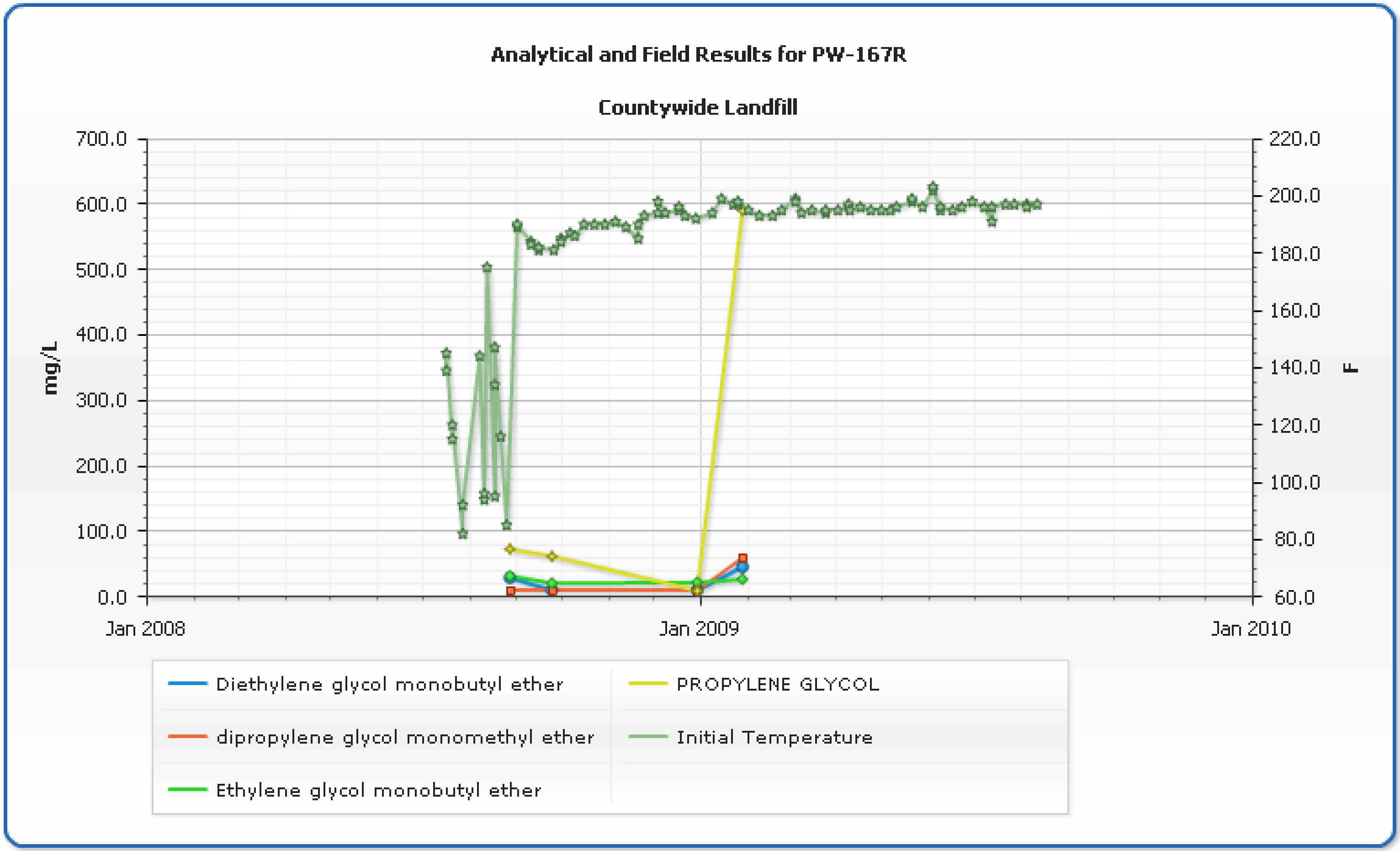

Analytical and Field Results for PW-164
Countywide Landfill
mg/L
F
160.0
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
Jan 2006
Jan 2007
Jan 2008
Jan 2009
Jan 2010
Diethylene glycol monobutyl ether
dipropylene glycol monomethyl ether
Ethylene glycol monobutyl ether
PROPYLENE GLYCOL
Initial Temperature


Analytical and Field Results for PW-165
Countywide Landfill
mg/L
F
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
180.0
160.0
140.0
120.0
100.0
80.0
60.0
40.0
Jan 2006
Jan 2007
Jan 2008
Jan 2009
Jan 2010
Diethylene glycol monobutyl ether
PROPYLENE GLYCOL
dipropylene glycol monomethyl ether
Initial Temperature
Ethylene glycol monobutyl ether

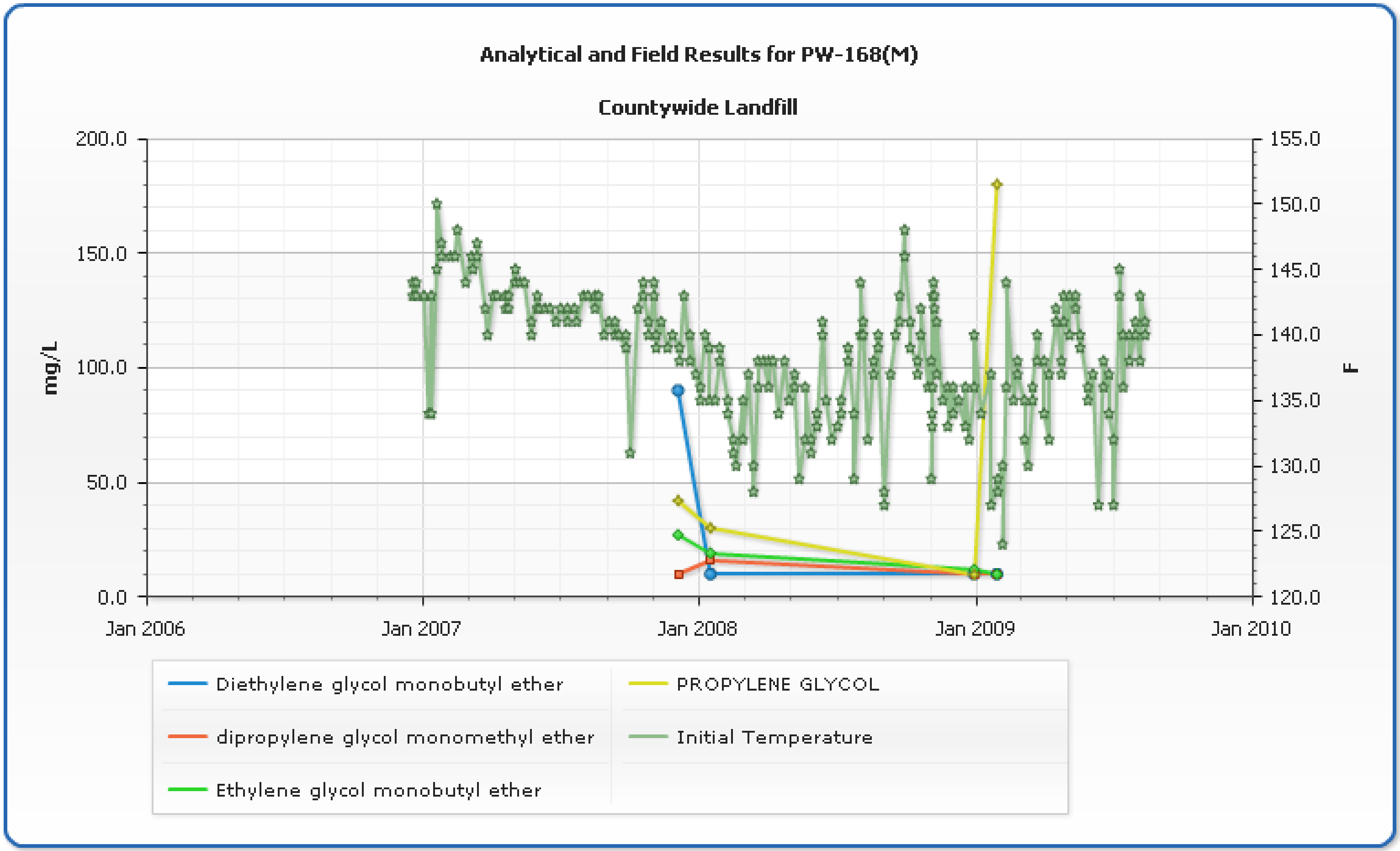


Analytical and Field Results for PW-166
Countywide Landfill
mg/L
F
160.0
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
180.0
160.0
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
Jan 2006
Jan 2007
Jan 2008
Jan 2009
Jan 2010
Diethylene glycol monobutyl ether
PROPYLENE GLYCOL
dipropylene glycol monomethyl ether
Initial Temperature
Ethylene glycol monobutyl ether

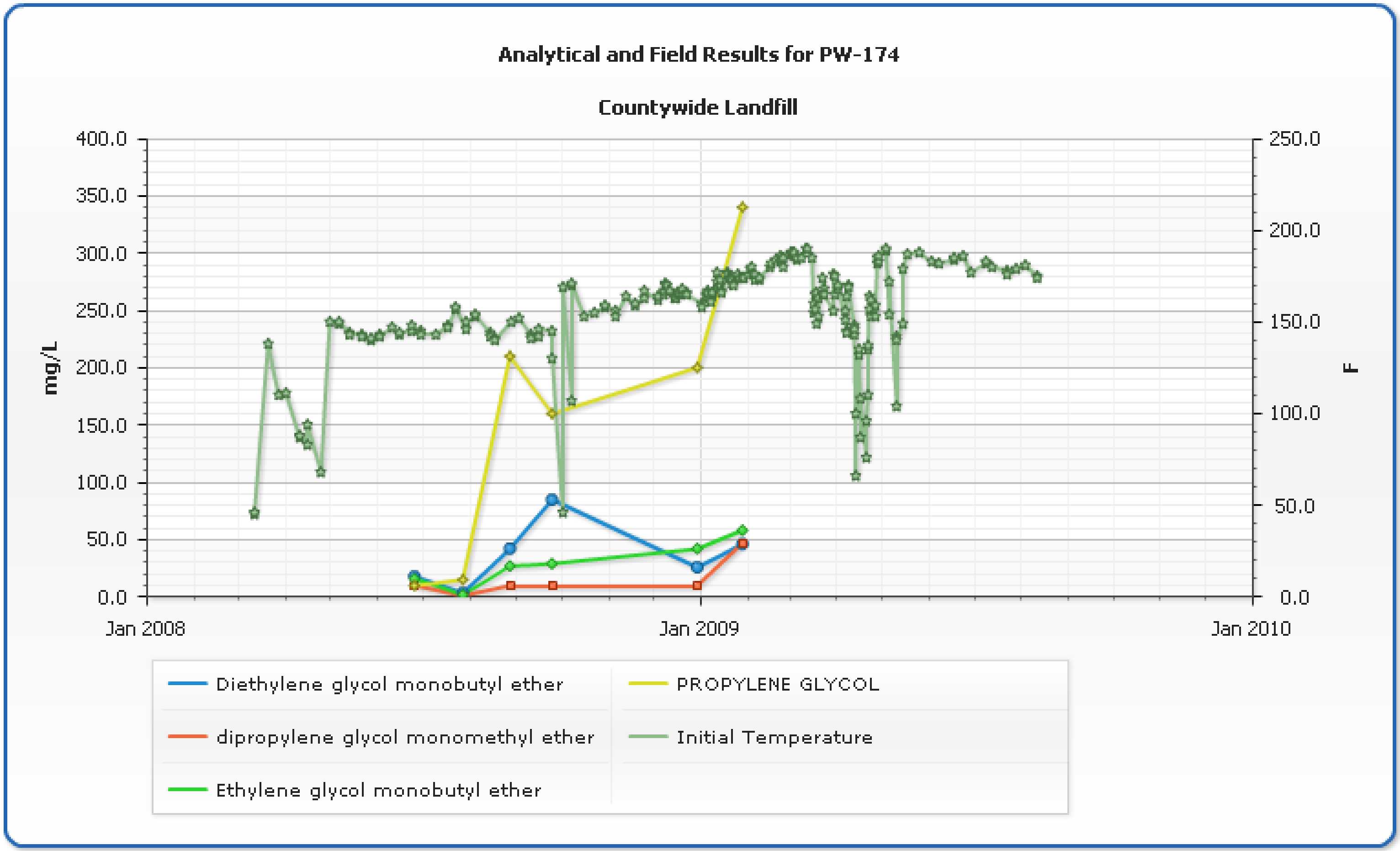

Analytical and Field Results for PW-167
Countywide Landfill
mg/L
F
900.0
800.0
700.0
600.0
500.0
400.0
300.0
200.0
100.0
0.0
220.0
200.0
180.0
160.0
140.0
120.0
100.0
80.0
60.0
40.0
Jan 2006
Jan 2007
Jan 2008
Jan 2009
Jan 2010
Diethylene glycol monobutyl ether
dipropylene glycol monomethyl ether
Ethylene glycol monobutyl ether
PROPYLENE GLYCOL
Initial Temperature



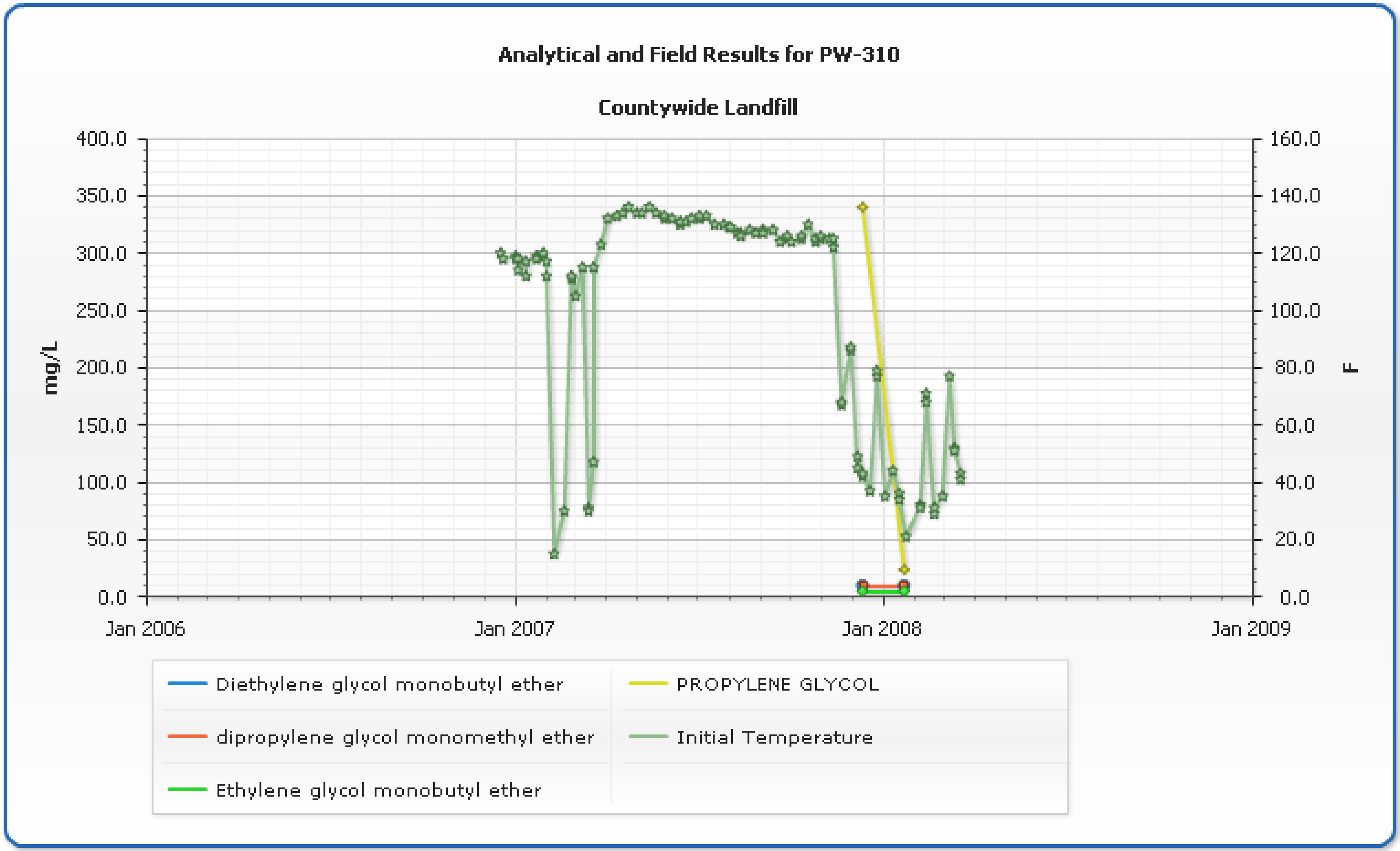
Analytical and Field Results for PW-167R
Countywide Landfill
mg/L
F
700.0
600.0
500.0
400.0
300.0
200.0
100.0
0.0
220.0
200.0
180.0
160.0
140.0
120.0
100.0
80.0
60.0
Jan 2008
Jan 2009
Jan 2010
Diethylene glycol monobutyl ether
dipropylene glycol monomethyl ether
Ethylene glycol monobutyl ether
PROPYLENE GLYCOL
Initial Temperature



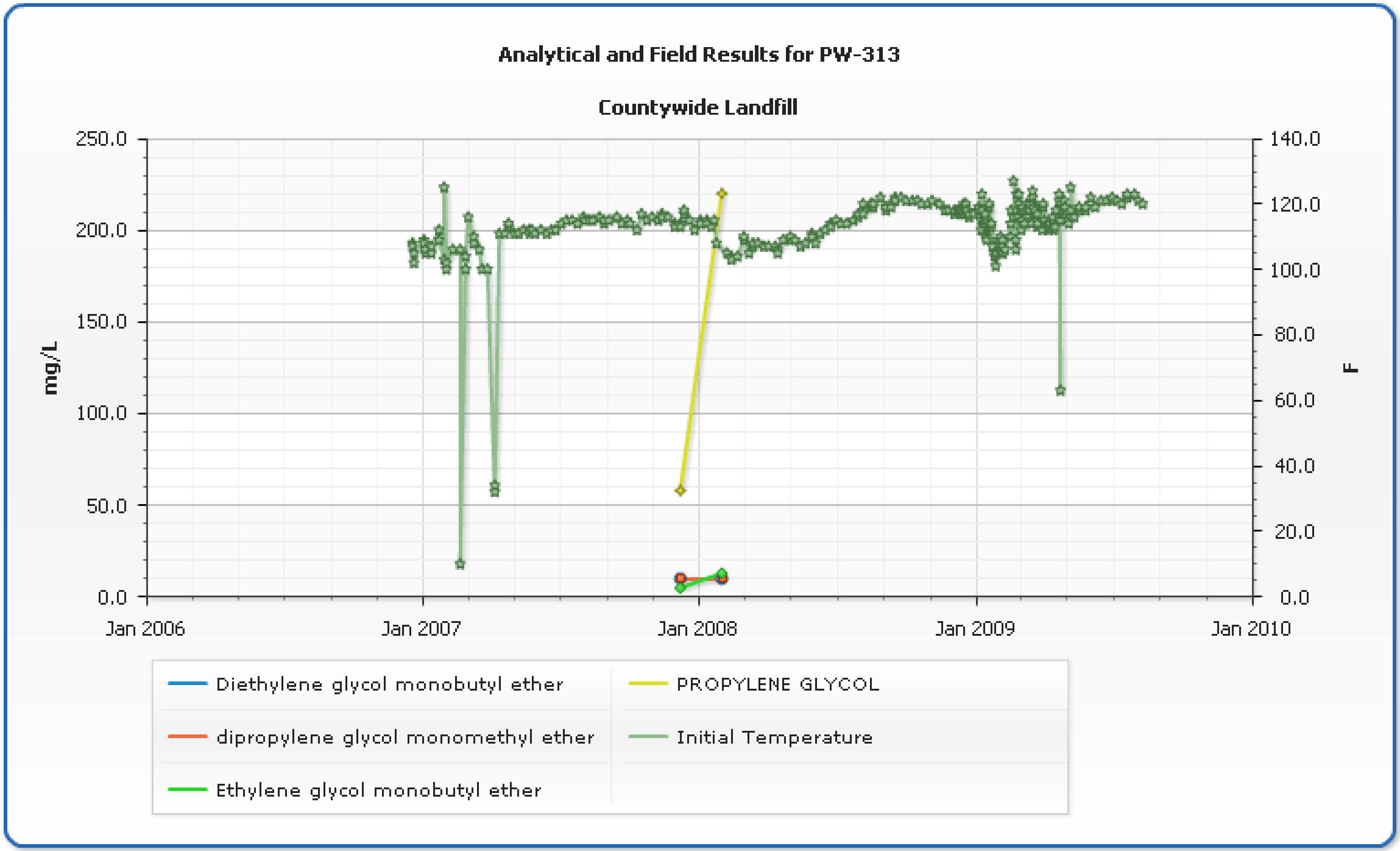
Analytical and Field Results for PW-168(M)
Countywide Landfill
mg/L
F
200.0
150.0
100.0
50.0
0.0
155.0
150.0
145.0
140.0
135.0
130.0
125.0
120.0
Jan 2006
Jan 2007
Jan 2008
Jan 2009
Jan 2010
Diethylene glycol monobutyl ether
dipropylene glycol monomethyl ether
Ethylene glycol monobutyl ether
PROPYLENE GLYCOL
Initial Temperature



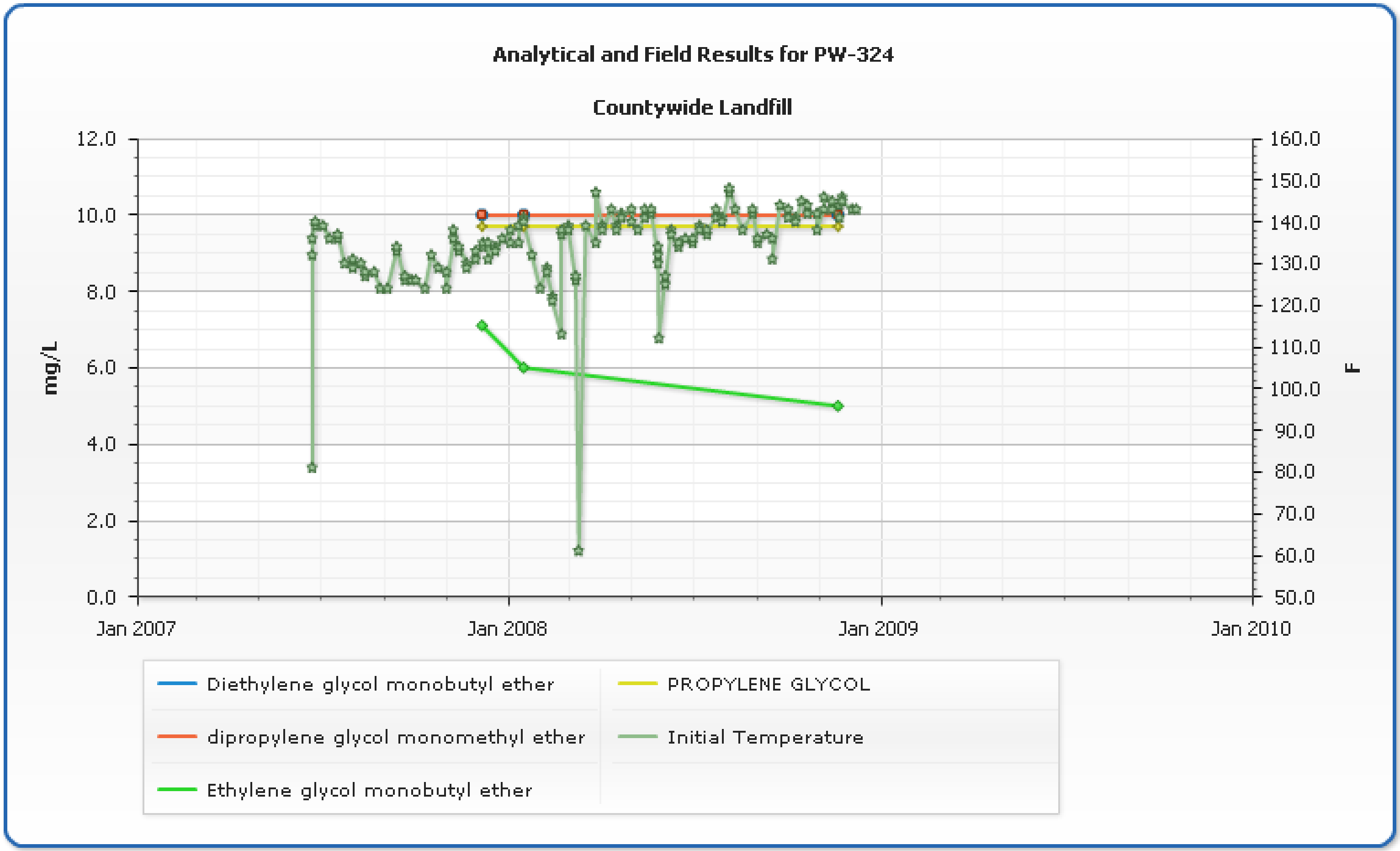
Analytical and Field Results for PW-174
Countywide Landfill
mg/L
F
400.0
350.0
300.0
250.0
200.0
150.0
100.0
50.0
0.0
250.0
200.0
150.0
100.0
50.0
0.0
Jan 2008
Jan 2009
Jan 2010
Diethylene glycol monobutyl ether
dipropylene glycol monomethyl ether
Ethylene glycol monobutyl ether
PROPYLENE GLYCOL
Initial Temperature

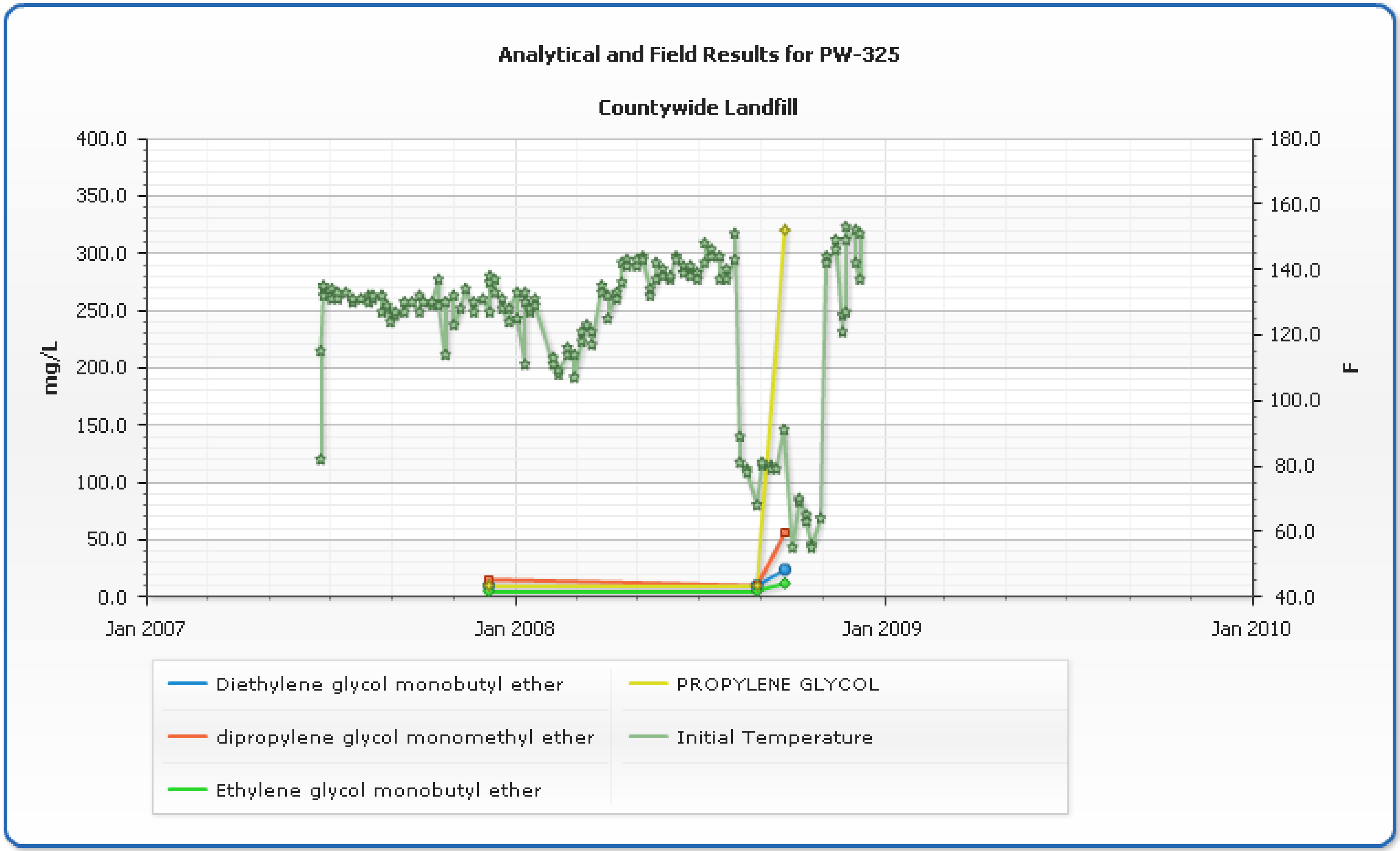


Analytical and Field Results for PW-310
Countywide Landfill
mg/L
F
400.0
350.0
300.0
250.0
200.0
150.0
100.0
50.0
0.0
160.0
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
Jan 2006
Jan 2007
Jan 2008
Jan 2009
Diethylene glycol monobutyl ether
dipropylene glycol monomethyl ether
Ethylene glycol monobutyl ether
PROPYLENE GLYCOL
Initial Temperature

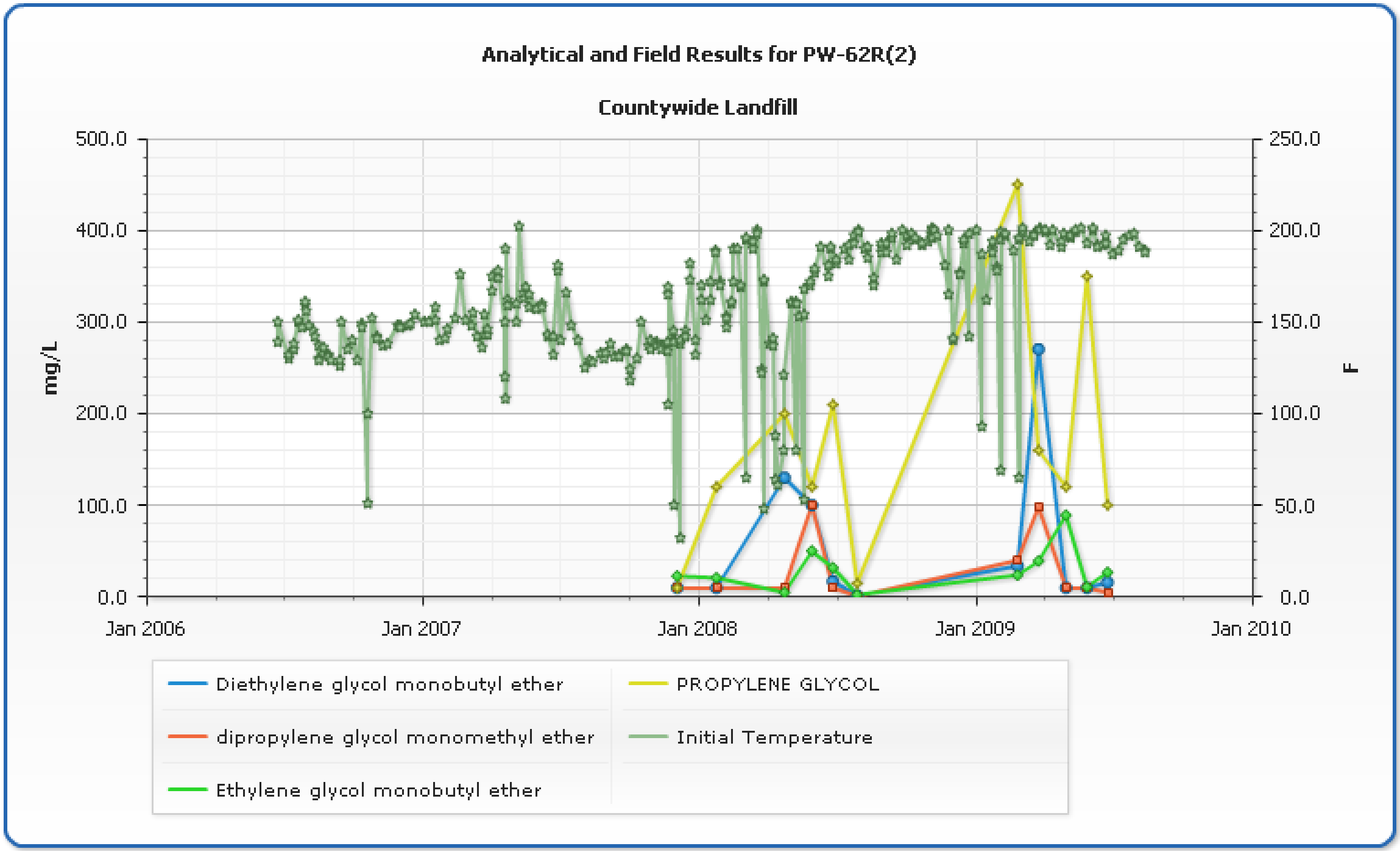


Analytical and Field Results for PW-313
Countywide Landfill
mg/L
F
250.0
200.0
150.0
100.0
50.0
0.0
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
Jan 2006
Jan 2007
Jan 2008
Jan 2009
Jan 2010
Diethylene glycol monobutyl ether
dipropylene glycol monomethyl ether
Ethylene glycol monobutyl ether
PROPYLENE GLYCOL
Initial Temperature

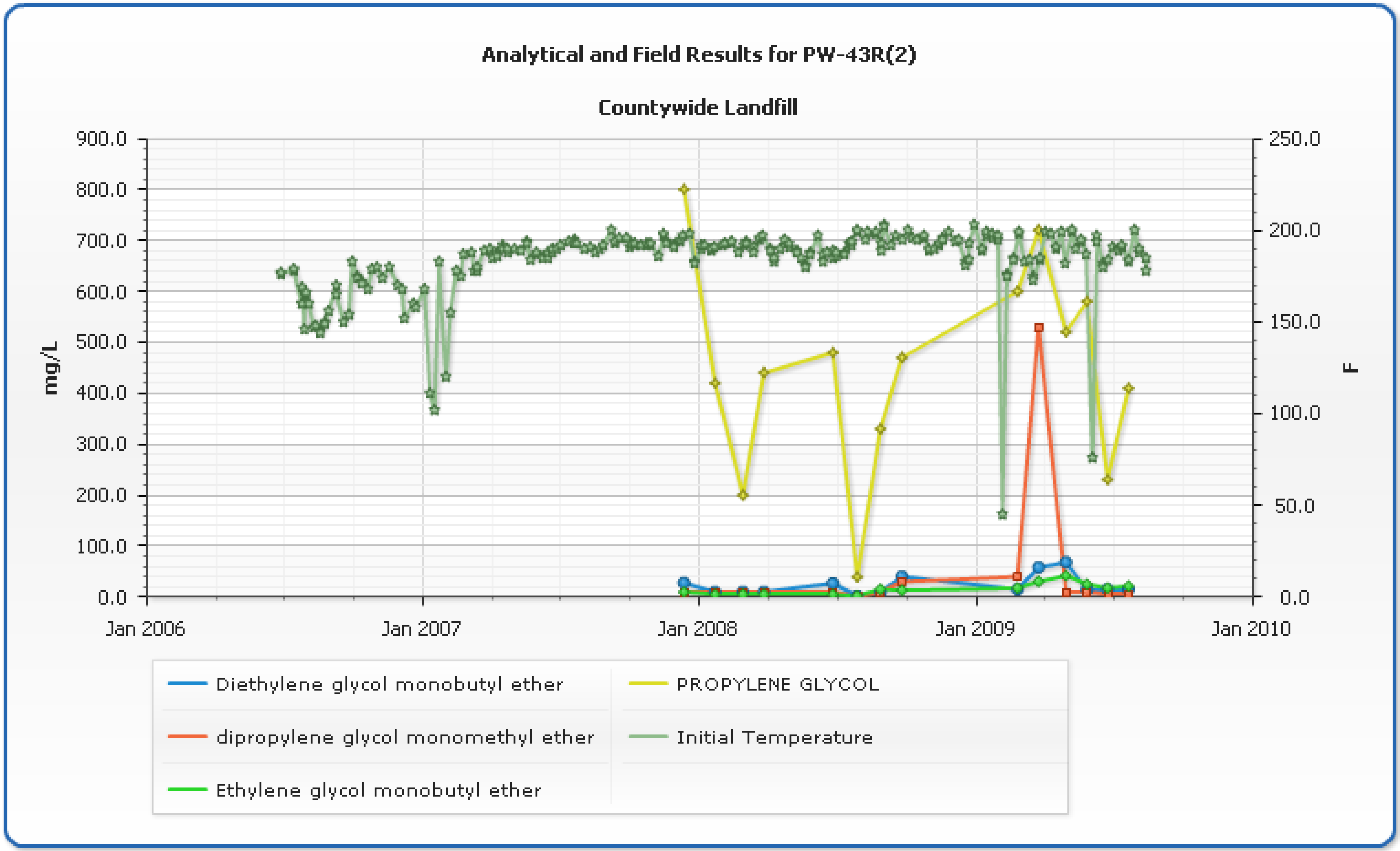

Analytical and Field Results for PW-324
Countywide Landfill
mg/L
F
12.0
10.0
8.0
6.0
4.0
2.0
0.0
160.0
150.0
140.0
130.0
120.0
110.0
100.0
90.0
80.0
70.0
60.0
50.0
Jan 2007
Jan 2008
Jan 2009
Jan 2010
Diethylene glycol monobutyl ether
PROPYLENE GLYCOL
dipropylene glycol monomethyl ether
Initial Temperature
Ethylene glycol monobutyl ether



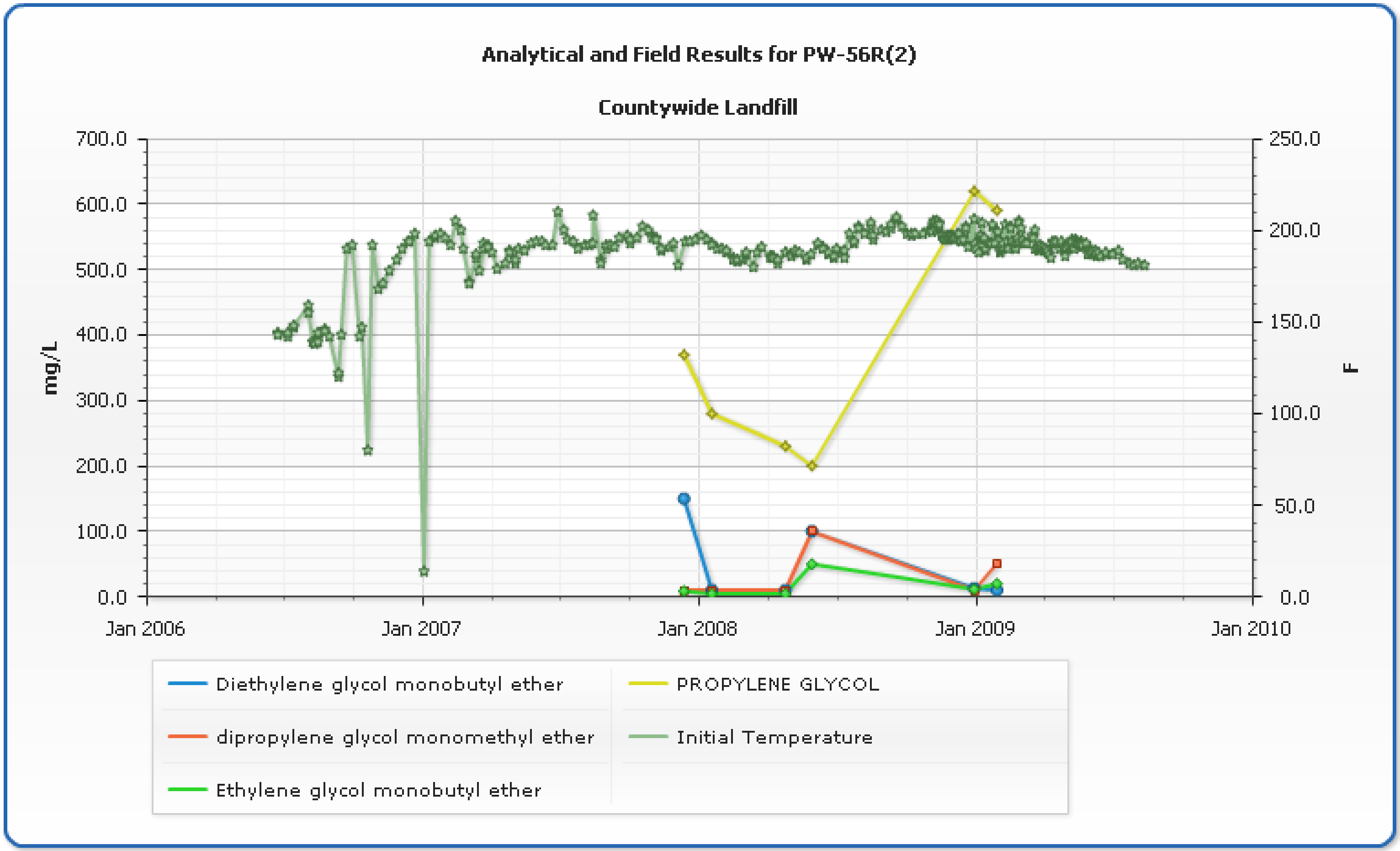
Analytical and Field Results for PW-325
Countywide Landfill
mg/L
F
400.0
350.0
300.0
250.0
200.0
150.0
100.0
50.0
0.0
180.0
160.0
140.0
120.0
100.0
80.0
60.0
40.0
Jan 2007
Jan 2008
Jan 2009
Jan 2010
Diethylene glycol monobutyl ether
dipropylene glycol monomethyl ether
Ethylene glycol monobutyl ether
PROPYLENE GLYCOL
Initial Temperature



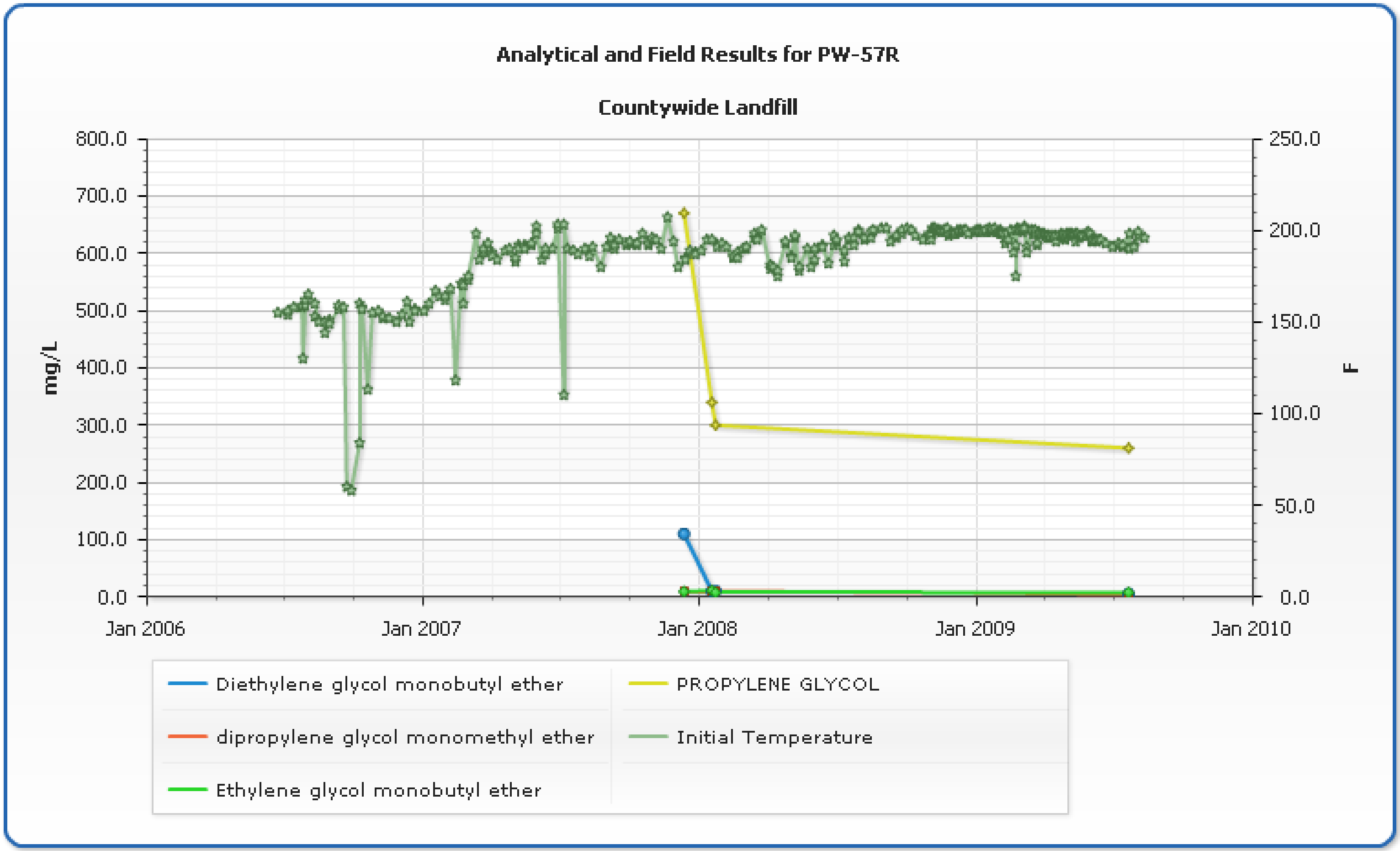
Analytical and Field Results for PW-62R(2)
Countywide Landfill
mg/L
F
500.0
400.0
300.0
200.0
100.0
0.0
250.0
200.0
150.0
100.0
50.0
0.0
Jan 2006
Jan 2007
Jan 2008
Jan 2009
Jan 2010
Diethylene glycol monobutyl ether
dipropylene glycol monomethyl ether
Ethylene glycol monobutyl ether
PROPYLENE GLYCOL
Initial Temperature



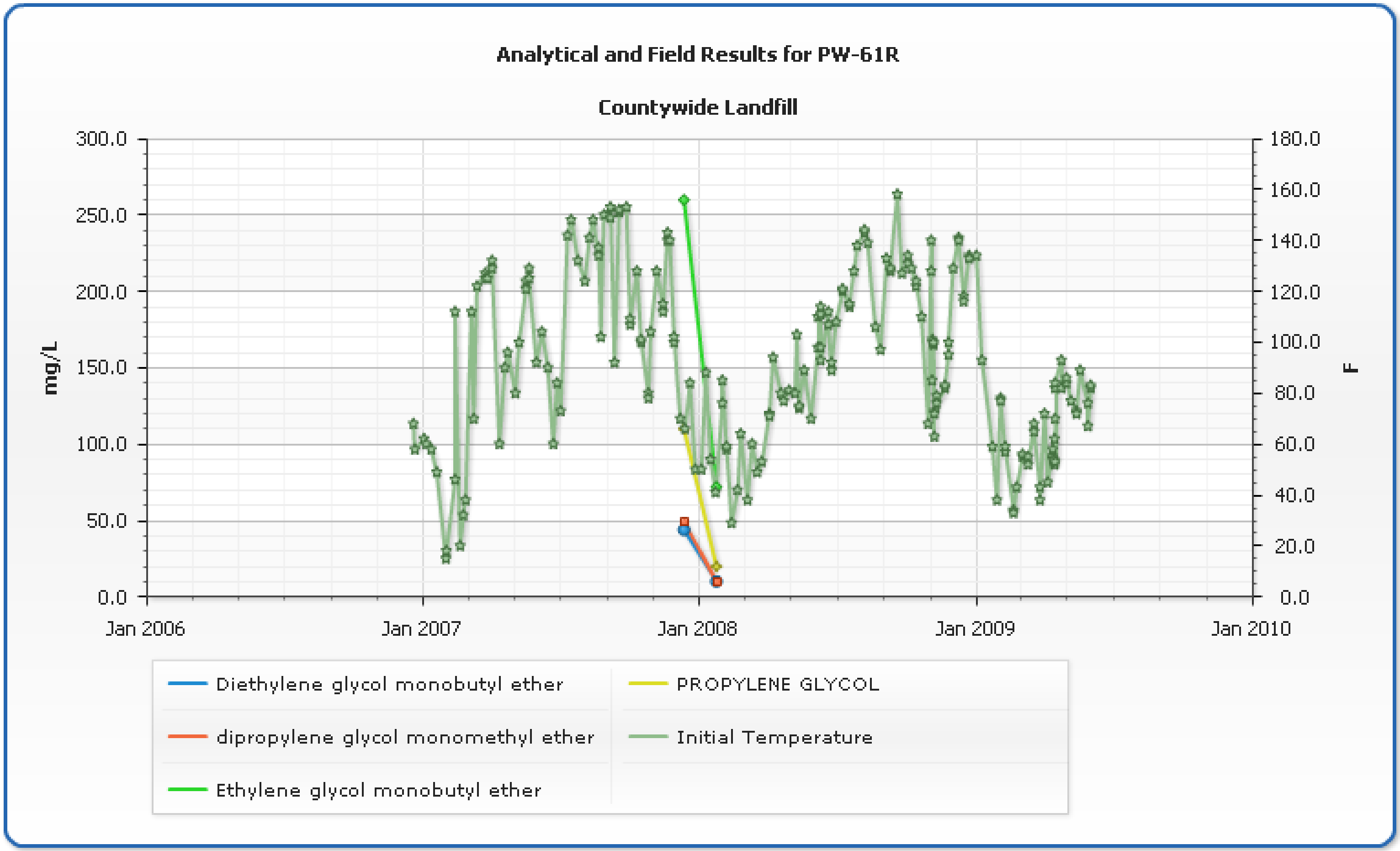
Analytical and Field Results for PW-43R(2)
Countywide Landfill
mg/L
F
900.0
800.0
700.0
600.0
500.0
400.0
300.0
200.0
100.0
0.0
250.0
200.0
150.0
100.0
50.0
0.0
Jan 2006
Jan 2007
Jan 2008
Jan 2009
Jan 2010
Diethylene glycol monobutyl ether
dipropylene glycol monomethyl ether
Ethylene glycol monobutyl ether
PROPYLENE GLYCOL
Initial Temperature



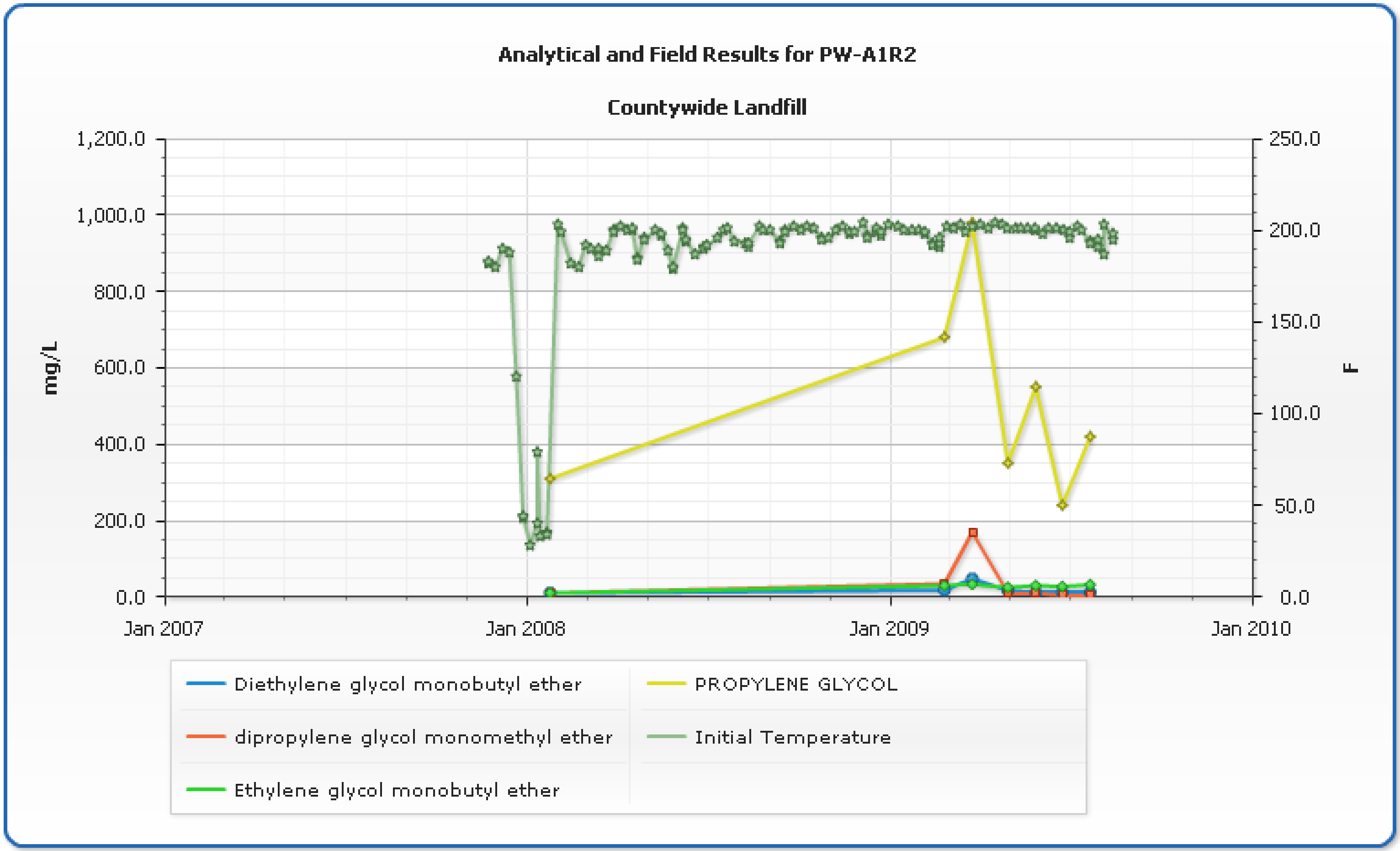
Analytical and Field Results for PW-56R(2)
Countywide Landfill
mg/L
F
700.0
600.0
500.0
400.0
300.0
200.0
100.0
0.0
250.0
200.0
150.0
100.0
50.0
0.0
Jan 2006
Jan 2007
Jan 2008
Jan 2009
Jan 2010
Diethylene glycol monobutyl ether
dipropylene glycol monomethyl ether
Ethylene glycol monobutyl ether
PROPYLENE GLYCOL
Initial Temperature



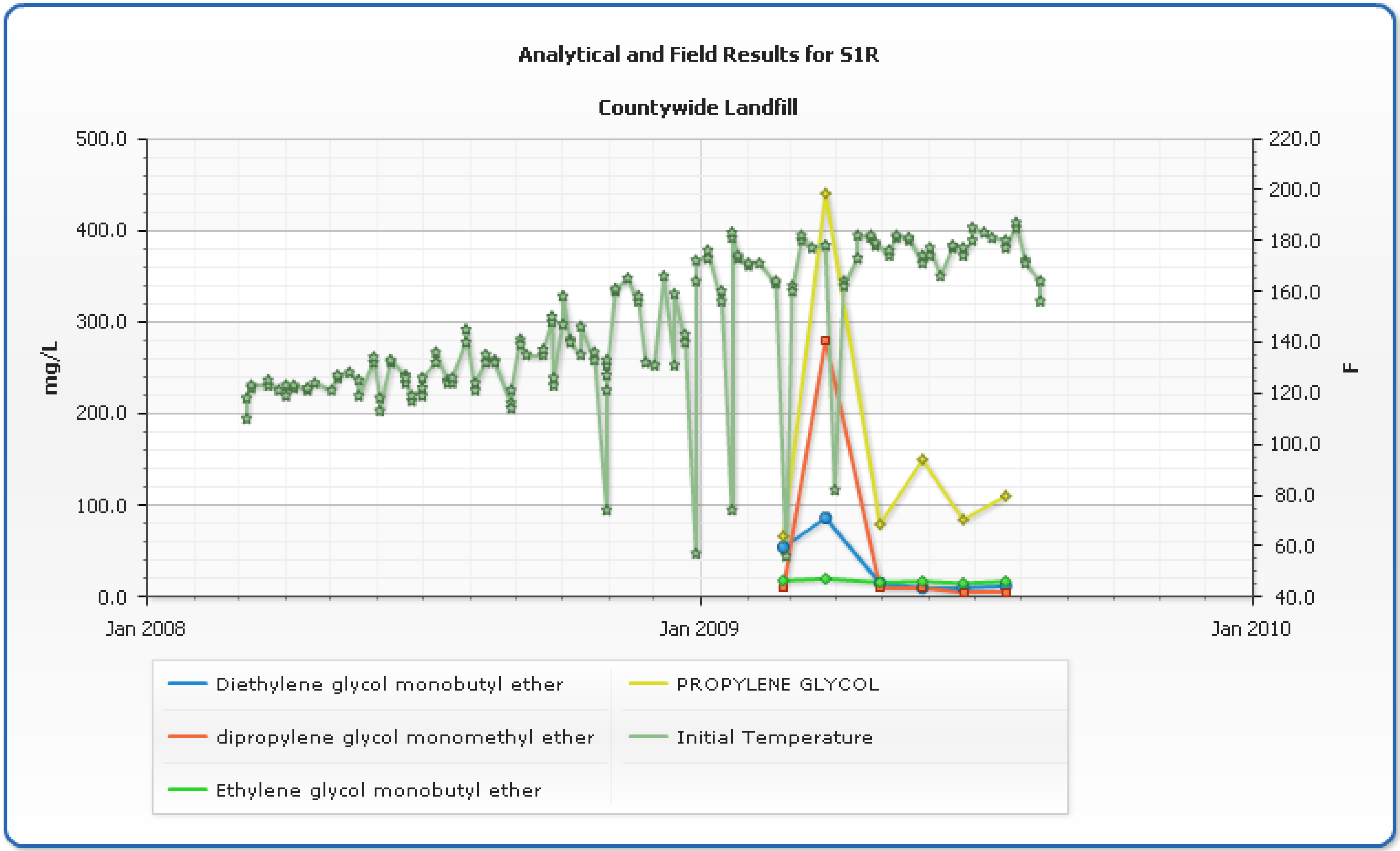
Analytical and Field Results for PW-57R
Countywide Landfill
800.0
700.0
600.0
500.0
400.0
300.0
200.0
100.0
0.0
mg/L
250.0
200.0
150.0
100.0
50.0
0.0
F
Jan 2006
Jan 2007
Jan 2008
Jan 2009
Jan 2010
Diethylene glycol monobutyl ether
dipropylene glycol monomethyl ether
Ethylene glycol monobutyl ether
PROPYLENE GLYCOL
Initial Temperature

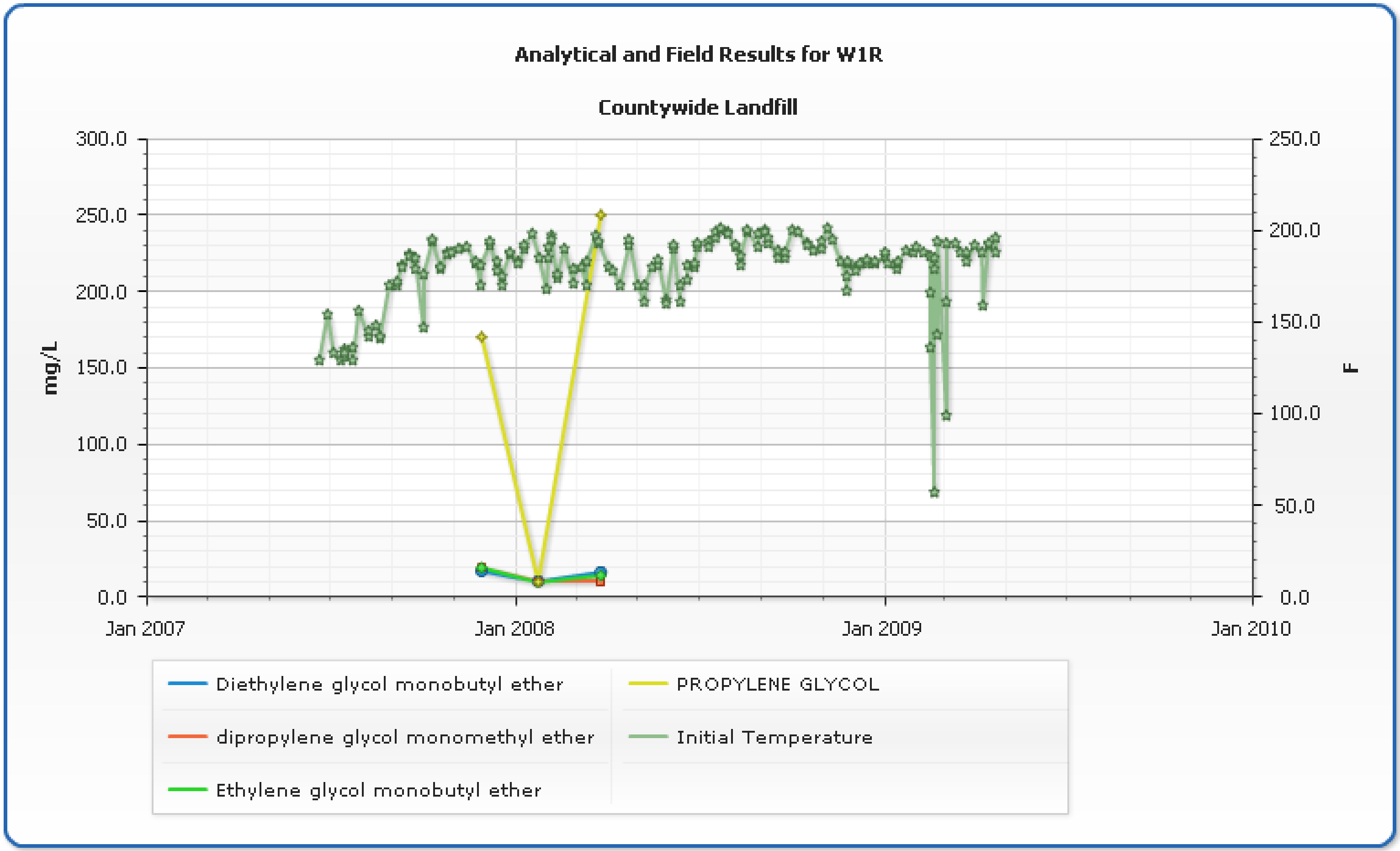


Analytical and Field Results for PW-61R
Countywide Landfill
mg/L
F
300.0
250.0
200.0
150.0
100.0
50.0
0.0
180.0
160.0
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
Jan 2006
Jan 2007
Jan 2008
Jan 2009
Jan 2010
Diethylene glycol monobutyl ether
dipropylene glycol monomethyl ether
Ethylene glycol monobutyl ether
PROPYLENE GLYCOL
Initial Temperature

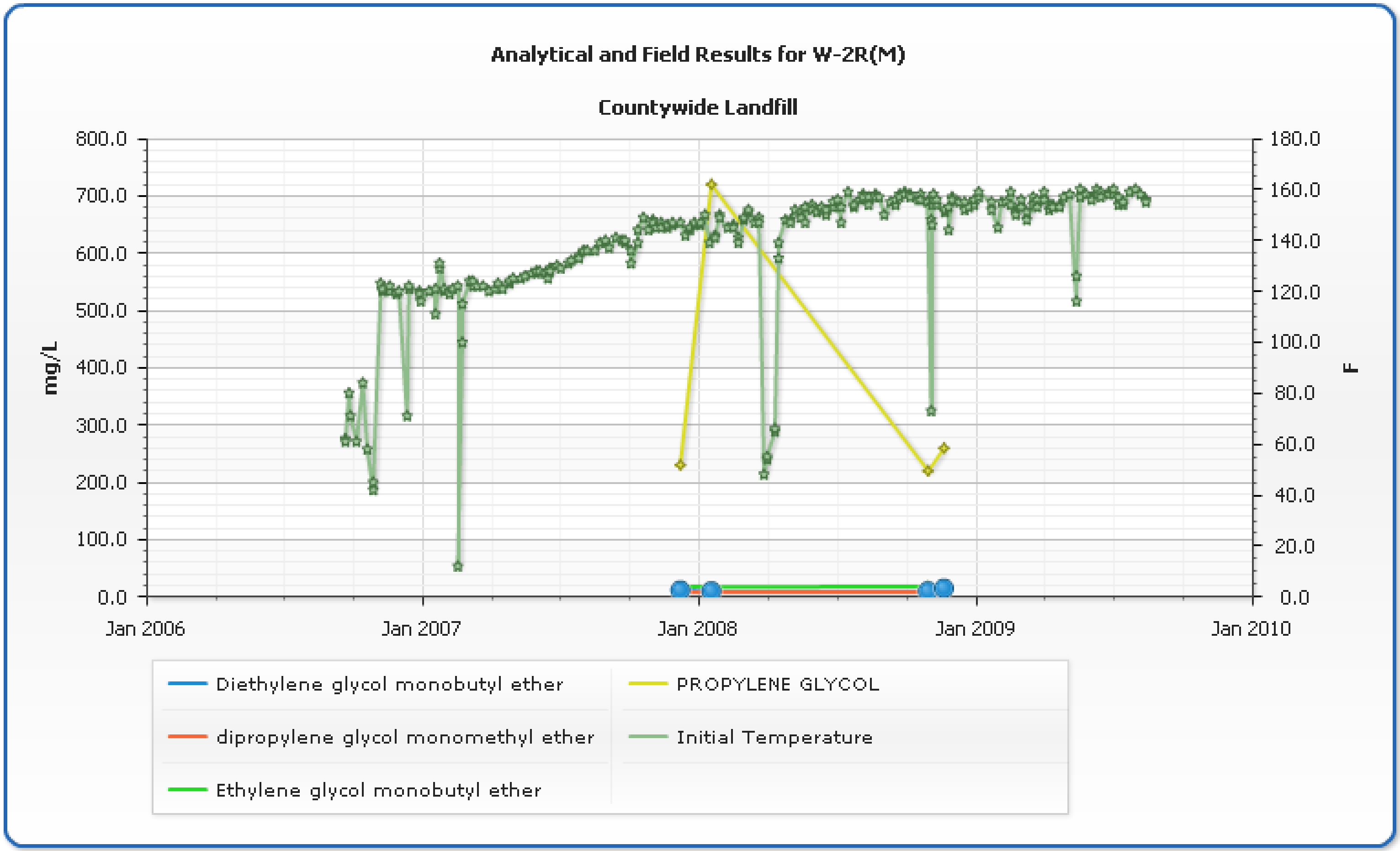


Analytical and Field Results for PW-A1R2
Countywide Landfill
mg/L
F
1,200.0
1,000.0
800.0
600.0
400.0
200.0
0.0
250.0
200.0
150.0
100.0
50.0
0.0
Jan 2007
Jan 2008
Jan 2009
Jan 2010
Diethylene glycol monobutyl ether
dipropylene glycol monomethyl ether
Ethylene glycol monobutyl ether
PROPYLENE GLYCOL
Initial Temperature

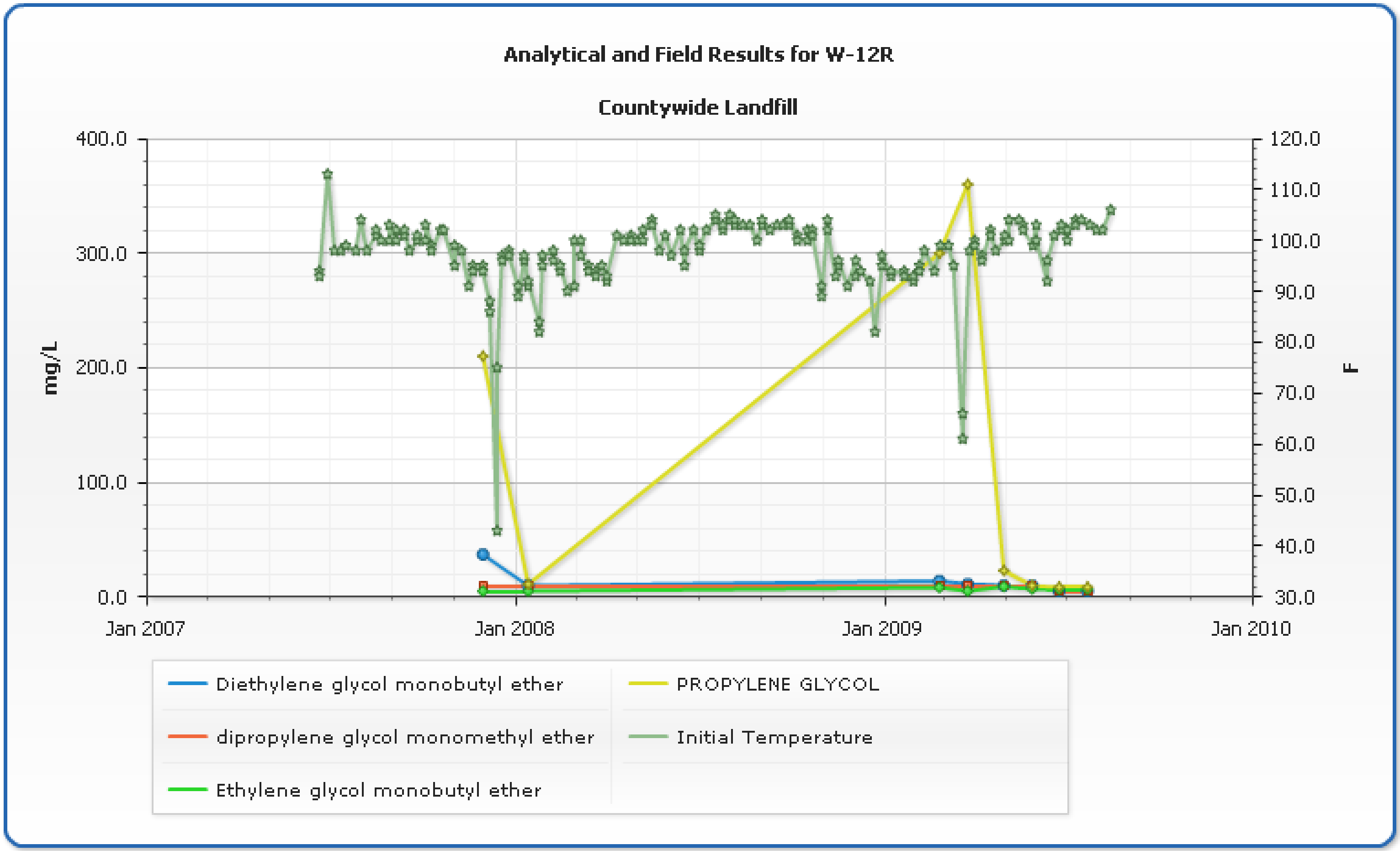

Analytical and Field Results for S1R
Countywide Landfill
mg/L
F
500.0
400.0
300.0
200.0
100.0
0.0
220.0
200.0
180.0
160.0
140.0
120.0
100.0
80.0
60.0
40.0
Jan 2008
Jan 2009
Jan 2010
Diethylene glycol monobutyl ether
dipropylene glycol monomethyl ether
Ethylene glycol monobutyl ether
PROPYLENE GLYCOL
Initial Temperature



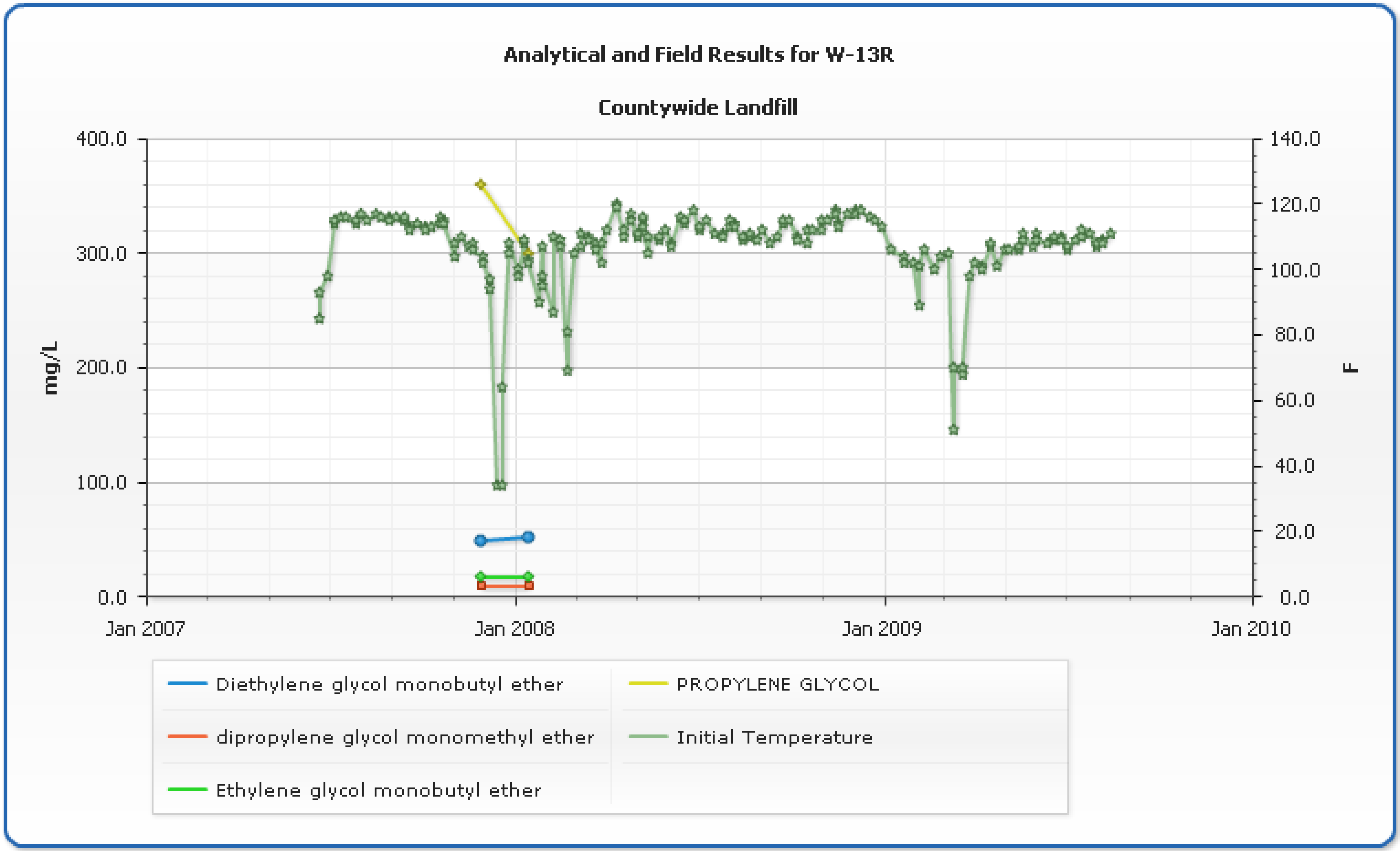
Analytical and Field Results for W1R
Countywide Landfill
mg/L
300.0
250.0
200.0
150.0
100.0
50.0
0.0
F
250.0
200.0
150.0
100.0
50.0
0.0
Jan 2007
Jan 2008
Jan 2009
Jan 2010
Diethylene glycol monobutyl ether
dipropylene glycol monomethyl ether
Ethylene glycol monobutyl ether
PROPYLENE GLYCOL
Initial Temperature



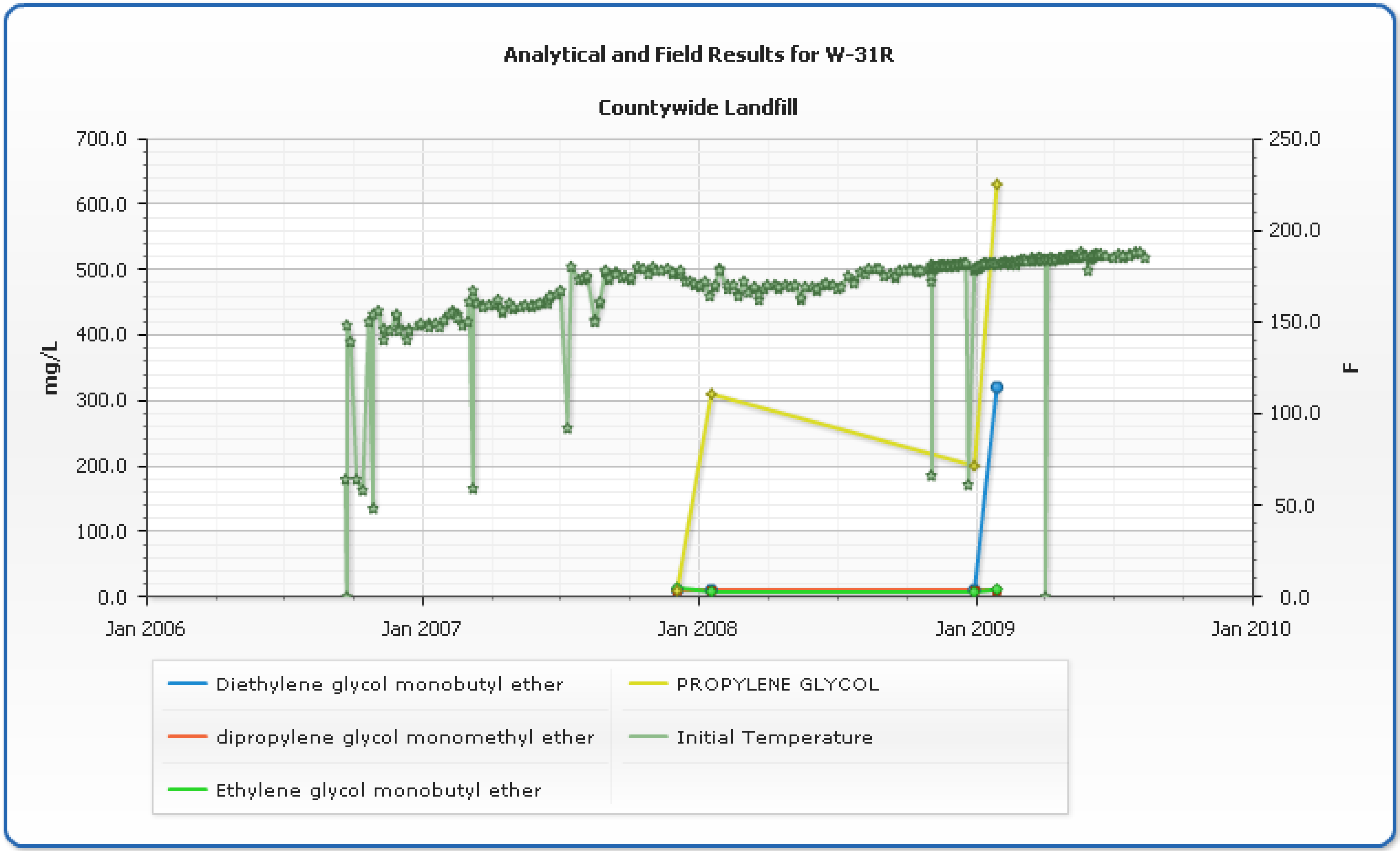
Analytical and Field Results for W-2R(M)
Countywide Landfill
mg/L
F
800.0
700.0
600.0
500.0
400.0
300.0
200.0
100.0
0.0
180.0
160.0
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
Jan 2006
Jan 2007
Jan 2008
Jan 2009
Jan 2010
Diethylene glycol monobutyl ether
dipropylene glycol monomethyl ether
Ethylene glycol monobutyl ether
PROPYLENE GLYCOL
Initial Temperature



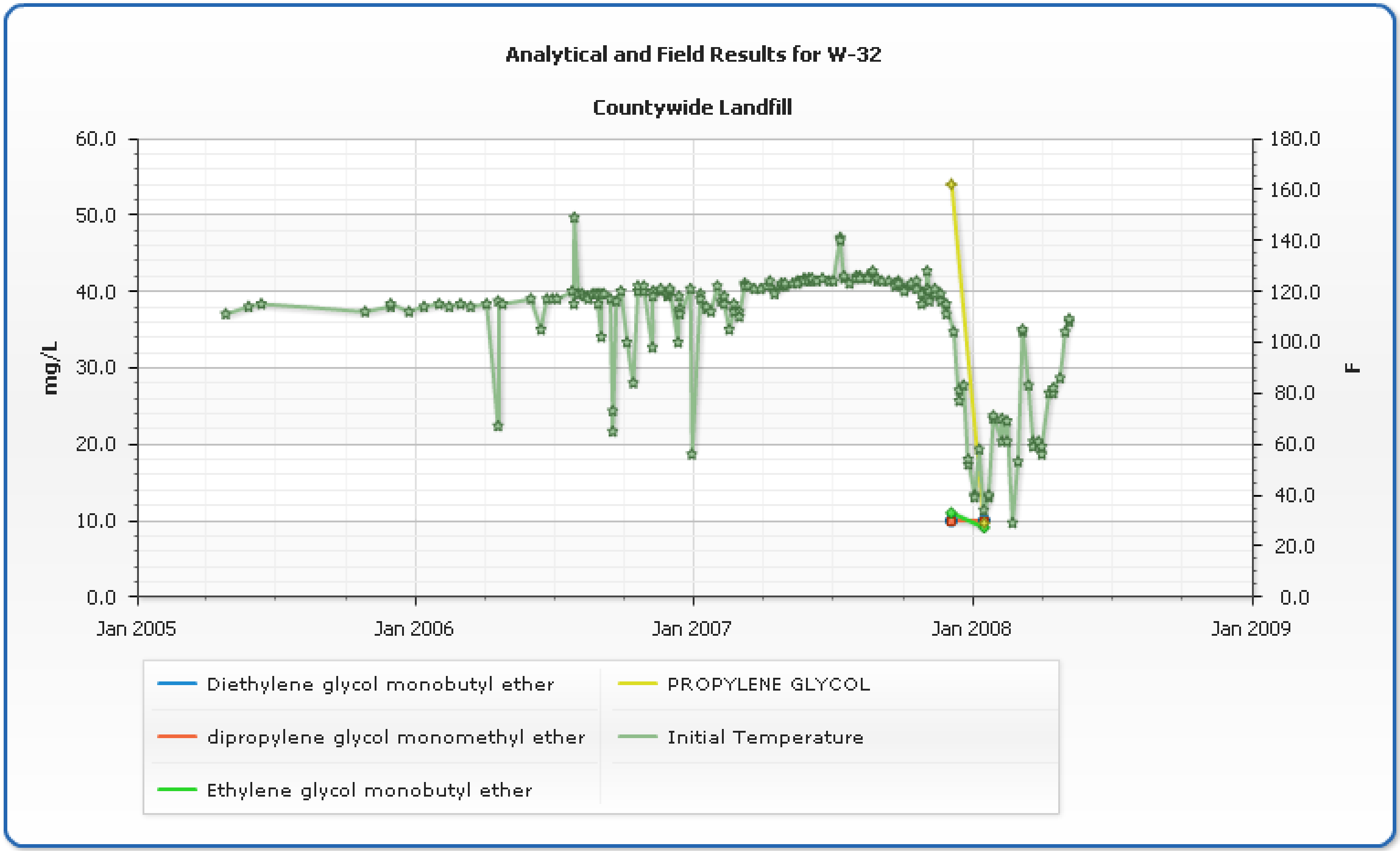
Analytical and Field Results for W-12R
Countywide Landfill
mg/L
F
400.0
300.0
200.0
100.0
0.0
120.0
110.0
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
Jan 2007
Jan 2008
Jan 2009
Jan 2010
Diethylene glycol monobutyl ether
dipropylene glycol monomethyl ether
Ethylene glycol monobutyl ether
PROPYLENE GLYCOL
Initial Temperature

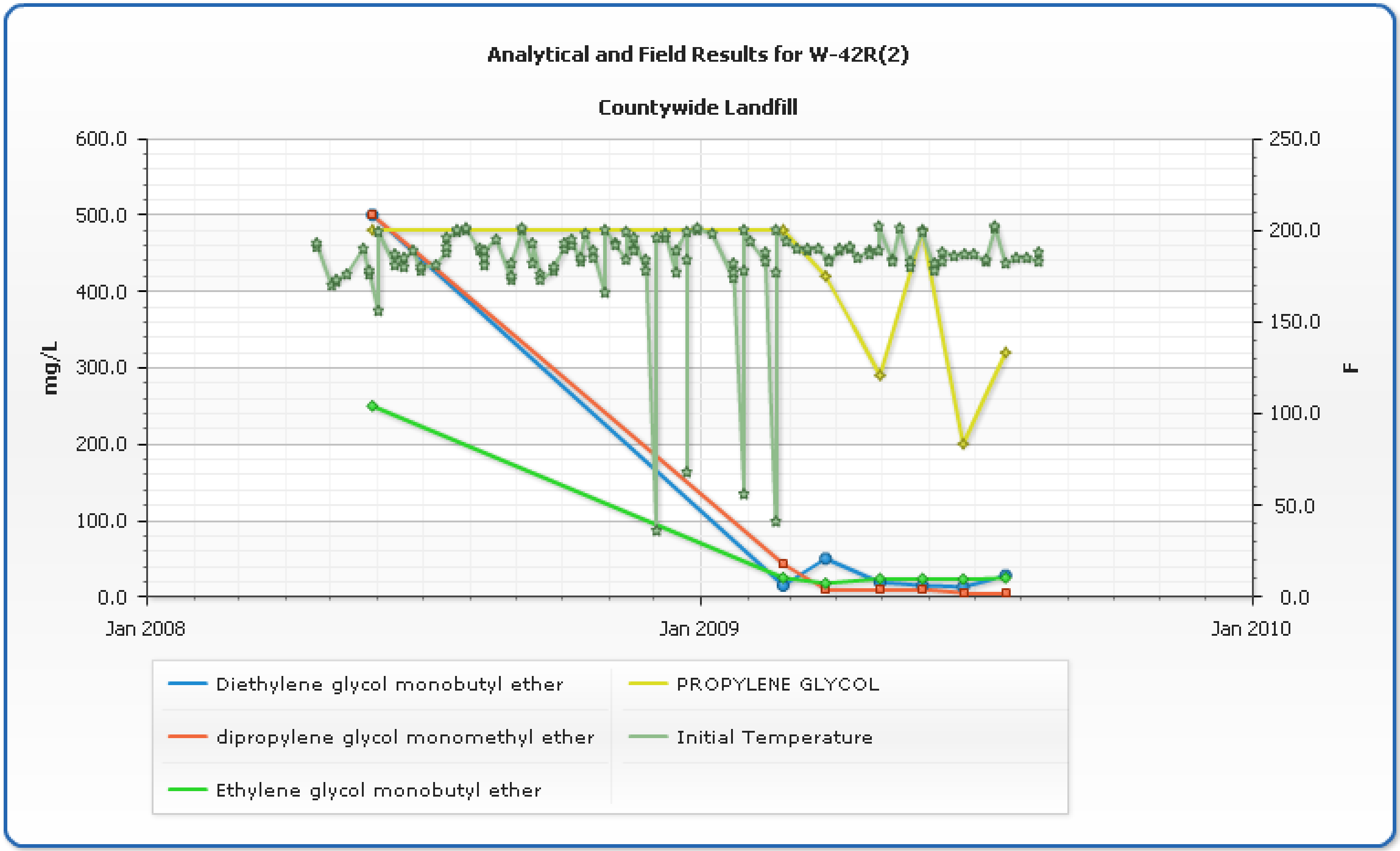


Analytical and Field Results for W-13R
Countywide Landfill
400.0
300.0
200.0
100.0
0.0
mg/L
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
F
Jan 2007
Jan 2008
Jan 2009
Jan 2010
Diethylene glycol monobutyl ether
dipropylene glycol monomethyl ether
Ethylene glycol monobutyl ether
PROPYLENE GLYCOL
Initial Temperature

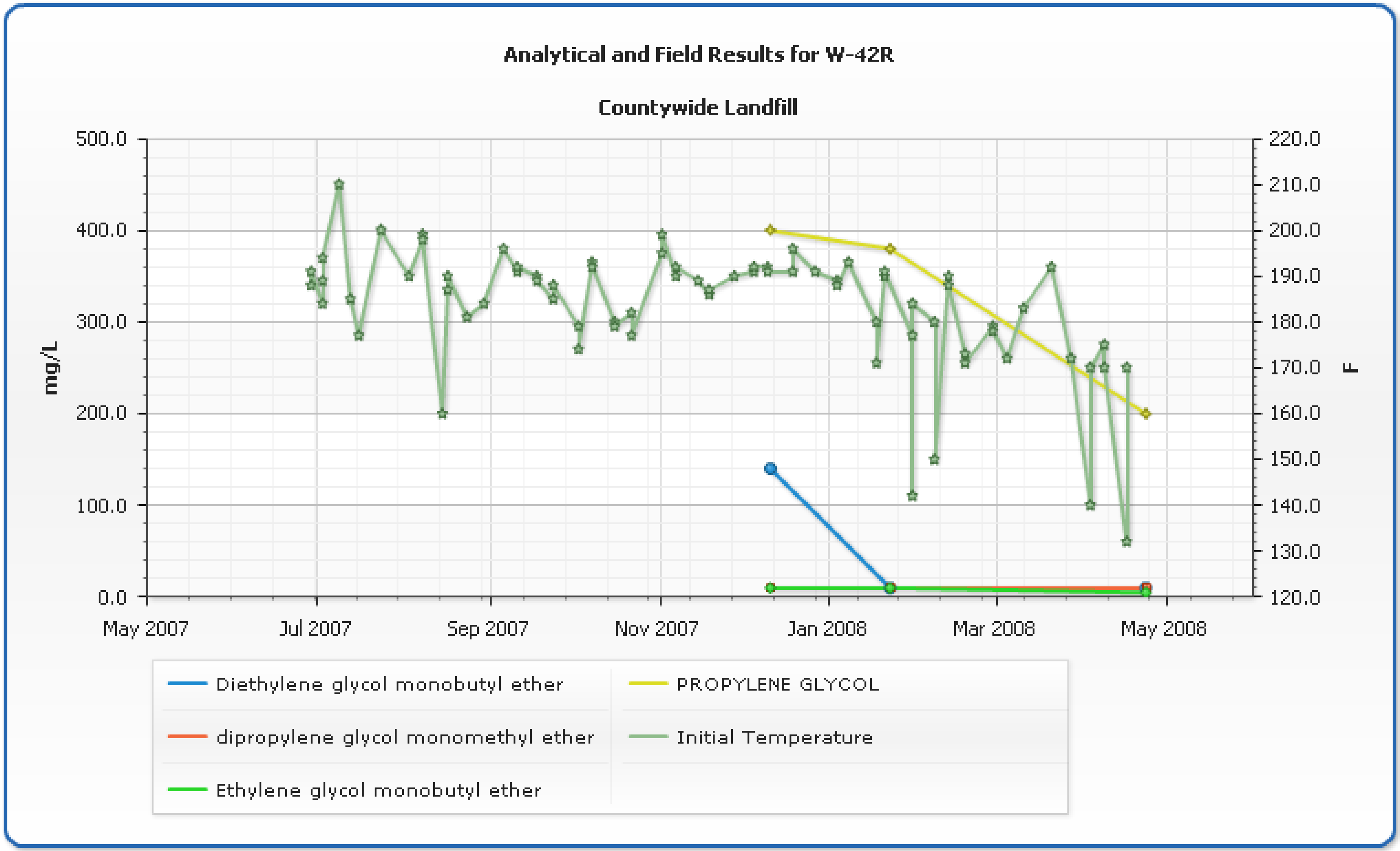


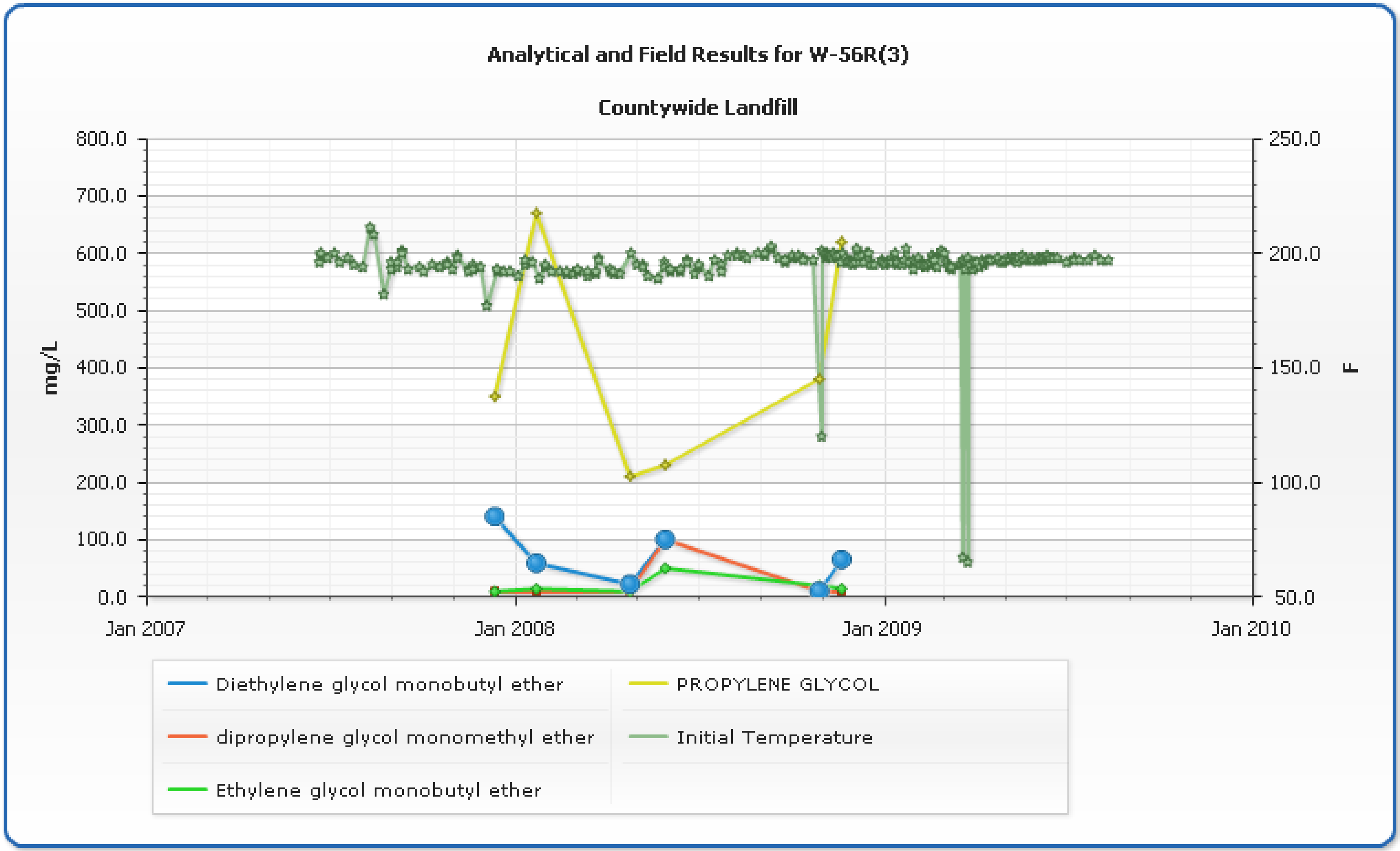
Analytical and Field Results for W-31R
Countywide Landfill
mg/L
F
700.0
600.0
500.0
400.0
300.0
200.0
100.0
0.0
250.0
200.0
150.0
100.0
50.0
0.0
Jan 2006
Jan 2007
Jan 2008
Jan 2009
Jan 2010
Diethylene glycol monobutyl ether
PROPYLENE GLYCOL
dipropylene glycol monomethyl ether
Initial Temperature
Ethylene glycol monobutyl ether


Analytical and Field Results for W-32
Countywide Landfill
mg/L
F
60.0
50.0
40.0
30.0
20.0
10.0
0.0
180.0
160.0
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
Jan 2005
Jan 2006
Jan 2007
Jan 2008
Jan 2009
Diethylene glycol monobutyl ether
dipropylene glycol monomethyl ether
Ethylene glycol monobutyl ether
PROPYLENE GLYCOL
Initial Temperature

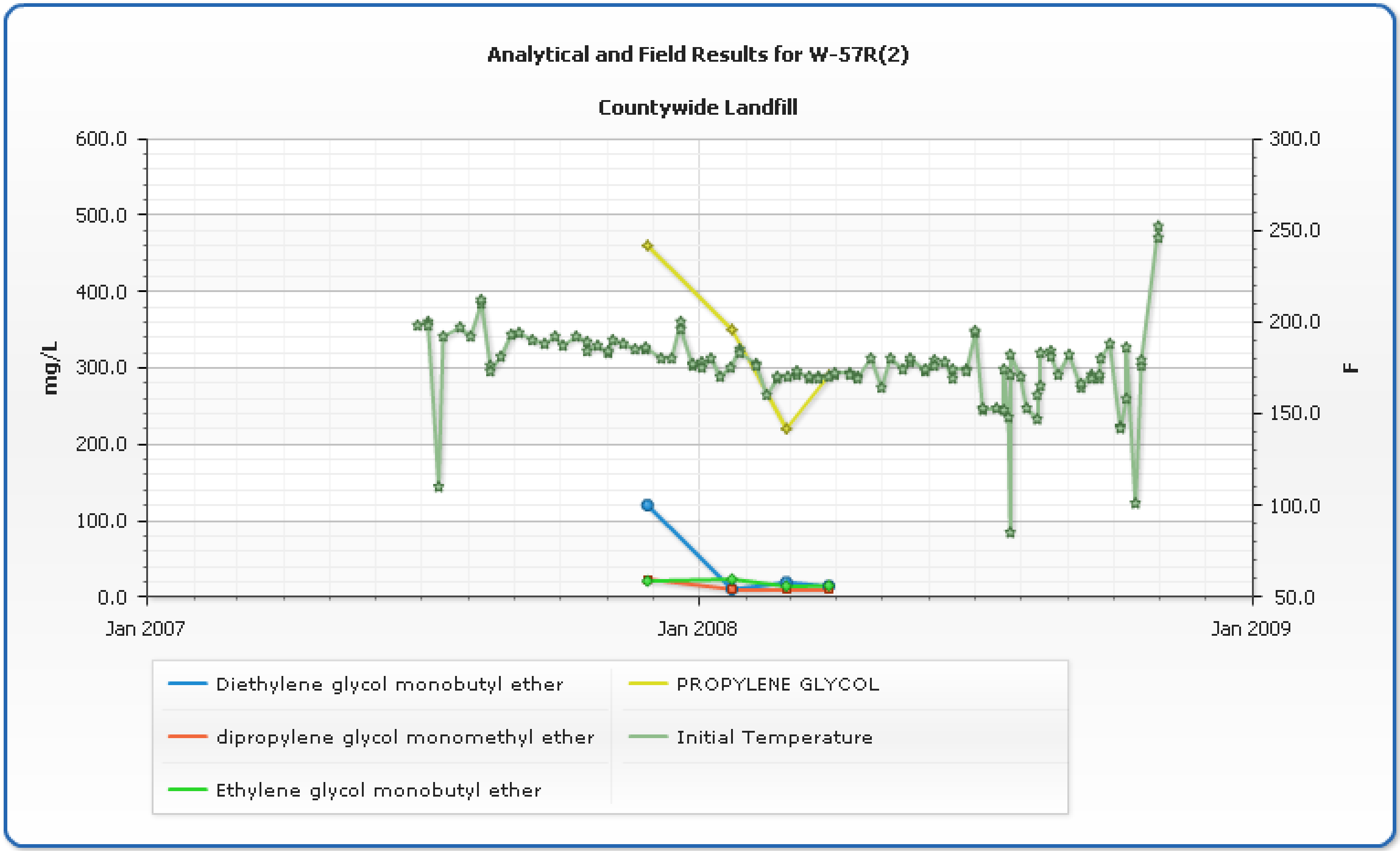


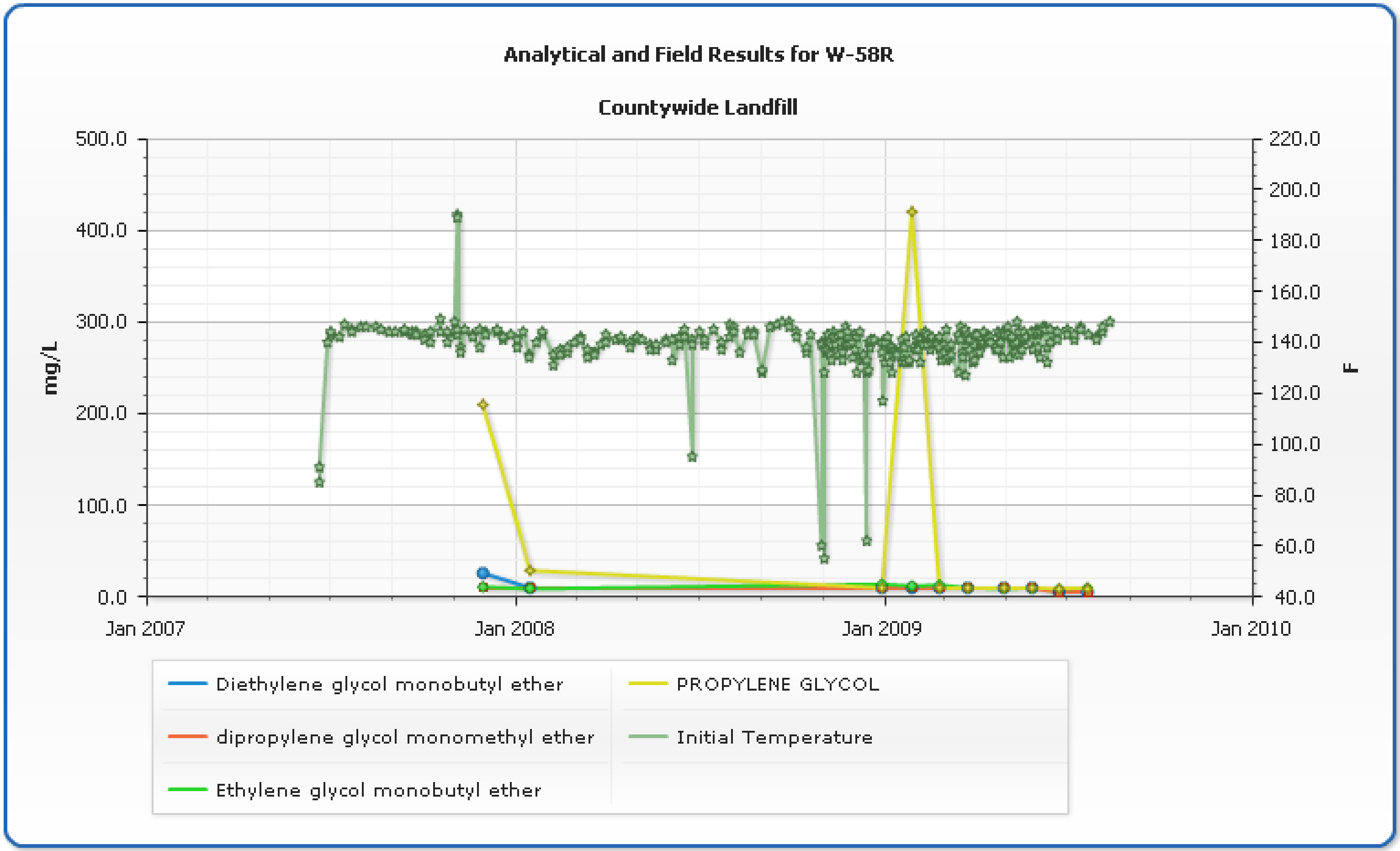
Analytical and Field Results for W-42R(2)
Countywide Landfill
mg/L
F
600.0
500.0
400.0
300.0
200.0
100.0
0.0
250.0
200.0
150.0
100.0
50.0
0.0
Jan 2008
Jan 2009
Jan 2010
Diethylene glycol monobutyl ether
dipropylene glycol monomethyl ether
Ethylene glycol monobutyl ether
PROPYLENE GLYCOL
Initial Temperature


Analytical and Field Results for W-42R
Countywide Landfill
mg/L
500.0
400.0
300.0
200.0
100.0
0.0
220.0
210.0
200.0
190.0
180.0
170.0
160.0
150.0
140.0
130.0
120.0
F
May 2007
Jul 2007
Sep 2007
Nov 2007
Jan 2008
Mar 2008
May 2008
Diethylene glycol monobutyl ether
dipropylene glycol monomethyl ether
Ethylene glycol monobutyl ether
PROPYLENE GLYCOL
Initial Temperature

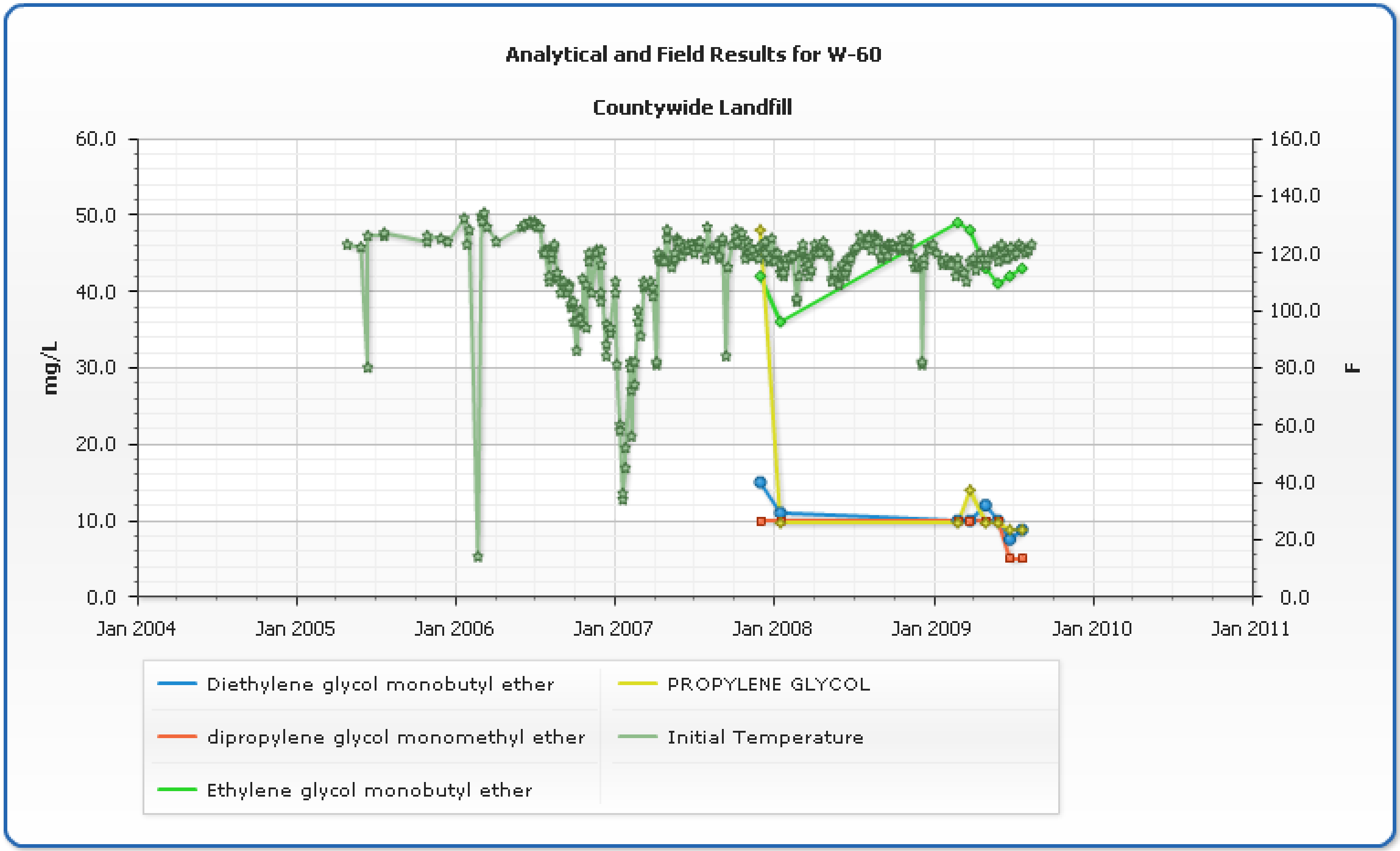


Analytical and Field Results for W-56R(3)
Countywide Landfill
800.0
700.0
600.0
500.0
400.0
300.0
200.0
100.0
0.0
mg/L
250.0
200.0
150.0
100.0
50.0
F
Jan 2007
Jan 2008
Jan 2009
Jan 2010
Diethylene glycol monobutyl ether
dipropylene glycol monomethyl ether
Ethylene glycol monobutyl ether
PROPYLENE GLYCOL
Initial Temperature


Analytical and Field Results for W-57R(2)
Countywide Landfill
mg/L
F
600.0
500.0
400.0
300.0
200.0
100.0
0.0
300.0
250.0
200.0
150.0
100.0
50.0
Jan 2007
Jan 2008
Jan 2009
Diethylene glycol monobutyl ether
dipropylene glycol monomethyl ether
Ethylene glycol monobutyl ether
PROPYLENE GLYCOL
Initial Temperature



Analytical and Field Results for W-58R
Countywide Landfill
mg/L
F
500.0
400.0
300.0
200.0
100.0
0.0
220.0
200.0
180.0
160.0
140.0
120.0
100.0
80.0
60.0
40.0
Jan 2007
Jan 2008
Jan 2009
Jan 2010
Diethylene glycol monobutyl ether
dipropylene glycol monomethyl ether
Ethylene glycol monobutyl ether
PROPYLENE GLYCOL
Initial Temperature



Analytical and Field Results for W-60
Countywide Landfill
mg/L
F
60.0
50.0
40.0
30.0
20.0
10.0
0.0
160.0
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
Jan 2004
Jan 2005
Jan 2006
Jan 2007
Jan 2008
Jan 2009
Jan 2010
Jan 2011
Diethylene glycol monobutyl ether
PROPYLENE GLYCOL
dipropylene glycol monomethyl ether
Initial Temperature
Ethylene glycol monobutyl ether

APPENDIX F

Sampling and Analysis Plan

Leachate and Landfill Gas Sampling and Analysis Plan

(Quality Assurance Sampling and Analysis Plan)

Site:

Prepared for:
Countywide Recycle & Disposal Facility
3619 Gracemont St. S.W.
East Sparta, Ohio 44626

Prepared by:
AECOM

July 23, 2009

AECOM Project No. 94127

SAMPLING PROGRAM REQUIREMENTS

This Sampling and Analysis Plan (SAP) pertains to the sampling and analysis of landfill leachate and landfill gas from the 88 acre unit of the Countywide Recycling and Disposal Facility (Countywide) which is located at 3619 Gracemont Street SE, East Sparta, Stark County, Ohio. The data quality objectives of this sampling program are to provide data that will be used to meet the Monitoring Objectives stated in Section 6.1 of Volume 1 of the OM&M Plan. The 88-acre remediation unit landfill leachate and landfill gas has been extensively characterized since 2006. Previous analyses reveal that the leachate and gas are extremely rich mixtures of a wide variety of chemicals and compounds. Normal landfill leachate and gas pose significant challenges for any analytical laboratory. The Countywide landfill gas and leachate has proven to be much more difficult to characterize than normal landfill leachate. As a result, severe matrix interferences occur and very high dilution ratios are needed in the lab. This results in high practical quantitation limits (PQLs) can be extremely high. However, for the stated data objectives, it has been determined that the historically achievable PQLs, and those referenced in this document are acceptable.

Countywide will conduct this sampling in accordance with the following sampling schedule:

Table 1 Field Sampling Summary

Analytical Parameters	Matrix	Sample Schedule	Subtotal Samples	Trip Blanks	Duplicate Samples[1]	MS/MSD Samples[1]	Total Field Samples
VOCs	Leachate	Quarterly	1 grab	1 per cooler	1 per 20	1per 20	TBD
Metals	Leachate	Quarterly	1 grab	NA	1 per 20	1 per 20	TBD
PCDD/PCDF	Leachate	Quarterly	1 grab	NA	1 per 20	1 per 20	TBD
pH, ammonia, chlorides, total alkalinity, specific conductance, TDS, Nitrate-nitrogen, sulfate, temperature, fluoride, COD, turbidity, sodium, potassium, magnesium, calcium, iron, manganese	Leachate	Quarterly	1 grab	NA	1 per 20	1 per 20	TBD
Methane, hydrogen, carbon monoxide, oxygen	Landfill Gas	Monthly	1 grab	NA	1 per 20	1 per 20	TBD
VOCs	Landfill Gas	Quarterly	1 grab	NA	1 per 20	1 per 20	TBD
PCDD/PCDF	Landfill Gas	Quarterly	1 grab	NA	1 per 20	1 per 20	TBD

Notes:
[1] Note required for QA-1 (screening)

Sampling locations and frequencies will be governed by the latest approved version of Table 9 of Volume 1 of the OM&M Plan which shall take precedence over any discrepancies contained herein.. Any minor deviations to the sampling frequencies or locations will be documented in the field sampling logbook. If it is determined that major changes to the sampling frequencies (i.e. monthly to bimonthly or quarterly) are needed then this SAP will be revised to reflect those changes.

The proposed analytical methods that will be used for the analysis of the landfill leachate and landfill gas are presented in Table 2.

Table 2 Contaminant Sources, Recommended Analysis, and Proposed Methods

Sample Source	Contaminant Sources	Recommended Analysis	Analytical Methods
☒ 88 acre unit	Landfill leachate	VOC[1]	8260B
		Aluminum, Antimony, Arsenic, Barium, Beryllium, Cadmium, Calcium, Chromium, Cobalt, Copper, Iron, Lead, Magnesium, Manganese, Nickel, Potassium, Selenium, Silver, Sodium, Thallium, Vanadium, Zinc	6010B
		PCDD/PCDF	1613B
		pH	9040C
		Ammonia	SM 4500-NH_3 B/C/G
		Chemical Oxygen Demand	SM 5220 C
		Chloride	SM 4500/4110B/E9212
		Fluoride	SM 4500/4110B/E340.2
		Nitrate-Nitrite	SM 4500/E353.2
		Temperature (Field)	SM 2550 B
		Total Alkalinity	SM 2320 B
		Total Dissolved solids	SM 2540 C
		Turbidity	180.1
		Specific Conductance	120.1
		Sulfate	SM 4500/4110B/E375.4
	Landfill Gas	VOC	TO-15
		PCDD/PCDF	TO-9A
		Methane, Hydrogen, Carbon monoxide, oxygen	ASTM D-1946

[1] See Appendix B of this SAP for O.A.C. 3745-27-10 Appendix 1 VOC Constituents

SAMPLING PROCEDURES

This section provides that sampling procedures that will be used for the collection of landfill leachate from the leachate collection system and landfill gas from the gas collection wells.

Leachate Collection System Samples

Landfill leachate samples will be collected directly from a spigot that is located near the base of the 500,000 gallon leachate collection system tank. One end of a hose will attached to the spigot and the other end will be pace into the concrete sump that is located in close proximity to the 500,000 gallon leachate collection system tank. The spigot will be opened and leachate will be discharged into the concrete sump for a period of not less than 30 seconds.

This is done to clear the system of any residual leachate in the system. Once the purging of the system is complete the hose will be disconnected from the spigot. Prior to collecting leachate samples place a catch tray below the spigot in order to catch any spillage that may occur during the sampling process.

The VOC samples will be collected first by placing a VOC vial directly underneath the spigot. The spigot will be slowly opened to allow a trickle flow from the spigot in order to minimize any aeration of the sample while filling the VOC vials. After the VOC vials have been filled the remaining sample containers are filled. The samples must be kept on ice at 4^{o}C until receipt at the laboratory. Any spillage into the catch tray will be emptied into the concrete sump. Leachate that is collected in the concrete sump is pumped back into the 500,000 leachate collection tank for proper disposal.

Landfill Gas Samples

Landfill gas samples for the analysis of reformed gases and VOCs will be collected using a rigid air sample box that allows tedlar bags to be filled directly by using negative pressure provided by a personal air pump. A 1-liter tedlar bag shall be labeled with the well number, date, and requested analysis using a permanent marker. This bag will then be connected to the sample inlet, inside the rigid sample box. The valve on the bag shall be opened (no more than one turn). A quick connect fitting and tygon tubing shall be connected to the purge port of the rigid sample box and the open end to the tube will be connected to the pump inlet. A length of tygon tube with quick connect shall be attached to the sample box, and the other end attached to the well sample port. Before evacuating the sample chamber, the technician will ensure the purge port is closed (secured with a cap).

Next, the sample box is closed and the sample pump activated and observed. Once the bag is inflated, the sample pump will be deactivated and the rigid sample box opened. The difference in pressure will allow the vacuum applied to the landfill gas extraction well location (sample location) to evacuate and purge the tedlar bag back into the well casing. Once the tedlar bag has been completely evacuated, the box will be resealed and the pump reactivated. Once the bag and sample line has been purged the procedure is repeated and the bag is filled for final sample collection.

Then the sample line is again crimped and the sample box is opened, the valve of the tedlar bag is closed and the bag is removed. Grab samples shall be collected from each location taking care as to not overfill (>50% full) the tedlar bags. Landfill gas samples will collected from locations which are actively collecting LFG.
Since this is a closed system, release of odors is minimized by maintaining a closed system during sampling, by purging sample bag back into the well casing vs. into ambient air odors are reduced during this procedure.

Landfill gas samples for the analysis of PCDD/PCDF will be collected using a sampling apparatus is assembled to include a tygon tube connected to the LFG well casing. This tube shall be connected to a 60 mL teflon impinger filled with 250 mL of dionized water. De-ionized water will be kept in an ice-bath to reduce the moisture content of the gas stream. Approximately 20 L of gas (this volume of sample maybe adjusted based on analysis of initial results) shall be collected by the use of a personal monitoring pump that draws the sample through the impingers and through the polyurethane foam (PUF) media. Flow rates will be gauged utilizing the pump's rotometer. The PUF tube contains sample media to which the compounds of interest adhere. The exhaust port of the personal monitoring pump shall be re-connected to the well which to allow the vacuum of the well to capture all exhausted gas. This helps minimize the amount of LFG exposed to the air and significantly reduce odors.

Once an adequate amount of LFG has been pulled though the impinger solution and PUF tube, the fluid collected in the impinger will be consolidated into an amber colored glass bottle. The samples shall be marked, the chain of custody form filled out, and the media is sent, on ice, to the laboratory for analysis.

Sample Handling and Custody Requirements

Preservation of samples is required to retain integrity. The most common preservation techniques include pH adjustment and temperature control. Field personnel will use container types in accordance with EPA-specified requirements and adhere to EPA-recommended preservation techniques for the parameters of concern. All samples collected for this project will be kept on ice at $4^{o}C \pm 2^{o}C$ until delivered to the laboratory. The containers are pre-cleaned by procedures in accordance with EPA specifications for glassware cleaning. The certificate of analysis will be on file at the laboratory. The selected analytical laboratory shall provide sample containers that will be used for collecting samples to be submitted for analysis.

The subcontracted laboratory will assign an alphanumeric identification number to each sample that is separate from the field sample identification system.

All sample labeling, packing, transportation, and chain-of-custody procedures will follow EPA and DOT sample handling and shipping protocols.

Chain of Custody

A chain-of-custody (COC) form will be included with each shipping container identifying, at a minimum, the following information for each sample in the container:

- Unique sample number according to the Sample Identification System
- Time and date of sample collection
- Name of person collecting sample
- Preservative used, and what kind used, if any
- Analysis to be performed by method number
- Sample matrix and volume
- Any special instructions such as turnaround time
- QC samples
- High concentrated samples

Field personnel initially collecting the samples are responsible for the care and custody of the samples until they are properly transferred or delivered to laboratory personnel. All samples will be accompanied by a COC record. When transferring the possession of samples, the individuals relinquishing and receiving the samples will sign, date and note the time on the record. The company from which the samples are relinquished and to which they are delivered, and the reason for transfer will be noted. This record documents the transfer of samples from the custody of the sampler to that of another person or laboratory.

The relinquishing individual will record specific shipping data on the COC. If sent by a common carrier, a bill of lading will be used. Freight bills and bills of lading will be retained as part of the permanent documentation.

Labeling

All samples collected from the site will be labeled in accordance with the following identification scheme:

- Project number or code
- Area or station where the sample was obtained
- Date (m/d/y) of sample collection
- Time (0000) of sample collection
- Sampler's name/signature
- Type of sample: grab, composite, etc.
- Sample matrix
- Whether or not a preservative was added, and if so what kind
- Type of analysis required
- Site specific sample number

The site-specific sample number should consist of the following:

Project Identification Code: A two-letter designation should be used to identify the site where the sample was collected (e.g., CR representing Countywide remediation).

Sample matrix and Location Code: Each sample should be identified by an alpha-code corresponding to the sample matrix/type, followed by a two-digit sample location number. The alpha code is as follows:

- LS – Leachate sample
- AS – Air sample
- TB – Trip blank sample
- FB – Field blank sample
- FD – Field duplicate sample
- MS – Matrix spike
- MSD – Matrix spike duplicate
- Dup – Duplicate

The location code will follow the sample type code. The location code consists of a two to five digit numeric or alpha-numeric code that indicates the sample location. Location codes lower than 10 will be preceded by '0' (e.g., 01; 02; etc.). The OM&M Manager may modify this identification process as long as consistency is maintained, and all required information is included.

Sample Preservation

The volumes, containers, preservatives, and holding times for the samples to be shipped to the analytical laboratory are presented in Table 3.

Table 3 Recommended Sample Container, Preservative, and Holding Times for Selected Methods

Analytical Group	Leachate[1]		
	Containers	**Preservative**	**Hold Time (days)**
Inorganics			
pH*	--	--	--
Turbidity	SM	I	2
Conductivity	SM	I	28[1]
Temperature*	SM	NA	I
Total Dissolved Solids	LP	I	2
Chloride	LP	NA	28
COD	LP	S/I	28
Total Alkalinity	LP	I	14
Metals (6010B)	LP	N	180
Sulfate	LP	I	28
Ammonia	LP	I	2
Nitrite-nitrate	SM	S	28
Nitrate	SM	S	28
Fluoride	LP	NA	28
Organics			
VOCs*	V	H/I	14/7[2]
Dioxins	LA[1]	I	75[3]
Analytical Group	**Landfill Gas**		
	Containers	**Preservative**	**Containers**
Organics			
VOCs*	Tedlar bag	NA	3[4]
Dioxins	PUF/impinger	I & keep in dark	47[5]
ASTM D-1946	Tedlar bag	NA	2[6]

General Footnotes:

* - Grab sample only, unless indicated a grab or composite is acceptable.
1 - Consult 40 CFR Part 136 Table II. - Required Containers, Preservation Techniques, and Holding Times for latest requirements.

Containers:

SM - Stormore 500 ml polyethylene
LP - One liter polyethylene
LA - One liter amber glass (Teflon lid)
V - 40 ml glass (Teflon septum lid)
1 - Collect 2 sample containers (LA) per sample plus 4 at one location for matrix spike

Preservatives:

H - HCl
S - H2SO4
I - Ice (4^{o}C)
N - 50% HNO3 (pH < 2.0 S.U.)
NA - Not applicable

Holding Times: in days unless noted otherwise:

I - Immediate (within 15 minutes: 40 CFR 136 Table II)
1 - Determine on-site if possible
2 - 7 days if not preserved
3 - 47 days: 7 days to extraction, 40 days to analysis
4 - 72 hours from collection to analysis or transfer to a can. After transfer to a can, the holding time is 30 day from sample collection.
5 - Method 8290 specifies 30 days to extraction plus 45 days to analysis
6 - 48 hours from collection to analysis or transfer to a can. After transfer to a can, the holding time is 30 day from sample collection.

Sample Packaging and Shipping

Environmental samples will be packaged and shipped as described below.

1. Samples will be shipped per Department of Transportation (DOT) and International Air Transportation Association (IATA) guidelines.
2. All sample containers will be placed in waterproof metal or equivalent plastic ice chests or coolers only.
3. After the pertinent information is on the sample label and tag, if required, the tag is secured around the sample container lid.
4. The volume level of the sample in the sample container is marked with a grease pencil.
5. Cushioning material is placed in the bottom of the cooler.
6. The bottles are sealed in clear plastic bags, with labels and tags clearly visible. The enclosed are placed upright in the cooler so that they do not touch during transit.
7. Ice bags if applicable are placed around, among, and on top of the sample bottles.
8. The cooler is filled with cushioning material.
9. Paperwork is placed in a waterproof plastic bag and closed.
10. The cooler drain is taped shut.
11. The cooler lid is secured with tape by wrapping it around the cooler in at least two places without covering any labels.
12. Completed shipping label is attached to the top of the cooler.
13. If needed, numbered and signed custody seals are affixed on front right and back left of the cooler. The seals are covered with wide, clear tape.
14. Samples will be express-shipped (overnight) to the laboratory under COC protocols.

Quality Control Requirements

Quality control procedures will be an integral part of each sampling methodology. These procedures will focus upon ensuring the collection of representative samples that are free from external contamination.

Although different extraction and/or analytical procedures will be used for the various parameters of interest, certain general quality control procedures are applicable to all methods. These include the following:

- Trip blanks are defined as 40-ml VOA vials filled in the laboratory with Type II reagent grade water, and transported to the sampling site. Trip blanks will accompany each cooler shipment of samples sent to the laboratory for analysis of VOCs. Trip blanks are analyzed for volatiles only.
- Temperature blanks will be used to monitor the temperature of the cooler for compliance with shipping protocol.
- Duplicate samples will be collected at a frequency of 5 percent to provide a measure of variability (i.e., total variability due to imprecision in both sampling and analytical procedures). For composited samples, compositing should be prepared separately to assess the precision of the field compositing.
- Matrix spike/matrix spike duplicates will be collected at a frequency of 1 per 20 samples.
- Chain-of-custody forms will accompany all samples.
- Sampling equipment used to collect organics will not be allowed to come in contact with any type of plastic.

Quality Control for Laboratory Analyses

The analytical process is continually checked and verified through the analysis of method blanks, instrument blanks, matrix spikes, duplicate matrix spikes, and sample duplicates. The laboratory department supervisor is responsible for the administration of the QC checks within each department. The records associated with the QC checks are reviewed as part of the system audits conducted by the Laboratory QA Manager. The data generated for each QC sample are reviewed by the department supervisor and a member of the senior technical staff as part of the normal data review process.

If the acceptance criteria for a batch of samples are not met, corrective actions are taken, as appropriate, until the QC criteria are met for the affected batch. Any out-of-compliance QC is documented in the project's case narrative, along with the corrective action steps taken.

Laboratory QC Samples and Protocol

Analytical Batch. The basic unit for analytical quality control is the analytical batch. The analytical batch is defined as samples that are prepared or analyzed together with the same method sequence and the same lots of reagents and with the manipulations common to each sample within the same time period or in continuous sequential time periods. Samples in each batch should be of similar composition. The maximum size of an analytical batch is 20 samples.

Batch QC. The batch QC procedure consists of analyzing method blanks and laboratory control samples as specified in the analytical method. The method blanks and laboratory control samples are described in the following subsections.

Method Blanks. Method blanks shall be analyzed to assess the level of background interference or contamination that exists in the analytical system and which might lead to the reporting of elevated concentration levels or false positive data. The method blank is defined as a blank matrix to which all reagents are added in the same volumes or proportions as used in sample preparation and carried through the complete sample preparation and analytical procedures. One method blank shall be analyzed per sample batch. Criteria for determining blank acceptability shall be based on consideration of the analytical techniques used, analytes reported, and quantitation limits required. Sample results will not be corrected for blank contamination. In instances where more than one blank is associated with a given sample, qualifications should be based upon a comparison with the associated blank having the highest concentration of a contaminant.

Laboratory Control Samples. Laboratory performance QC shall be based on the use of standard control solutions that are prepared independently from the standard solutions used in establishing the calibration curve, to calculate precision and accuracy data. The data are compared daily or on a per batch basis to established control limits that must be as stringent as those stated within the individual methods to verify compliance. This data, along with the method blank data, will be used to assess daily laboratory performance.

Matrix Specific QC. Matrix specific QC is based on the use of an actual environmental sample for precision and accuracy determinations and relies on the analysis of matrix duplicates, surrogate compounds, matrix spikes, and matrix spike duplicates. The required frequency of these sample types is established within the analytical method, or as specified for this project.
Depending on the method, duplicate samples or matrix spikes and matrix spike duplicates (MS/MSDs) are analyzed at the frequency of 1 per 20 for each different sample matrix. For certain methods, circumstances may dictate using duplicate samples and one spike sample. Spiked samples that do not meet established accuracy criteria will be further evaluated under the laboratory data validation protocol. Only samples from the project will be spiked or used as duplicates.

Individual compound recoveries will be compared with acceptance limits. In the event a matrix spike analyte fails acceptance criteria, the MS/MSD will be re-extracted/re-analyzed once. Only those target analytes that failed MS criteria must be within acceptance limits in the re-extraction/re-analysis for the MS/MSD to be considered in control. Once it has been established which analytes failed acceptance criteria in the MS and MSD, these analytes will be considered out of control due to sample matrix effects.

Surrogate Compounds. For GC and GC/MS analyses, the analytical process includes the addition, subsequent detection, and recovery calculations of surrogate spiking compounds. Surrogate compounds are added to every sample at the beginning of the sample preparation, and the surrogate recovery is used to monitor matrix effects and sample preparation. Samples are re-extracted/re-analyzed once when surrogate recovery is outside control limits. Corrective actions required when surrogates are out of control are method dependent.

2.5.2.2 Establishment of Control Limit

Each laboratory monitors the percent spike recovery in LCS, MS, and MSD, and the surrogate recovery in all samples where surrogates are appropriate. The RPD in MS/MSD or sample/duplicate, depending on the method, is also monitored. From these results, in-house control limits are calculated. The MS, LCS, and surrogate acceptance limits are periodically updated. The current precession and accuracy acceptance limits are list in Appendix A of the SAP.

Spikes and duplicates/spike duplicates will be run for each different matrix and at least once for every 20 samples or each batch. Surrogates spikes are used in every sample where appropriate for the method.

Control charts have been established to monitor trends, provide warning, or indicate out-of-control situations as they happen. After a minimum of 20 results have been obtained for a spike blank, spike sample, or spiked duplicate for each particular analysis, the mean result and its standard deviation will be tabulated. The control chart will be a graph of the mean value line with upper and lower warning control lines. The warning limit will be set at $\pm$ 2 standard deviations of the mean and the out-of-control limits at $\pm$ 3 standard deviations of the mean. This will be performed for each procedure and matrix type. Results from the same matrix type and procedure will be plotted for the most recent 20 data points. Control limits are evaluated periodically, and updated as appropriate.

Field Equipment Calibration

The equipment used in collecting field data will include a variety of instruments. Proper maintenance, calibration, and operation of each instrument will be the responsibility of the field personnel and the instrument technicians assigned to the project. All instruments and equipment used during the field activities will be maintained, calibrated, and operated according to the manufacturers' guidelines and recommendations.

All field equipment referenced in sections 6.3.1, 6.3.2, 6.3.3, 6.3.4, 6.3.6, 6.3.8, and 6.3.9 through 6.3.13 of the Operation, Maintenance and Monitoring Plan will be calibrated in accordance with the manufacture specifications. Field equipment will be calibrated in accordance with the equipment operating manuals prior to use in the field as appropriate and/or a change in calibration response.

Copies of the instrument manuals will be maintained in the field office. A record of field calibration of analytical instruments will be maintained by field personnel on the appropriate field logs. In addition, any notes on unusual results, changing of standards, battery charging, and operation and maintenance will be included in the logbook.

All instruments are to be stored, transported, and handled with care in accordance with the handling instructions in the operating manuals to preserve equipment accuracy. Damaged instruments will be taken out of service immediately and not used again until a qualified technician repairs and recalibrates the instruments.

Calibration Frequencies for pH and Temperature Measurements

Field instruments that are used in sampling will be calibrated to the specifications that are listed in EPA Specifications and Guidance and manufacturer-recommended intervals.

Records of calibration and certifications will be maintained on file and provided to the project QC/QA manager. A brief summary of the procedures for each piece of major field measurement equipment follows:

pH Meter. Calibration for pH is performed at intervals specified by the manufacturer using standard buffer solutions having pH values of 4, 7, and 10. Calibration knobs are used to set the meter to read the value of the standard. The meter is calibrated at the start and end of each sampling day with pH buffers 4, 7, and 10, whichever are expected to bracket the actual sample. The meter is also periodically checked during the sampling period using pH buffer 7. If the reading varies more than one-tenth of a unit between calibration checks, the meter will be recalibrated.

Thermometer. Mercury thermometers are calibrated to NIST standards prior to initial use and are visually inspected at least once a year. Dial thermometers and electronic thermometers are calibrated at three points against an NIST-calibrated thermometer once a year.

QUALITY ASSURANCE REQUIREMENTS

The following QA requirements will be implemented on this project:

Data with Definitive Confirmation

Definitive data are generated using rigorous analytical methods, such as EPA reference methods. Data are analyte-specific, with confirmation of analyte identity and concentration. Methods generating definitive data produce tangible raw data (e.g., chromatograms, spectra, digital values) in the form of paper printouts or computer-generated electronic files. Data may be generated at the site or at an off-site location, as long as the quality control requirements are satisfied.

Definitive Data QA/QC Elements:

- Sample results summary
- Cross reference sample ID (laboratory/client
- Sample holding times
- Detection limits and qualifiers
- Internal and external chain of custody documentation
- Initial and continuing calibration data
- Interference check sample (ICP)
- ICP serial dilution
- Initial and continuing blank data (inorganics)
- Method blanks (instrument, extraction, etc.)
- Surrogate spike data with control limits
- Matrix spike/matrix spike duplicate with control limits (organics)
- Matrix spike and duplicate with control limits (inorganics)
- Laboratory Control Sample with control limits
- Internal standard area count and retention time
- GC/MS tuning criteria
- Ion abundance ratios for dioxins/furans
- Second column confirmation data

- Raw data
- A case narrative to include cleanup and dilution procedures and interference's encountered

DATA VERIFICATION

This objective requires that at least 10% of the samples in the analytical data package be evaluated for all of the elements listed as definitive data, above. The remaining samples will be reviewed for holding times, blank contamination, precision, accuracy, detection limits, and confirmed compound identification. This objective also requires review of all elements for all samples in each analyte category in every tenth data package received from the individual lab.

Data verification is defined as, "the process of evaluating the completeness, correctness, and conformance/compliance of a specific data set against the method, procedural, or contractual specifications".

The data verification chemist shall review the entire definitive data report package including but not limited to raw data, extraction log books, internal chains-of-custody, and corrective action measures and, based on this review, apply appropriate final data qualifiers for the definitive data. Initially, the data verification chemist must review the flags applied by the laboratory for accuracy.

The data verification chemist may use various checklists during the verification process to document all the verification activities. The data verification chemist shall review all data, field QC samples, and will also appropriately qualify any of the associated site samples identified with the field QC sample(s). All changes to the data or flags must be explained in the Data Verification Report.

Field data are checked for documentation of completeness in data sheets and in logbooks, adherence to sample collection and testing procedures, inclusion of required field QC samples, correct preservation of samples, and complete and correct chain-of-custody forms with signature and date at each transfer of custody.

Analytical laboratory data are checked for completeness of analysis as requested, inclusion of required frequency of QC samples, conformance to acceptance criteria for QC samples, adherence to holding times requirements, and second column confirmation where required. Nonconformances will be reviewed for acceptable corrective action for any out-of-control events.

Results from field duplicates are compared and Relative Percent Difference (RPD) calculated, where possible. If one or both results are non-detects, the RPD cannot be calculated. For values less than five times the detection limit, RPDs will not be calculated. Results are evaluated based on whether corresponding values are close. RPDs below 30 percent represent good agreement. If every duplicate pair shows larger differences, sampling or analytical procedures will be re-evaluated.

All laboratory and field blanks will be reviewed for blank contamination, and the sample results qualified in the event that the contamination level multiplied by five exceeds the sample result.

In instances where more than one blank is associated with a given sample, qualifications should be based upon a comparison with the associated blank having the highest concentration of a contaminant.

The results must not be corrected by subtracting any blank value. The guidelines specified in the following EPA documents may be used as applicable when performing the data verification process:

- EPA National Functional Guidelines for Organic Data Review; October 1999, EPA-540/R-99-008
- USEPA Hazardous Waste Support Branch Validating Air Samples Volatile Organic Analysis of Ambient Air In Canister by Method TO-15, SOP # HW-31, Revision #4, October 2006
- EPA National Functional Guidelines for Inorganic Data Review, February 1994b, EPA-540/R-94-013
- Validating PCDDs and PCDFs by HRGC/HRMS; HW-19, Revision 1, October 2006
- EPA National Functional Guidelines for Chlorinated Dioxin/Furan Data Review, August 2002, EPA 540-R-02-003

Data will be reviewed and verified by experienced personnel. Data review and verification may be documented on special forms. For projects where electronic data deliverables have been provided by the laboratory, the electronic data will be evaluated against the hard copy provided by the laboratory.

Appendix A

Practical Quantitation limits and Precision and Accuracy Criteria

Practical Quantitation Limits for Method 8260B

Volatile Organic Compounds SW-8260B	Aqueous Samples Practical Quantitation Limit[(a)] (µg/L) 5 ml purge
Acetone	10
Acrylonitirle	20
Benzene	1.0
Bromochloromethane	1.0
Bromodichloromethane	1.0
Bromoform	1.0
Methyl bromide	1.0
Methyl ethyl ketone	10
Carbon disulfide	1.0
Carbon tetrachloride	1.0
Chlorobenzene	1.0
Dibromochloromethane	1.0
Chloroethane	1.0
Chloroform	1.0
Methyl chloride	1.0
1,2-Dibromo-3-chloropropane	2.0
1,2-Dibromoethane	1.0
Methylene bromide	1.0
1,3-Dichlorobenzene	1.0
1,4-Dichlorobenzene	1.0
trans-1,4-Dichloro-2-butene	1.0
1,1-Dichloroethane	1.0
1,2-Dichloroethane	1.0
cis-1,2-Dichloroethene	1.0
trans-1,2-Dichloroethene	1.0
1,1-Dichloroethene	1.0
1,2-Dichloropropane	1.0
cis-1,3-Dichloropropene	1.0
trans-1,3-Dichloropropene	1.0
Ethylbenzene	1.0
2-Hexanone	10
Methyl iodide	1.0
Methylene chloride	1.0
4-Methyl-2-pentanone	10
Styrene	1.0
1,1,1,2-Tetrachloroethane	1.0
1,1,2,2-Tetrachloroethane	1.0
Tetrachloroethene	1.0
Toluene	1.0
1,1,1-Trichloroethane	1.0
1,1,2-Trichloroethane	1.0
Trichloroethene	1.0
Trichlorofluoromethane	1.0

Volatile Organic Compounds SW-8260B	Aqueous Samples Practical Quantitation Limit[(a)] (µg/L) 5 ml purge
Vinyl acetate	2.0
Vinyl chloride	1.0
Total Xylenes	2.0

a. Practical quantitation limits listed are highly matrix dependent. Should the samples need to be diluted the PQL will need elevated accordingly.

QC Acceptance Criteria for Method 8260B

Volatile Organic Compounds SW-8260B	Accuracy Aqueous (%R)	Precision Aqueous (% RPD)
Acetone	22-200	≤ 30
Acrylonitrile	50-130	≤ 30
Benzene	80-116	≤ 30
Bromochloromethane	70-130	≤ 30
Bromodichloromethane	87-130	≤ 30
Bromoform	76-150	≤ 30
Methyl bromide	64-129	≤ 30
Methyl ethyl ketone	28-237	≤ 30
Carbon disulfide	73-139	≤ 30
Carbon tetrachloride	75-149	≤ 30
Chlorobenzene	76-117	≤ 30
Dibromochloromethane	81-138	≤ 30
Chloroethane	66-126	≤ 30
Chloroform	84-128	≤ 30
Methyl chloride	48-123	≤ 30
1,2-Dibromo-3-chloropropane	70-130	≤ 30
1,2-Dibromoethane	70-130	≤ 30
Methylene bromide	70-130	≤ 30
1,3-Dichlorobenzene	70-130	≤ 30
1,4-Dichlorobenzene	70-130	≤ 30
1,1-Dichloroethane	86-123	≤ 30
1,2-Dichloroethane	79-136	≤ 30
cis-1,2-Dichloroethene	85-113	≤ 30
trans-1,2-Dichloroethene	80-120	≤ 30
1,1-Dichloroethene	63-130	≤ 30
1,2-Dichloropropane	82-115	≤ 30
cis-1,3-Dichloropropene	84-130	≤ 30
trans-1,3-Dichloropropene	84-130	≤ 30
Ethylbenzene	86-116	≤ 30
2-Hexanone	35-200	≤ 30
Methyl iodide	70-130	≤ 30
Methylene chloride	78-118	≤ 30
4-Methyl-2-pentanone	78-141	≤ 30
Styrene	85-117	≤ 30
1,1,1,2-Tetrachloroethane	70-130	≤ 30
1,1,2,2-Tetrachloroethane	85-118	≤ 30
Tetrachloroethene	88-113	≤ 30
Toluene	74-119	≤ 30
1,1,1-Trichloroethane	78-140	≤ 30
1,1,2-Trichloroethane	83-122	≤ 30
Trichloroethene	75-122	≤ 30
Trichlorofluoromethane	70-130	≤ 30
1,2,3-Trichloropropane	70-130	≤ 30
Vinyl acetate	70-130	≤ 30
Vinyl chloride	61-120	≤ 30

Volatile Organic Compounds SW-8260B	**Accuracy Aqueous (%R)**	**Precision Aqueous (% RPD)**
Total Xylenes	87-116	≤ 30
Dibromofluoromethane	73-122	
Toluene-d8	76-110	
4-Bromofluorobenzene	74-116	
1,2-Dichloroethane-d4	61-128	

Practical Quantitation Limits for Method 1613B

Dioxin/Furan Compounds	Aqueous Samples Practical Quantitation Limit[a] (pg/L)
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	10
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	50
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	50
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	50
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	50
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	50
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	100
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	10
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	50
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	50
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	50
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	50
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	50
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	50
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	50
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	50
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	100

a. Practical quantitation limits listed are highly matrix dependent. Should the samples need to be diluted the PQL will need elevated accordingly.

QC Acceptance Criteria for Method 1613B

Dioxin/Furan Compounds	Accuracy Air (%R)	Precision Air (% RPD)
2,3,7,8-TCDD	67-158	$\leq$ 30
1,2,3,7,8-PeCDD	70-142	$\leq$ 30
1,2,3,4,7,8-HxCDD	70-164	$\leq$ 30
1,2,3,6,7,8-HxCDD	76-134	$\leq$ 30
1,2,3,7,8,9-HxCDD	64-162	$\leq$ 30
1,2,3,4,6,7,8-HpCDD	70-140	$\leq$ 30
OCDD	78-144	$\leq$ 30
2,3,7,8-TCDF	75-158	$\leq$ 30
1,2,3,7,8-PeCDF	80-134	$\leq$ 30
2,3,4,7,8-PeCDF	68-160	$\leq$ 30
1,2,3,4,7,8-HxCDF	72-134	$\leq$ 30
1,2,3,6,7,8-HxCDF	84-130	$\leq$ 30
2,3,4,6,7,8-HxCDF	70-156	$\leq$ 30
1,2,3,7,8,9-HxCDF	78-130	$\leq$ 30
1,2,3,4,6,7,8-HpCDF	82-122	$\leq$ 30
1,2,3,4,7,8,9-HpCDF	78-138	$\leq$ 30
OCDF	63-170	$\leq$ 30

Practical Quantitation Limits for Method 6010B

Inorganic Metals SW-6010B	Aqueous Samples
	Practical Quantitation Limit[a] (µg/l)
Aluminum	200
Antimony	10
Arsenic	5
Barium	10
Beryllium	3
Cadmium	2
Calcium	1000
Chromium	5
Cobalt	5
Copper	5
Iron	100
Lead	3
Magnesium	1000
Manganese	5
Nickel	10
Potassium	1000
Selenium	5
Silver	3
Sodium	1000
Thallium	10
Vanadium	7
Zinc	20

a. Practical quantitation limits listed are highly matrix dependent. Should the samples need to be diluted the PQL will need elevated accordingly.

QC Acceptance Criteria for Method 6010B

Inorganic Metals SW-6010B	Accuracy Aqueous (%R)	Precision Aqueous (% RPD)
Aluminum	75-125	≤ 20
Antimony	75-125	≤ 20
Arsenic	75-125	≤ 20
Barium	75-125	≤ 20
Beryllium	75-125	≤ 20
Cadmium	75-125	≤ 20
Calcium	75-125	≤ 20
Chromium	75-125	≤ 20
Cobalt	75-125	≤ 20
Copper	75-125	≤ 20
Iron	75-125	≤ 20
Lead	75-125	≤ 20
Magnesium	75-125	≤ 20
Manganese	75-125	≤ 20
Nickel	75-125	≤ 20
Potassium	75-125	≤ 20
Selenium	75-125	≤ 20
Silver	75-125	≤ 20
Sodium	75-125	≤ 20
Thallium	75-125	≤ 20
Vanadium	75-125	≤ 20
Zinc	75-125	≤ 20

Practical Quantitation Limits for General Chemistry Parameters

Analyte	Aqueous Samples
	Practical Quantitation Limit[a] (mg/l)
Chemical Oxygen Demand	20
Chloride	1
Fluoride	1
Nitrate-Nitrite	0.1
Specific Conductance	1
Sulfate	1
Total Alkalinity	5
Total Dissolved Solids	10
Turbidity	0.5

a. Practical quantitation limits listed are highly matrix dependent. Should the samples need to be diluted the PQL will need elevated accordingly.

QC Acceptance Criteria for General Chemistry Parameters

Analyte	Accuracy Aqueous (%R)	Precision Aqueous (% RPD)
Chemical Oxygen Demand	90-110	$\leq$ 20
Chloride	90-110	$\leq$ 20
Fluoride	90-110	$\leq$ 20
Nitrate-Nitrite	79-117	$\leq$ 20
Specific Conductance	75-125	$\leq$ 20
Sulfate	90-110	$\leq$ 20
Total Alkalinity	90-127	$\leq$ 20
Total Dissolved Solids	88-110	$\leq$ 20
Turbidity	75-125	$\leq$ 20

Practical Quantitation Limits for Method TO-15

Volatile Organic Compounds TO-15	Air Samples Practical Quantitation Limit[a] (ppb (v/v))
Acetone	5
1,3-Butadiene	0.4
Benzene	0.2
Bromomethane	0.2
Bromodichloromethane	0.2
Bromoform	0.2
Benzyl chloride	0.4
Methyl ethyl ketone	0.2
Carbon disulfide	0.5
Carbon tetrachloride	0.2
Chlorobenzene	0.2
Dibromochloromethane	0.2
Chloroethane	0.2
Chloromethane	0.5
Chloroform	0.2
Cyclohexane	0.5
1,2-Dibromoethane	0.2
1,2-Dichloro-1,1,2,2-tetrafluoroethane	0.2
1,2-Dichlorobenzene	0.2
1,3-Dichlorobenzene	0.2
1,4-Dichlorobenzene	0.2
Dichlorodifluoromethane	0.2
trans-1,4-Dichloro-2-butene	
1,1-Dichloroethane	0.2
1,2-Dichloroethane	0.2
cis-1,2-Dichloroethene	0.2
trans-1,2-Dichloroethene	0.2
1,1-Dichloroethene	0.2
1,2-Dichloropropane	0.2
cis-1,3-Dichloropropene	0.2
trans-1,3-Dichloropropene	0.2
Ethyl acetate	2.0
Ethylbenzene	0.2
4-Ethyltoluene	0.4
n-Heptane	0.5
Hexachlorobutadiene	1.0
n-Hexane	0.5
2-Hexanone	0.5
Methyl iodide	
Methylene chloride	0.5
4-Methyl-2-pentanone	0.2
Methyl-tert-butyl ether	1.0

Volatile Organic Compounds TO-15	Air Samples Practical Quantitation Limit[(a)] (ppb (v/v))
Styrene	0.2
1,1,2,2-Tetrachloroethane	0.2
Tetrachloroethene	0.2
Tetrahydrofuran	1.0
Toluene	0.2
1,2,4-Trichlorobenzene	1.0
1,1,1-Trichloroethane	0.2
1,1,2-Trichloroethane	0.2
Trichloroethene	0.2
1,2,2-Trichloro-1,2,2-trifluoroethane	0.2
1,3,5-Trimethylbenzene	0.2
Trichlorofluoromethane	0.2
Vinyl acetate	1.0
Vinyl chloride	0.2
o-Xylenes	0.2
m-Xylenes & p-Xylenes	0.2

a. Practical quantitation limits listed are highly matrix dependent. Should the samples need to be diluted the PQL will need elevated accordingly.

QC Acceptance Criteria for Method TO-15

Volatile Organic Compounds TO-15	Accuracy Air (%R)	Precision Air (% RPD)
Acetone	70-130	$\leq$ 30
1,3-Butadiene	70-130	$\leq$ 30
Benzene	70-130	$\leq$ 30
Bromomethane	70-130	$\leq$ 30
Bromodichloromethane	70-130	$\leq$ 30
Bromoform	70-130	$\leq$ 30
Benzyl chloride	70-130	$\leq$ 30
Methyl ethyl ketone	70-130	$\leq$ 30
Carbon disulfide	70-130	$\leq$ 30
Carbon tetrachloride	70-130	$\leq$ 30
Chlorobenzene	70-130	$\leq$ 30
Dibromochloromethane	70-130	$\leq$ 30
Chloroethane	70-130	$\leq$ 30
Chloromethane	70-130	$\leq$ 30
Chloroform	70-130	$\leq$ 30
Cyclohexane	70-130	$\leq$ 30
1,2-Dibromoethane	70-130	$\leq$ 30
1,2-Dichloro-1,1,2,2-tetrafluoroethane	70-130	$\leq$ 30
1,2-Dichlorobenzene	70-130	$\leq$ 30
1,3-Dichlorobenzene	70-130	$\leq$ 30
1,4-Dichlorobenzene	70-130	$\leq$ 30
Dichlorodifluoromethane	70-130	$\leq$ 30
trans-1,4-Dichloro-2-butene	70-130	$\leq$ 30
1,1-Dichloroethane	70-130	$\leq$ 30
1,2-Dichloroethane	70-130	$\leq$ 30
cis-1,2-Dichloroethene	70-130	$\leq$ 30
trans-1,2-Dichloroethene	70-130	$\leq$ 30
1,1-Dichloroethene	70-130	$\leq$ 30
1,2-Dichloropropane	70-130	$\leq$ 30
cis-1,3-Dichloropropene	70-130	$\leq$ 30
trans-1,3-Dichloropropene	70-130	$\leq$ 30
Ethyl acetate	70-130	$\leq$ 30
Ethylbenzene	70-130	$\leq$ 30
4-Ethyltoluene	70-130	$\leq$ 30
n-Heptane	70-130	$\leq$ 30
Hexachlorobutadiene	70-130	$\leq$ 30
n-Hexane	70-130	$\leq$ 30
2-Hexanone	70-130	$\leq$ 30
Methyl iodide	70-130	$\leq$ 30
Methylene chloride	70-130	$\leq$ 30
4-Methyl-2-pentanone	70-130	$\leq$ 30
Methyl-tert-butyl ether	70-130	$\leq$ 30
Styrene	70-130	$\leq$ 30
1,1,2,2-Tetrachloroethane	70-130	$\leq$ 30

Volatile Organic Compounds TO-15	Accuracy Air (%R)	Precision Air (% RPD)
Tetrachloroethene	70-130	$\leq$ 30
Tetrahydrofuran	70-130	$\leq$ 30
Toluene	70-130	$\leq$ 30
1,2,4-Trichlorobenzene	70-130	$\leq$ 30
1,1,1-Trichloroethane	70-130	$\leq$ 30
1,1,2-Trichloroethane	70-130	$\leq$ 30
Trichloroethene	70-130	$\leq$ 30
1,2,2-Trichloro-1,2,2-trifluoroethane	70-130	$\leq$ 30
1,3,5-Trimethylbenzene	70-130	$\leq$ 30
Trichlorofluoromethane	70-130	$\leq$ 30
Vinyl acetate	70-130	$\leq$ 30
Vinyl chloride	70-130	$\leq$ 30
o-Xylenes	70-130	$\leq$ 30
m-Xylenes & p-Xylenes	70-130	$\leq$ 30
4-Bromofluorobenzene	70-130	

Practical Quantitation Limits for ASTM D1946

Fixed Gases ASTM D-1946	Air Samples Practical Quantitation Limit[a] (ppm (v/v))
Methane	8.100
Hydrogen	201.5
Carbon monoxide	10.02
Oxygen	253.0

a. Practical quantitation limits listed are highly matrix dependent. Should the samples need to be diluted the PQL will need elevated accordingly.

QC Acceptance Criteria for ASTM D1946

Fixed Gases ASTM D-1946	Accuracy Air (%R)	Precision Air (% RPD)
Methane	80 -120	$\leq$ 20
Hydrogen	80 -120	$\leq$ 20
Carbon monoxide	80 -120	$\leq$ 20
Oxygen	80 -120	$\leq$ 20

Practical Quantitation Limits for Method TO-9A

Dioxin/Furan Compounds	Air Samples Practical Quantitation Limit[(a)] (pg/sample)
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	10
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	50
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	50
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	50
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	50
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	50
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	100
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	10
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	50
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	50
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	50
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	50
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	50
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	50
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	50
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	50
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	100

a. Practical quantitation limits listed are highly matrix dependent. Should the samples need to be diluted the PQL will need elevated accordingly.

QC Acceptance Criteria for Method TO-9A

Criterion	Requirement
Satisfy ID criteria	Integrated ion abundance ratio within ±15% of theoretical ions monitored for a given analyte maximize within 2 seconds of each other Retention time for 2,3,7,8-substituted analytes must be within 3 seconds of the corresponding 13C12-labeled IS or surrogate 2,3,7,8-isomers without 13C12-standards meet method ID criteria Signal-to-noise ratio for monitored ions >2.5 Absence of polychlorinated diphenyl ethers
Recoveries for $^{13}C12$-labeled tetra-,penta-, hexa-CDDs/CDFs	50 - 120%
Recoveries for $^{13}C12$-labeled heptachlorodibenzodioxin and octachlorodibenzodioxin	40 - 120%
Accuracy achieved for PCDDs/PCDFs in method spike at 0.25 - 2.0 pg/m^3	70 - 130%
Precision achieved for duplicate method spikes or quality assurance samples	±30%
Recovery of PUF pre-spike	50 - 120%
Method blank contamination	Free of contamination that would interfere with field sample results
MDL range for method blank and field blank (individual isomers)	0.02 - 0.25 pg/sample

Appendix B

O.A.C. 3745-27-10 Appendix 1 Constituents

APPENDIX I

Compound	CAS RN2
1) Antimony	See note 3
2) Arsenic	See note 3
3) Barium	See note 3
4) Beryllium	See note 3
5) Cadmium	See note 3
6) Chromium	See note 3
7) Cobalt	See note 3
8) Copper	See note 3
9) Lead	See note 3
10) Nickel	See note 3
11) Selenium	See note 3
12) Silver	See note 3
13) Thallium	See note 3
14) Vanadium	See note 3
15) Zinc	See note 3
16) Acetone	67-64-1
17) Acrylonitrile	107-13-1
18) Benzene	71-43-2
19) Bromocholoromethane	74-97-5
20) Bromodicholoromethane	75-27-4
21) Bromoform; Tribromomethane	75-25-2
22) Carbon disulfide	75-15-0
23) Carbon tetrachloride	56-23-5
24) Chlorobenzene	108-90-7
25) Chloroethane; Ethyl cloride	75-00-3
26) Chloroform; Trichloromethane	67-66-3
27) Dibromochloromethane; Chlorodibromomethane	124-48-1
28) 1,2-Dibromo-3-chloropropane; DBCP	96-12-8
29) 1,2 Dibromoethane;Ethylene dibromide;EDB	106-93-4
30) o-Dichlorobenzene; 1,2-Dichlorobenzene	95-50-1
31) p-Dichlorobenzene; 1,4-Dichlorobenzene	106-46-7
32) trans-1,4-Dichloro-2-butene	110-57-6
33) 1,1-Dichloroethane; Ethylidene chloride	75-34-3
34) 1,2-Dichloroethane; Ethylidene dichloride	107-06-2
35) 1,1-Dichloroethylene; 1,1-Dichloroethene; Vinylidene chloride	75-35-4
36) cis-1,2-Dichlorothylene; cis-1,2-Dichloroethene	156-59-2
37) trans-1,2-Dichloroethylene; trans-1,2-Dichloroethene	156-60-5
38) 1,2-Dichloropropane; Propylene dichloride	78-87-5
39) cis-1,3-Dichloropropene	10061-01-5
40) trans-1,3-Dichloropropene	10061-02-6
41) Ethylbenzene	100-41-4
42) 2-Hexanone; Methyl butyl ketone	591-78-6
43) Methyl bromide; Bromomethane	74-83-9
44) Methyl chloride; Chloromethane	74-87-3
45) Methylene bromide; Dibromomethane	74-95-3
46) Methylene chloride; Dichloromethane	75-09-2
47) Methyl ethyl ketone; MEK; 2-Butanone	78-93-3
48) Methyl iodide; iodomethane	74-88-4
49) 4-Methyl-2-pentanone; Methyl isobutyl ketone	108-10-1
50) Styrene	100-42-5
51) 1,1,1,2-Tetrachloroethane	630-20-6
52) 1,1,2,2-Tetrachloroethane	79-34-5

53) Tetrachloroethylene; Tetrachloroethene;
Perchloroethylene 127-18-4
54) Toluene. 108-88-3
55) 1,1,1-Trichloroethane; Methylchloroform. 71-55-6
56) 1,1,2-Trichloroethane. 79-00-5
57) Trichloroethylene; Trichloroethene 79-01-6
58) Trichloroflouromethane; CFC-11 75-69-4
59) 1,2,3-Trichloropropane 96-18-4
60) Vinyl acetate. 108-05-4
61) Vinyl chloride 75-01-4
62) Xylenes. . . . . See note 4
63) Ammonia
64) Chloride
65) Sodium
66) Potassium
67) Temperature
68) pH
69) Specific conductance
70) Total dissolved solids
71) Total alkalinity
72) Nitrate-nitrite
73) Sulfate
74) Magnesium
75) Calcium
76) Turbidity
77) Iron
78) Manganese

Note 1. Common names are those widely used in government regulations, scientific publications, and commerce; synonyms exist for many chemicals.

Note 2. Chemical Abstract Service registry number.

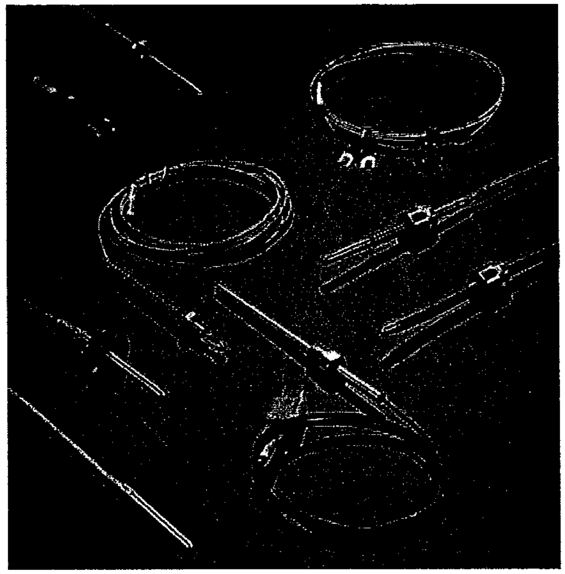
Note 3. Analysis for these compounds shall be representative of the quality background ground water that has not been affected by past or present operations at the sanitary landfill facility and representative of the quality of ground water passing directly downgradient of the limits of solid waste placement.

Note 4. Xylene (total): this entry includes o-xylene (CAS RN 96-47-6), m-xylene (CAS RN 108-38-3), p-xylene (CAS RN 106-42-3), and unspecified xylenes (dimethylbenzenes) (CAS RN 1330-20-7).

APPENDIX G

Type T Thermocouple Information

Thermocouple Designs Ideal For Medium Duty Processes



Over 90 years of manufacturing, research and design makes Watlow a world class supplier of temperature measurement products. We have designed and manufactured millions of thermocouples for industrial and commercial equipment. People involved in critical process control of food, plastics and metal rely on our sensors.

We are ready to meet your sensing needs with our extensive offering of thermocouples. However, if the variations listed in this catalog are unable to satisfy your requirements, Watlow can custom manufacture sensors to your exacting specifications. Contact your Watlow representative for details.

Applications

- Plastic injection molding machinery
- Food processing equipment
- Deicing
- Plating baths
- Industrial processing
- Medical equipment
- Pipe tracing control
- Industrial heat treating
- Packaging equipment
- Liquid temperature measurement
- Refrigerator temperature control
- Oven temperature control

Tolerances

Tube diameters: ±0.003 in. (0.08 mm)

Hose lengths: +2 in. / 0 (+51 mm / 0)

Lead wire lengths: +2 in. / 0 (+51 mm / 0)

Tube lengths:
0.375 in. O.D. ± 0.25 in. (10 mm O.D. ±6 mm)
All others ±0.125 in. (±3 mm)

Performance Capabilities

Fiberglass insulated thermocouples are capable of temperatures up to 480°C (900°F) for continuous operation.

Features and Benefits

Fast delivery

- Over a million thermocouple variations are part of the Rapid Ship program.

Custom-tailored" standard products, including:

- 32 standard sheath lengths
- Lead lengths from six to 360 inches
- Stainless steel braid or hose protection
- J, K, T and E calibrations
- Grounded, ungrounded and exposed junctions
- Flat and drill point
- Epoxy sealed cold ends
- Adjustable depths
- Flexible extensions
- Washers, nozzles and clamp bands
- Custom diameters
- PFA coated and stainless steel sheaths
- Straight, 45˚ bend or 90˚ bend
- Locking bayonet caps in standard, 0.47 in. (12 mm) and 0.59 in. (15 mm)

- **Custom manufactured thermocouples**
  - Units designed and built to your specifications

WATLOW

5710 Kenosha Street
Richmond, Illinois 60071 USA
Phone: +1 (815) 678-2211
FAX: +1 (815) 678-3961
Internet: www.watlow.com/sensors
e-mail: info@watlow.com

RIC-GA-0305

ISO 9001 : 2000
Registered Company
Richmond, Illinois USA

Printed in the USA on Recycled Paper, 15% Postconsumer Waste

Construction

Thermocouples feature flexible SERV-RITE® wire insulated with woven fiberglass or high temperature engineered resins. For added protection against abrasion, products can be provided with stainless steel wire braid and flexible armor. ASTM E 230 color-coding identifies standard catalog thermocouple types.

The addition of a metal sheath over the thermocouple provides rigidity for accurate placement and added protection of the sensing junction. Mounting options include springs, ring terminals, specialized bolts, pipe style clamps and shims.

Options:

- **Adjustable Spring Style Construction**
  Adjustable spring style thermocouple fits a large range of hole depths. Bends to any angle, eliminating the requirement to stock numerous styles.
- **Adjustable Armor Style Construction**
  Adjustable armor thermocouple fits a large range of hole depths. Bends to any angle, eliminating the requirement to stock numerous styles. Stainless steel hose offers additional lead protection in demanding applications.
- **Rigid Sheath (⅛ and 3/16 in. diameter)**
  Rigid sheath provides protection and accurate placement through bulkheads or platens. Use with a compression fitting for water tight immersion applications. Bent rigid tube offers protection and accurate lead placement around machinery.
- **Rigid Sheath with Threaded Fitting (⅛ and 3/16 in. diameter)**
  Rigid sheath with threaded fitting provides accurate placement in process applications.
- **PFA Encapsulated Style**
  The rigid sheath is covered with a 0.010 in. (0.25 mm) wall of PFA for corrosion resistance in acid environments. An epoxy seal improves moisture resistance of sensor and provides a barrier for migrating fumes in corrosive applications.
- **Flanged Style**
  The flanged thermocouple allows rapid assembly and low profile when going through bulkheads.
- **Rigid Sheath Fixed Bayonet Style**
  Bayonet fittings allow rapid attachment. Spring pressure on the junction tip assures fast response time. This style of bayonet fitting is quick connecting and allows leads to exit with a protective sheath.
- **Large Diameter Rigid Sheath Style (¼ and ⅜ in. diameter)**
  Rigid sheath provides protection and accurate placement through bulkheads or platens. Use with a compression fitting for water tight immersion application. Bent rigid tube offers protection and accurate lead placement around machinery.
- **Flexible Extensions**
  Flexible extensions allow the disconnecting of thermocouples from a system without disturbing the remaining wiring.
- **Insulated Wire Thermocouple Style 61 and Style 62**
  Constructed with SERV-RITE® insulated thermocouple wire Styles 61 and 62 are economical and versatile thermocouples with the option of an exposed or protected measuring junction.
- **Ring Terminal Style**
  The nickel terminal can be placed beneath existing screws or bolts to permit surface temperature measurement.
- **Nozzle Style**
  The nozzle thermocouple has a short installation depth and a low profile thus allowing control of thin sections of platens.

Kapton® is a registered trademark of E. I. du Pont de Nemours & Company.

- **Pipe Clamp Style**
  The stainless steel clamp allows temperature measurement without drilling or tapping. It is perfect for the measurement of pipe temperatures.
- **Grommet Style**
  Extremely low profile of the stainless steel grommet provides fast response time.
- **Brass Shim Style**
  The shim stock thermocouple has low profile and can be placed between components for measurement of surface temperature. Also available in other shim dimensions.
- **Stainless Steel Shim Style**
  The shim stock thermocouple has low profile and can be placed between components for measurement of surface temperature. Available in other shim dimensions.
- **Melt Bolt Thermocouple**
  Watlow plastic melt bolt thermocouples are designed so that the sensitive closed end portion of the tip can be inserted directly into the plastic stream of an extruder or injection molding machine. The measuring junction is thermally isolated from the metal bolt mass, assuring accurate reading of the melt temperature up to 260°C (500°F) continuous. Available in J or K calibration only. Bolt is 300 series stainless steel. Other calibrations are available on special order.
- **Kapton® Bracket Thermocouple**
  The Kapton® thermocouple, when used with the aluminum bracket, has been designed primarily to measure roller temperature. By putting a light pressure on the roller, the Kapton® thermocouple measures roller surface temperature without using slip rings. This type of set-up greatly reduces lag time and eliminates the cost of slip rings and their associated maintenance problems. It can also be used to measure conveyor belt temperatures or any other moving part by riding gently on the part surface.
  - Continuous use at 200°C (400°F), 260°C (500°F) for limited periods
  - Low mass
  - Fast response
  - Totally insulated construction
  - Available in Type J or K
- **Low Profile Kapton® Thermocouple (without Bracket)**
  When used without the bracket it can be placed between heated parts for accurate temperature measurement. At the thermocouple junction, the overall thickness is only 0.016 in. (0.4 mm), so that it doesn't interfere with fit or thermo conductivity.
- **Kapton® Peel and Stick Thermocouple**
  This sensor needs no bracket and no special mounting. Simply peel away the backing and this self-adhesive film will bond to almost any surface. Temperature ratings for continuous use is 200°C (400°F).
- **Newbury Nozzle Style**
  A direct replacement for OEM Type J nozzle thermocouples held in place with a set screw. The sheath is ⅛ inch diameter with a 90°bend and a spring strain relief.

How to Order

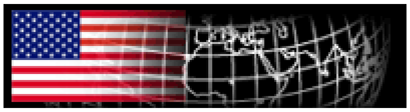
Ordering information differs for different options. Please consult factory for details.

Availability

Most thermocouples listed are available for next day shipment. Consult factory for details.

APPENDIX H

Fluke Digital Thermometer Information



Fluke 50 Series II Thermometers

Specifications	
Temperature accuracy	**Above -100 °C:** J, K, T, E, and N-type: ±[0.05% + 0.3°C]* R and S-type: ±[0.05% + 0.4°C]* **Below -100 °C:** J, K, E, and N-types: ±[0.20% + 0.3°C]* T-type: ±[0.50% + 0.3°C]
Temperature	**J-type:** -210 °C to 1200 °C **K-type:** -200 °C to 1372 °C **T-type:** -250 °C to 400 °C **E-type:** -150 °C to 1000 °C **N-type:** -200 °C to 1300 °C * **R and S-type:** 0 °C to 1767 °C *
Temperature scale	ITS-90
Applicable standards	NIST-175
Display Resolution	0.1 °C, 0.1 K < 1000 1°C, 1 K >=1000
Note	* Only the Fluke Models 53 II and 54 II thermometers are capable of measuring N, R, and S-type thermocouples.

Environmental Specifications	
Operating Temperature	-10 °C to 50 °C
Storage Temperature	-40 °C to 60 °C
Humidity (Without Condensation)	0% to 90%; 0 °C to 35 °C 0% to 70%; 0 °C to 50 °C

Safety Specifications	
Overvoltage category	CSA C22.2 No. 1010.1 1992; EN 61010 Amendments 1,2
Agency Approvals	CE, CSA, TÜV (pending)

Mechanical & General Specifications	
Size	173 mm L x 86 mm W x 38 mm
Weight	400 g
Batteries	3 AA batteries; typical 1000-hour life

APPENDIX I

88-Acre Remediation Area
Health and Safety Plan

88-Acre Operations, Maintenance and Monitoring Health & Safety Plan

Countywide Recycling and Disposal Facility

REPUBLIC SERVICES, INC.℠
Adding value at every stop!™

Prepared for:

Republic Services of Ohio II, LLC

3619 Gracemont Street, S.W.
East Sparta, OH 44626
(330) 874-3855

Prepared by:

AECOM
36133 Schoolcraft Road
Livonia, MI 48150

April 10, 2009

Prepared For:

Republic Services of Ohio II, LLC
dba Countywide Recycling and Disposal Facility
3619 Gracemont Street, S.W.
East Sparta, OH 44626

Table of Contents

APPENDICIES

1 INTRODUCTION

This Health & Safety Plan (HASP) sets forth the minimum health and safety (H&S) procedures to be followed during work performed at the Countywide Recycling & Disposal Facility (Countywide) in Stark County, Ohio under the 88-Acre Operations, Maintenance and Monitoring Plan (OM&M Plan). The OM&M Plan has been implemented subsequent to the completion of the actions required pursuant to the United States Environmental Protection Agency (U.S. EPA) Settlement Agreement and Order of Consent (AOC), Docket No. V-W-08_C-897 executed April 11, 2008 and subsequent letter dated October 24, 2008, formerly requesting Countywide to submit a Work Plan to construct a physical isolation break to “achieve a complete separation, full containment and isolation of the ongoing reaction affecting Cells 1-6.” This HASP establishes the basic procedures required to protect personnel involved in the 88-acre area operation, maintenance and monitoring (OM&M) activities at Countywide. It also prescribes practices to protect the public and the immediate environment from potential hazards that may be caused by these efforts.

Nothing in this OM&M HASP relieves any OM&M personnel, contractor or subcontractor of responsibility to provide a safe workplace. The OM&M Team and their contractors shall ensure their personnel and subcontractors comply with the provisions set forth in this and any additional plans. OM&M personnel and all contractors are required to review this and any additional plans and acknowledge review prior to on-site project participation. This OM&M HASP shall be distributed prior to initiation of activities at the site.

This OM&M HASP is included as an appendix to the OM&M Plan. Information contained in the OM&M Plan is incorporated by reference in this OM&M HASP (e.g., site maps and detailed site information). Both the OM&M Plan and this OM&M HASP must be on-site during field work and accessible to Countywide personnel and contractors.

This OM&M HASP addresses known significant site hazards and establishes the minimum requirements for safe project execution. The OM&M Manager (OM&MM) shall be responsible for enforcing compliance with this plan and relevant Countywide procedures. All Occupational Safety and Health Administration (OSHA), United States Environmental Protection Agency (USEPA), Ohio Environmental Protection Agency (Ohio EPA), and other applicable regulations shall be strictly adhered to. In addition, the OM&MM shall coordinate all on-site activities with Countywide personnel to ensure construction activities are conducted safely with the adjacent Countywide active landfill on-site activities.

If site hazards or required controls are significantly different from those discussed in this plan, the plan shall be modified by a Field Change Request (FCR) or similar document. Downgrades in protective measures must be reviewed and approved in advance by the OM&MM. Upgrades to protective measures shall be made as needed with subsequent notification of the OM&MM.

2 SITE AND PROJECT BACKGROUND

Countywide is a fully lined Subtitle D solid waste landfill located in Stark County, Ohio. Countywide is owned and operated by Republic Services of Ohio II, LLC (Republic). Countywide is permitted and licensed to accept solid waste as defined in the Ohio Revised Code and has been in operation since 1991. Countywide was owned and operated by another solid waste company until February 1999, when it was purchased by Republic. The facility was designed and constructed with state-of-the-art engineered systems to protect the environment, including composite liner system, leachate collection system, and landfill gas collection and control system (LFGS).

Countywide estimates that it accepted approximately 600,000 tons of non-hazardous aluminum process waste between 1993 and 2006. The majority of this aluminum process waste was described as “dross” or “salt cake”, which are by-products of the melting of aluminum with a salt flux. A small portion of the aluminum process waste was baghouse dust and shredder/delaq fines.

Subsequent to completion of the the AOC activities, the Countywide site was bifurcated, separating the 88-acre (generally cells 1-6) from the remainder of the landfill. The 88-acre area is operated, maintained and monitored under the requirements set forth in the aforementioned OM&M Plan.

3 OM&M HEALTH AND SAFETY RESPONSIBILITIES

KEY OM&M PERSONNEL

Position	Name	Phone
OM&M Manager	Michael Darnell	(502) 803-6573
Gas Management System OM&M Supervisor	TBD	TBD
Leachate Management System OM&M Supervisor	TBD	TBD
Liner System OM&M Supervisor	TBD	TBD

OM&M MANAGER

The OM&MM or their designee is responsible for administration of all H&S actions required by the current OM&M Plan and HASP as follows:

- Managing day-to-day H&S personnel and activities of OM&M personnel, contractors and subcontractors used to complete the OM&M activities.
- Schedule and lead OM&M project meetings scheduled at appropriate intervals for the duration of the project where safety issues and concerns are discussed.
- Work with and coordinate subcontractors to schedule appropriate sized, trained and qualified labor force and equipment assets.
- Adjust work schedule due to weather impacts.

OM&M H&SR responsibilities include the following:

- Implementing and verifying compliance with this OM&M HASP and documenting any deviations from anticipated conditions. The original remediation project HASP which was the basis of the OM&M HASP was developed with the support of a Certified Industrial Hygienist (CIH).
- Conducting and documenting routine safety inspections.

- Documenting deficiencies identified in the daily inspections and responsible parties, procedures, and timetables for correction.
- Stopping work or upgrading protective measures (including protective clothing) if uncontrolled H&S hazards are encountered. Indications of uncontrolled H&S hazards include monitoring instrument readings in excess of the established action limits, etc. The OM&MM or his designee must also authorize resumption of work following correction of the adverse condition(s).
- Ensuring that site personnel have access to this plan and are aware of its provisions.
- Conducting a OM&M pre-implementation H&S briefing covering potential chemical and physical hazards, safe work practices, and emergency procedures.
- Maintaining on-site auditable documentation of Material Safety Data Sheets (MSDSs) for applicable materials utilized at the site, training for site workers and visitors, calibration/maintenance of field instruments, environmental and personal exposure monitoring results, notification of accidents/incidents, reports of any chemical overexposure or excessive levels, and notification to employees of chemical exposure data.
- Confirming that all on-site OM&M personnel have received the training listed in the Training Requirements section (Section 8) of this OM&M HASP.
- Ensuring that all monitoring equipment is operating according to the manufacturer's specifications and performing field checks of instrument calibration.
- Ensuring monitoring for potential on-site exposures is conducted in accordance with this OM&M HASP.
- Updating the OM&M HASP (field changes) to ensure that it adequately identifies all tasks and significant hazards at the site and notifying OM&M personnel of changes.
- Investigating accidents and near accidents and reporting per Republic requirements.
- Conducting or ensuring routine “tailgate” safety briefings are taking place.
- Controlling visitor access to the 88-acre remediation area.
- Support Countywide in determination of response level in accordance with the Incident Management System Plan (IMSP).

OM&M SUPERVISOR(S)

The OM&M Supervisors shall oversee the OM&M activities associated with the 88-acre site and shall be responsible for site accessibility and safety. He/she also shall be responsible for enforcing the field requirements of this OM&M HASP. At a minimum the OM&M Supervisors shall have three years experience in similar work and OSHA Excavation Competent Person training when appropriate. The OM&M Supervisor(s) will have responsibility for the following:

- Conducting and documenting safety inspections if the H&SR is not onsite;
- Conducting or routine “tailgate” safety briefings if the H&SR is not available or onsite.
- Controlling visitor access to the work area in conjunction with the OM&MM and H&SR.

SITE PERSONNEL

All site personnel performing work related to the 88-acre OM&M Plan are responsible for complying with the provisions set forth in the OM&M HASP and working in a safe manner. Each employee’s greatest safety tool is their ability to Stop Work. Each employee is empowered and expected to stop his or her own work or the work of co-workers if any person’s safety or the environment are at risk.

4 EXCLUSION AND WORK ZONES

The exclusion zone for this project includes those areas within the limits of the 88-acre area where:

- Waste is exposed and any of the action limits listed in Section 6 are exceeded beyond an instantaneous or intermittent duration
- Forceful emissions exist which cannot be controlled with engineering controls
- Excavations are stable but exceed a 25-ft depth, and require entry by personnel and equipment, except where exempted by the H&SR or their designee

Areas of exposed waste which naturally or through engineered controls do not exceed the action limits listed in Section 6 are considered work zones.

5 HAZARDS

OM&M tasks present a variety of potential physical hazards, with heavy equipment operations offering the greatest potential for significant injury. Potential physical hazards include being struck by moving/mobile equipment, fire, explosion, inclement weather, reduced visibility, dense condensation from exposed waste, slips and trips, and heavy lifting/moving. It is not anticipated that sufficient quantities of landfill gas, above that which can be diluted below the lower explosive limit by normal air movement, will accumulate except near the surface of exposed waste. Appropriate monitoring will be performed to protect the equipment operators and ground personnel from both flammable and toxic gasses. The appropriate plans and materials will be on hand to deal with landfill gas and/or surficial waste fires. Plans have been prepared to deal with unlikely or unanticipated risks and are described in the OM&M Plan.

Data collected from the 88-acre area indicate that the reaction has not moved to or beyond the limits of the Cells 4B/5B/5C and Cell 7 Isolation Break which was completed in 2009. Ongoing visual inspection and monitoring of the landfill will be conducted to confirm that the reaction has not progressed north of the Isolation Break and that the excavation can be completed safely.

Appendix A contains the Job Safety Analyses (JSAs) for the work to be performed during OM&M activities.

POTENTIAL EXPOSURES

Landfill gas in the excavation area may contain methane, carbon monoxide, hydrogen, carbon dioxide, ammonia, organic compounds, and hydrogen sulfide. National Institute of Occupational Safety and Health (NIOSH) Safety Cards will be maintained onsite for potential chemical hazards which are known to be present and which are likely to be encountered on the site. Other potential hazards are discussed in the Countywide HASP Documents provided electronically to the onsite OM&M Manager and available in the Site H&S office.

FIRE AND EXPLOSION HAZARDS

Prior to commencement of OM&M field activities, the OM&M Team will conduct a meeting to review the project and review the site's most recent update of the Incident Management System

Plan (IMSP). This Plan is located in the Countywide office as well as the office of the onsite OM&M Manager. All subcontractors or personnel after commencement of OM&M activities will review the IMSP prior to commencement of their activities on the 88-acre area.

Several potential scenarios exist for fire during OM&M activities. These include: flash combustible gas fire, spontaneous combustion of waste, digging into active combustion, and equipment fire. During excavation and drilling activities, observations for evidence of subsurface fire will be made including smoke (visual and olfactory), water vapor with high carbon monoxide, flame or glowing.

Landfill gas fires could be ignited as a result of a spark generated by contact between the excavation equipment and metal or rock in the waste. However, landfill gas at flammable concentrations is only anticipated near the waste surface, as it will dilute rather quickly in open air. If landfill gas is ignited, a continuously burning or sustaining fire is not anticipated. This is because the landfill gas will not diffuse from the waste at a rate sufficient to sustain continuous burning. If monitoring detects explosive levels of landfill gas 18 inches to 24 inches above the waste surface, work will be halted until the gas dissipates and/or fans are applied to the work area to ensure the gas dissipates before reaching explosive concentrations. A landfill gas fire may ignite paper or other combustible material within the solid waste. If this situation occurs, the waste fire will be extinguished according to the IMSP. The OM&MM and H&SR should be immediately notified of a fire. The OM&MM and/or H&SR will determine the proper approach to dealing with the fire in accordance with the IMSP and authorize action accordingly.

The potential of spontaneous combustion exists during any excavation activities in the 88-acre area. The area of exposed waste during excavation activities will be reduced as much as possible, thereby minimizing chances of spontaneous combustion.

Smoldering waste, if encountered, should be spread out and smothered with soil to provide temporary control until the appropriate personnel and equipment can be mobilized to completely extinguish and remove the waste from the excavation area.

Should any excavation be performed in cold weather, and waste temperatures are warmer than atmospheric temperatures. This will result in the formation of plumes or wafts of water vapor condensation rising from the fresh waste excavation and may not be indicative of high temperatures or combustion.

Provisions during major excavations will be made to control events by:

- Staging at least 100 cubic yards of non-combustible fill material at two places in the vicinity of the 88-acre area with immediate access to heavy equipment for fire suppression.
- Staging fire extinguishers on each piece of heavy equipment.

Standby equipment and materials will be available for use in managing small fires that could occur as a result of ignition of the solid waste from a landfill gas flash. Generally, small fires should be extinguished by smothering with soil from the stockpile maintained in close proximity to the excavation area. A dozer, loader, or backhoe can be used to retrieve the soil from the stockpile and deposited in the area of the fire to eliminate the source of oxygen that is needed to sustain the fire. Water will also be available from standby equipment, but should only be used if smothering with soil does not successfully extinguish the fire. If initial attempts to extinguish the fire in accordance with the procedure outlined in the IMSP fail, the OM&MM or H&SR will contact local emergency fire fighting units for assistance.

Potential Fire or Explosion Hazards from Common Landfill Gas Components	
Component	**Potential to Pose a Fire or Explosion Hazard**
Methane	Methane is highly explosive when mixed with air at a volume between its Lower Explosive Limit (LEL) of 5 % and its Upper Explosive Limit (UEL) of 15%. At concentrations below 5% and above 15%, methane is not explosive.
Hydrogen	Hydrogen is highly explosive when mixed with air at a concentration between its LEL of 4 % and UEL of 74.5 %. At this landfill, hydrogen is produced at greater than typical quantities by a hydrolysis reaction between aluminum waste and water within the landfill.
Carbon Monoxide	Carbon monoxide is explosive when mixed with air at a concentration between its LEL of 12.5 % and UEL of 57 %. At this landfill, carbon monoxide is produced at greater than typical quantities by a pyrolytic reaction as the organic material in the solid waste is heated by the reaction between aluminum waste and water within the landfill.
Carbon dioxide	Carbon dioxide is not flammable or explosive.
Nitrogen	Nitrogen is not flammable or explosive.
Oxygen	Oxygen is not flammable, but is necessary to support combustion.
Ammonia	Ammonia is flammable. Its LEL is 15% and its UEL is 28%. However, ammonia is unlikely to collect at a concentration high enough to pose an explosion hazard.
NMOCs	Potential explosion hazards vary by chemical. For example, the LEL of benzene is 1.2% and its UEL is 7.8%. However, benzene and other NMOCs alone are unlikely to collect at concentrations high enough to pose explosion hazards.
Hydrogen sulfide	Hydrogen sulfide is flammable. Its LEL is 4% and its UEL is 44%. However, in most landfills, hydrogen sulfide is unlikely to collect at a concentration high enough to pose an explosion hazard.

Health Effects from Oxygen-deficient Environments	
Oxygen Concentration	**Health Effects**
21%	Normal ambient air oxygen concentration
17%	Deteriorated night vision (not noticeable until a normal oxygen concentration is restored), increased breathing volume, and accelerated heartbeat
14% to 16%	Increased breathing volume, accelerated heartbeat, very poor muscular coordination, rapid fatigue, and intermittent respiration
6% to 10%	Nausea, vomiting, inability to perform, and unconsciousness
Less than 6%	Breathing spasms, convulsive movements, and death in minutes
	Source: OSHA n.d.b

6 AIR MONITORING

Select OM&M personnel will wear personal 4-gas meters while working in the exclusion and work zone areas at the discretion of the OM&MM, H&SR or their designee. At a minimum, excavator operators, one person per ground work group team using the “Buddy” system, CQA personnel, and the H&SR will wear personal 4-gas meters when performing or working near gas wells, invasive work or repairs of tears in the liner system. All others will be at the discretion of the OM&MM, H&SR or their designee. The survey crew while working in the 88-acre area will not be required to wear 4-gas meters if they are accompanied by or are working in the vicinity of personnel equipped with 4-gas meters. The meters should be capable of monitoring oxygen, explosive gas levels, carbon monoxide, and hydrogen sulfide. Meters will be operated and calibrated in accordance with all manufacturers' specifications. Meters will be downloaded and data reviewed at the discretion of the OM&MM, H&SR or their designee. In addition to the personal monitors, the H&SR will maintain the following instruments.

- Explosive Gases Meter
- Carbon Monoxide Detector
- Hydrogen Sulfide Meter
- Ammonia Meter
- Photo Ionization Detector (PID).

Entry into any excavated area without supplied air will not be permitted if any of the following concentrations are detected and evaluated in accordance with the procedures listed below:

- methane gas levels are detected at 25% of the LEL for methane gas or higher.
- hydrogen sulfide gas levels are detected at 10 ppm or higher in worker breathing zone.
- oxygen levels are detected at 19.5% oxygen gas by volume or lower in worker breathing zone.
- carbon monoxide levels are detected at 25 ppm or higher in worker breathing zone.
- ammonia levels are detected at 25 ppm or higher in worker breathing zone.
- VOC concentrations are higher than 1 ppm (or >10 ppm if benzene is not present) in worker breathing zone.

OM&M personnel will monitor for explosive concentrations of landfill gas, hydrogen sulfide, carbon monoxide and oxygen deficiencies prior to and during entry into the work and exclusion zones. All personnel must evacuate the excavated area if the above levels are detected in the breathing zone. Personnel may not reenter the excavated area until safe gas levels are attained by engineered controls or other means.

The following 4-gas meter procedures are applicable both inside and outside exclusion and work zones:

To reduce false/avoidable meter alerts, personnel should:
1. Avoid standing or working next to engine exhaust pipes when wearing a 4-gas meter.
2. Avoid standing next to fueling ports, nozzles, etc. when wearing a 4-gas meter.
3. Avoid standing or working downwind of ventilation fans. Relocate fan direction if necessary.
4. Avoid blocking cover, inlets and outlets of the 4-gas meter. This can result in inadequate readings resulting in alarms.

In case of alarm:
1. Personnel should step away from the immediate area, observe the type and level of reading and attempt to reset the alarm after the meter has had a chance to purge itself.
2. Verify that all the recommendations are being adhered to and that engineering controls, if applicable, are operating properly.
3. Should the personnel be unable to reset their meter they should notify their supervisor.
4. Supervisor shall determine if alarm is valid or not.

5. If alarm is valid or if all precautions are taken and alarm continues, personnel will evacuate the affected area. The H&SR or his designee will be notified. The OM&MM or H&SR and supervisor will review the situation, determine a plan of action to rectify the situation, verify that the plan of action is implemented and confirm that the plan of action expected results are achieved.

Return to the area where an exceedance has occurred will not be permitted until such time as the cause for the exceedance has been identified, mitigated, and deemed safe by the OM&MM, H&SR, or their designee.

Monitoring Requirements and Action Limits

Hazard or Measured Parameter	Area	Interval	Limit	Action	Tasks
Four-Gas Meter:					
LEL	Site Personnel	Continuously	>25% LEL	Evacuate the area immediately and notify the OM&MM and H&SR or designee and supervisor(s)	All tasks
Oxygen			<19.5% O_2		
Carbon Monoxide			>25 ppm		
Hydrogen Sulfide			>10 ppm		
Airborne organics with 10.6 eV PID or equivalent	Breathing zone (14 inches in front of employee's shoulder).	At least once every 30 minutes during excavation activities; continuously during elevated readings.	PID ≤ 1 ppm PID ≥1 ppm 1 ≥ PID ≥ 10 ppm Benzene ≤ 1 ppm PID ≥ 10 ppm or Benzene and/or vinyl chloride ≥1 ppm	Continue work in level D and continue monitoring. Level D and initiate monitoring with hand pump/detector tubes for benzene. Continue in Level D and initiate continuous PID monitoring Withdraw and evaluate: -identify impacts -notify H&SR and OM&MM and supervisor(s) -implement control measures, potentially including ventilation or Level C Personal Protective Equipment (PPE).	Excavation and drilling activities
Oxygen concentration and flammability with combustible gas indicator	Prior to and during entry of excavation areas in worst case areas	At least once every 30 minutes during excavation activities; continuously during elevated readings.	<10% LEL >10% LEL <19.5% O_2	Continue and evaluate source -Withdraw and allow area to ventilate for a minimum of 30 minutes; -Notify OM&MM, H&SR and supervisor(s)	Excavation and drilling activities
Ammonia	Breathing zone (2-3 feet from source or 14 inches in front of employee's shoulder).	At least once every 30 minutes during excavation activities; continuously during elevated readings.	<25 ppm >25 ppm	Level D Withdraw and evaluate: -identify impacts -notify OM&MM, H&SR and supervisor(s) -implement control measures, potentially including ventilation or Level C PPE.	All tasks
Visual Dust	In or near work area	Continuously during activities with the potential for dust generation	Visual dust	Initiate dust control (e.g., wetting area, use of plastic, etc) and adjust operations to minimize dust generation.	All tasks
Temperature	In or near work area	At least twice daily to record approximate lowest and highest temperatures.	>70°F <40°F	Administrative controls (See Section 7.12).	All tasks.

7 PERSONAL PROTECTIVE EQUIPMENT

Level D protection will be required for all work in the Isolation Break work area. Level D protection consists of a hard hat, safety glasses, steel toed shoes with hard soles, earplugs if necessary, long sleeves if necessary, and safety vest. The OM&MM or H&SR will determine if situations warrant additional or upgraded PPE.

No special decontamination procedures will be required for the project execution. General decontamination procedures outlined in the IBHASP will be followed.

8 TRAINING AND MEDICAL MONITORING

Personnel who participate in field activities associated with this project are subject to the training requirements presented below. Medical monitoring will be required if respiratory protection becomes necessary.

Training	Worker	Supervisors	Site Visitor
Remediation Area Visitor Safety Orientation	✓	✓	✓
Incident Management System Plan	✓	✓	×
Excavation Competent Person	×	✓	×
Site Specific Worker Training	✓	✓	×
Site Specific Hazard Communication Training	✓	✓	×
Respiratory Protection Training	✓*	✓*	×
Safety Briefing (daily and whenever conditions or tasks change)	✓	✓	×
Site Visitor Training	×	×	✓
First Aid/CPR (Standard Red Cross or Equivalent)	≥1 worker	×	×

✓= required
×= not required
*= Initial response personnel

OM&M SITE WORKER TRAINING

Personnel on-site working on the 88-acre OM&M project must have received the site-specific safety training. Signatures of those attending and the type of briefing(s) must be entered in project documentation before site access will be granted. The original Project site-specific training shall include the following site-specific information, as appropriate:

- Project details, scope, and objectives;
- Names of site H&S personnel and alternates;
- Contents of the OM&M HASP;
- Relevant Countywide Procedures;
- Hazards and symptoms of landfill gas and aluminum dross reaction exposure;
- Required Monitoring;
- Exposure Limits and Action Levels;
- Hazards and symptoms of chemicals used on-site;
- Physical hazards in the workplace;
- Excavation Hazards;
- Fire and Explosion Hazards;
- Location and availability of written hazard communication program;
- Site and task PPE (including purpose, donning, doffing, proper use);
- Safe work practices to minimize risks;
- Safe use of engineering controls and equipment;
- Site control measures;
- Reporting requirements for spills and emergencies;

- Doffing and decontamination procedures to prevent the spread of chemical contamination;
- Contingency plans (communications, phone numbers, emergency exits, assembly point, etc.) as detailed in the IMSP;
- Spill containment procedures (reporting, clean-up methods, etc.); and
- Emergency equipment locations and use (fire extinguishers, spill kits, etc.).

Personnel on site working on the OM&M must receive training related to the OM&M JSAs. Signatures of those attending and the type of the briefing(s) must be obtained before access to the 88-acre area is granted.

Information presented in the OM&M HASP training (i.e., training slides, etc.) will be maintained onsite for reference and use in tailgate meetings.

Safety “tailgate” briefings shall be held on a daily basis and when conditions or tasks change. These briefings shall be conducted by the OM&MM, H&SR or subcontractor supervisor (or his designee) and shall be attended by all OM&M workers and supervisors. These briefings shall address site-specific safety issues and shall be used as an opportunity to refresh workers on specific procedures and to address new hazards and controls. All attendees shall be required to sign the daily safety “tailgate” briefing attendance list.

SITE VISITOR TRAINING

Site visitors shall receive a briefing specific to hazards and controls associated with their intended site duties by the H&SR or designee. All site visitors will report to the OM&M field office once onsite and report to the OM&MM or H&SR. A site visitor shall be escorted by qualified personnel when in a controlled area to ensure the individual will not be exposed to hazards for which he/she has not received training. All site visitors shall be required to sign the daily visitor sign-in sheet.

9 EMERGENCY RESPONSE AND MEDICAL TREATMENT PROCEDURES

All Emergency Response will be in accordance with the Republic IMSP (January 2009) which can be found in the OM&M field office and Countywide H&S office. The OM&MM, H&SR or their designee shall remain in charge of all personnel during emergency activities. The OM&MM, H&SR or their designee shall perform emergency notification of emergency medical services, fire department, contractor supervisor(s), and Countywide personnel. The OM&MM, H&SR or their designee shall also escort or assign an escort to off-site emergency responders. To minimize the potential for accidents and injuries, regular H&S inspections shall be conducted by the H&SR. After an emergency occurs, the OM&MM, H&SR, subcontractor supervisor(s) and field team shall participate in a briefing to discuss the event, identify the causes, identify corrective measures, and evaluate the responses.

All personnel working on-site shall be trained in the requirements of this section. This shall include recognizing emergencies, reporting emergencies to the OM&MM, H&SR and subcontractor supervisor(s) and responding to emergencies. Employees shall also be informed of any changes in potential emergencies or response plans. Emergency phone numbers and hospital map are included in Appendix B and shall be posted on-site or kept in project vehicles.

POTENTIAL EMERGENCIES

Credible potential emergencies for this project include fires, minor chemical spills, and personnel injury. In case of a landfill related emergency not on the 88-acre area, site personnel will notify the OM&MM, H&SR and subcontractor supervisors. In case of an emergency on the 88-acre area, the OM&MM, H&SR or designee shall notify appropriate Countywide personnel. All emergencies shall be coordinated through 911 emergency assistance.

Fires

The potential exists for fires to occur during OM&M activities. In addition, gasoline and diesel fuel will be present on-site. The OM&MM shall assure that at least 100 cubic yards of non-combustible fill are stockpiled in two places in the vicinity of the 88-acre area and be reserved for immediate access to heavy equipment for fire suppression. In the event of a fire, the provisions of the IMSP shall be employed. OM&M personnel will:

- Not put themselves at risk
- Immediately notify the existence and location of fire through verbal communication, on-site radios, etc.
- For smaller fires, attempt to extinguish the fire using available on-site equipment (i.e., fire extinguishers, earth moving equipment, etc.)
- For larger fires, evacuate the scene
- Notify all OM&M personnel, visitors, and/or OM&M subcontractors in the immediate area
- Notify the Countywide General Manager, Operations Manager and/or Area Engineer to the situation
- Call for the Fire Department at 911 if necessary
- Activate facility communication system to notify all site personnel of the emergency
- If the emergency is deemed to be significant, the OM&MM or H&SR will contact Stark County Emergency Management Agency (EMA) and/or Stark County Local Emergency Planning Committee (LEPC).

If there is any doubt about the safety of extinguishing the fire, OM&M personnel shall evacuate the area. The OM&MM, H&SR, subcontractor supervisor or knowledgeable employee shall provide the fire department with relevant information when they arrive.

Spills

Potential spills include releases of fuels, lubricants, and hydraulic fluids. In the event of a spill or leak, the employee making the discovery shall immediately notify the OM&MM, H&SR and/or the subcontractor supervisor. The procedures as outlined in the IMSP shall be employed and include:

- Reporting any spill by calling the OM&MM, H&SAM and Countywide HSM. If possible, identifying the material and estimating the volume released.
- For small spills, attempting to contain and clean up the spill using the on-site spill kit.
- For larger spills, attempting to contain the spill, if possible or practical. If there are any questions with regard to safety, evacuate the area.
- Maintaining containment and cleanup supplies necessary for small spills.

- Completing an incident report as necessary.
- Refer to the Countywide Site Spill Prevention, Control, and Countermeasure (SPCC) Plan for additional requirements for any spill. The SPCC Plan is available at the Site main office.

Medical Emergencies

Field crews will use a variety of equipment that could cause injuries. In the event of a medical emergency, the OM&MM, H&SR or subcontractor supervisor shall notify the emergency medical service immediately. At least one first aid/CPR-trained individual shall be on-site at all times and this individual shall provide first aid pending release of the injured person to emergency medical staff. Personnel with injuries that are not clearly trivial shall be transported by ambulance rather than project personnel.

EMERGENCY ALERTING

In addition to two way radios and cell phones, each team shall have a means for generating an audible alarm, which shall consist of a compressed gas horn or vehicle horn. These devices shall be used to signal to other project personnel in the event of accidents or emergencies. Short blasts (less than 1/2 second) of the horn shall be used to request assistance, while extended blasts (more than 2 seconds) shall signal an evacuation.

EVACUATION

The IMSP designates the evacuation routes and an assembly area. All employees shall be familiar with the evacuation routes and assembly area. Refer to the IMSP for site maps.

EMERGENCY EQUIPMENT

Several items of emergency equipment shall be maintained at the work site. Any incident that is not clearly controllable by personnel wearing standard site clothing plus protective gloves and using the listed equipment will require reevaluation by the H&SR or designee. If the H&SR does not feel that on-site personnel can safely control the emergency with the available equipment, the crew shall use alternate approaches such as allowing a small fire to burn out or evacuating the site. The required emergency equipment includes:

- 16-unit first aid kit indoors or in weatherproof container, inspected weekly;
- Compressed gas horns or vehicle horn;
- Fire extinguisher(s) (at least 20-B) 25 to 75 feet from outside flammables storage (or use) area;
- Basic spill kit suitable to handle small spills of decontamination fluids, hydraulic fluid, or fuels and containing sorbent pads, tubes, and nitrile or similar gloves; and
- Cell phone.

10 GENERAL CODE OF SAFE PRACTICES (ALL WORK AREAS, ALL EMPLOYEES).

The following rules apply to all site activities:

- Personnel will stay upwind and a safe distance away from hazards whenever possible.
- Daily safety ("tailgate") briefings shall be conducted by the OM&MM, H&SR or subcontractor supervisor (or his designee) to inform personnel of new hazards, procedures, or any safety issues that develop during work activities.
- Project personnel and management personnel are responsible to suspend/stop work and require all personnel to evacuate the affected area if any of the following situations occur:
  - inadequate H&S precautions on the part of any on-site personnel, and
  - potential significant environmental insult as a result of planned activities.
- Personnel shall perform only those tasks that they believe they can do safely.
- Personnel shall notify the H&SR of any medical conditions (e.g., allergy to bee stings, diabetes, pregnancy) that require special consideration.
- Personnel shall maintain proper workplace housekeeping to minimize the potential for trips and other accidents.
- Contact with potentially impacted substances shall be avoided. Site personnel in the exclusion zone shall avoid walking through puddles, pools, mud, kneeling on the ground, and placing equipment on the ground.
- Spills shall be prevented to the greatest extent possible. In the event that a spill occurs, the material shall be contained.
- Eating, drinking, smoking, chewing gum or tobacco, and other practices that increase the probability of hand-to-mouth transfer are prohibited in excavation areas.
- Workers shall wash their hands and faces upon leaving the work area and prior to eating or drinking.
- All injuries and accidents requiring more than first aid shall be reported to the OM&MM, H&SR and subcontractor supervisor.
- All on-site workers shall abide by a buddy system. Members of a buddy team shall maintain verbal or visual contact.

Refer to the Countywide Site HASP Documentation for:

- Other physical hazards associated with construction sites and landfill operations
- Noise hazards associated with construction sites and landfill operations
- Cold/heat stress
- Working around heavy construction equipment
- Personal hygiene.

11 LOGS, REPORTS, AND RECORDKEEPING

The following logs, reports, and records will be developed and maintained for this site by the H&SR or his designee:

- Daily safety meeting topics,
- Completed equipment safety inspections,
- OM&M HASP plan documentation,
- IMSP Program records,
- Air monitoring records,
- First aid administered,

- H&S equipment maintenance records, and
- Records of visits of all outside personnel.

APPENDIX A

JOB SAFETY ANALYSES

APPENDIX B

HOSPITAL LOCATION MAP
AND
EMERGENCY PHONE NUMBERS

IN CASE OF EMERGENCY DIAL 911

PROJECT CONTACT NUMBERS

OM&M Manager Michael Darnell	330-874-3855 (office) 502-803-6573
H&S Representative TBD	

HOSPITAL MAP
UNION HOSPITAL
659 BOULEVARD STREET
DOVER, OH

DIRECTIONS TO HOSPITAL:

1. Depart Gracemont St SW 0.3 mi
2. Keep left to stay on Gracemont St SW 0.1 mi
3. Bear left onto Sherman Church Ave SW 0.3 mi
4. Road name changes to CR-102 / Sherman Church Rd NE 0.8 mi
5. Road name changes to Mulberry St / Park Ave SW 0.4 mi
6. Keep straight onto SR-212 / Park St SE 0.4 mi
7. Turn left to stay on SR-212 / N Cary Dr 0.1 mi
8. Take ramp right and follow signs for I-77 South 9.8 mi
9. At exit 83, take ramp right for Oh-39 toward Sugarcreek / Dover 0.2 mi
10. Turn left onto SR-39 / SR-211 / N Tuscarawas Ave 1.2 mi
11. Turn left onto W Front St 0.2 mi
12. Turn right onto SR-800 / Wooster Ave 0.5 mi
13. Keep left to stay on SR-800 / E Iron Blvd 0.6 mi
14. Arrive at 659 Boulevard St

COUNTYWIDE RECYCLING & DISPOSAL FACILITY
88-ACRE REMEDIATION AREA
INCIDENT MANAGEMENT SYSTEM (IMS) CONTACT LIST

Countywide RDF
3619 Gracemont Road SW
East Sparta, Ohio
44626

From the North: Take I-77 South to Fohl Road (exit 99). Turn right (West) and go to the first stop light. Turn left (South) onto Sherman Church Road and go 5 miles to Gracemont Avenue. Turn left (East) onto Gracemont and go approximately on fourth mile. Entrance is on left.

From the South, take I-77 North to the Bolivar exit (exit 93) and turn to the left onto Rt 212 (West). Go to the stop sign and turn right (North). Travel North on Rt 212 approximately one mile. Turn right on first road to right (Gracemont). Go approximately one fourth mile. Entrance is on left.

IMMEDIATE ACTION EMERGENCY PHONE NUMBERS

When calling 911, wait 20 seconds for answer. Ask for response from both East Sparta and Bolivar emergency services.

Life Flight Location 40º 40’ 20.01” N LAT 81º 25’ 34.96” W LONG

Level 1 (Site personnel/Contractors) Response

Name	Responsibilities	Home	Cell	Nextel
Site Personnel				
Michael Darnell	IC	-----------------	502-803-6573	
Paul Finton[2]	IC 1st Alt.	740-545-9468	740-294-1337	
Larry Elliott	IC 2nd Alt.	330-339-6599	330-340-0318	
Tim Vandersall[2]	IC 3rd Alt.	330-699-5274	330-618-7272	
Randy Lane	Equipment Operator	740-545-6878	330-340-2842	
Jim Mike	Equipment Operator	330-874-3057	330-795-0544	
Jim Steigerwald	Env. Compliance	330-497-4678	330-316-2020	
Subcontractors				
Mike Slutz	JMW	330-874-9620	330-806-4328	
Todd Ladrach	JMW	330-859-9909	330-705-6954	
Mike Ferguson	Beaver Excavating	740-922-2968	330-353-3928	
Rusty Hannahs	Beaver Excavating	740-489-9855	330-353-3935	
Phil Brower	Beaver Excavating	330-588-3078	740-525-9879	
Rich Stidd	Beaver Excavating	330-353-7268	740-922-2920	
Bob Caron[2]	AEG	-----------------	330-352-0320	
Bob Memmer	Hilscher-Clarke	330-452-9806	330-353-2455	
Ralph Ury	Dusk to Dawn Security	330-837-9992	330-418-3381	

Notes: 1. All Level 1 Response Team shall have a IMSP contact list, functioning flashlights for all responders, IMSP copy, appropriate PPE and adequate communication equipment; PID and 4-gas meter for team at discretion of Incident Commander.
2. These persons have access to and are trained to use a PID.

3. Level 2 and 3 Response information, other emergency phone numbers and resource information listed on back.

Level 2 (Fire Departments) Response [In addition to Level 1 contacts]

Name	Responsibilities	Phone
East Sparta Fire Department	1st Responder	911 or 330-866-9211
Bolivar Fire Department	2nd Responder	911 or 330-874-3115

Level 3 (Determination and contacts to be initiated by Incident Commander)

Other Emergency Phone Numbers:

MedFlight Columbus	800-222-5433
Metro Life Flight, Cleveland	800-255-2229
Mercy Medical Center	330-489-1000
Union Hospital	330-343-3311
Aultman Hospital	330-452-9911
American Electric Power	800-672-2231
Northeast Ohio Natural Gas Corp.	800-237-2099

Resource Summary (subject to change based on status of construction and OM&M activities in progress)

Item	Location
Tanker	Adjacent to CWRDF Maintenance Shop
Foam Additive (Drench)	CWRDF Storage Building
Water Trucks (CWRDF, JMW, BEC)	1 - located in Maintenance Shop 3 - located adjacent to Maintenance Shop 1 – located in Beaver equipment staging area
Fire Extinguishers	CWRDF Maintenance Shop – 1st floor, below stairwell
PID	Remediation trailer – PHSO Office

OM&M Health & Safety Plan **Commitment to Comply:**
Signature below indicates that each individual has reviewed the attached Heath and Safety Plan, has received site-specific training (briefing), and agrees to comply with the requirements of this plan.

Printed Name	Signature	Date

General Work Activities **JOB SAFETY ANALYSIS FOR COUNTYWIDE WORK ACTIVITIES**		
Personal Protective Equipment (PPE)	**Selected**	**Comments**
Safety Shoes	X	Required
Hard Hat	X	Required
Safety Glasses With Side Shields	X	Required
Hearing Protection	X	As required
High Visibility Clothing or Traffic Vest	X	Required
Air Purifying Respirator	X	If site-specific monitoring indicate use is necessary
Supplied Air – Level B	X	If site-specific monitoring indicates use is necessary
Gloves	X	Use of contaminant specific glove (i.e. Nitrile, PVC, leather, etc.) when handling contaminated material. Heavy duty work gloves for material handling. Leather for clearing vegetation
Other	X	Four-gas meter capable of monitoring O2, LEL, CO, and H2S at the discretion of the H&SR or his designee
Other	X	PID capable of monitoring hydrocarbons as directed by the H&SR or his designee
Other	X	Ammonia meter capable of monitoring ammonia as directed by the H&SR or his designee

Potential Hazard	**Controls**
Chemical exposure	Compliance with OM&M HASP Section 6, Air Monitoring Wash hands before eating or drinking. Hazard communication labels on all chemical containers. MSDSs onsite for all chemicals in use. Site-specific training must address chemicals, hazards, and proper handling. Safety glasses and nitrile gloves for chemical/contaminant contact, or PPE as required in the MSDS. Review in tailgate meeting.

Potential Hazard	**Controls**
Excavation atmospheric monitoring	If directed by the H&SR or his designee, employees will continuously monitor air quality during field activities using a 4-gas meter. Ensure personnel using monitoring equipment are trained on the instrument(s) being used. Verify that equipment calibration is up to date. If it is not, calibrate accordingly. If vapors are expected, approach area of concern from upwind direction and stay upwind/crosswind of potential vapor sources. Should 4-gas meter alarms sound indicating an atmospheres containing less than 19.5% oxygen or having a lower explosive limit greater than 25%, proceed in accordance with the 4-gas Meter Operation procedure included in Section 6 of the OM&M HASP. The same procedure will be followed if employees are exposed to hazardous substances including: - Hydrogen sulfide at 10 ppm or higher in the worker breathing zone - Carbon monoxide levels at 25 ppm or higher in the worker breathing zone - Ammonia levels at 25 ppm or higher in the worker breathing zone - VOC concentrations higher than 1 ppm (or greater than 10 ppm if benzene is not present) in worker breathing zone *Note; Incorporation of engineering controls during excavation activities resulting in exposed waste including but not limited to placement of fans and blowers with odor control to blow air away from workers results in this activity being performed in non-exclusion zone conditions. The H&SR or his designee in conditions resulting in exposed waste will monitor conditions and verify that the engineered controls are in place and operating properly. Should monitoring results indicate that atmospheric conditions are not being controlled at the levels described herein, additional engineering controls may be required.*
Contact with overhead structures or utilities	Survey location and ensure absence of obstructions and overhead utilities prior to setup. Equipment will not be allowed to come within 10 feet of overhead energized power lines. Use spotter when working near utilities. Develop system of hand signals to warn operators of hazards in cases of high noise. Position equipment to avoid overhead utility lines by distance defined by voltage and local regulations. Review in tailgate meeting.
Buried utilities	All buried utilities in the vicinity of the excavation will be located prior to excavating in the vicinity of the utility. Spotter will be used when uncovering utility to minimize potential of making physical contact between utility and mechanical equipment. Hans tools will be used directly adjacent to utility to complete exposure.
Electric shock	Compliance with Countywide HASP Section P14. Ensure compliance with Countywide Electrical Procedures. Portable electrical tools and all portable electrical equipment must be connected through ground fault circuit interrupters. Implement lockout/tagout procedures on all electrical or other energy source hazards prior to commencement of work.

Potential Hazard	**Controls**
Excavation safety	Excavation conducted under the direction of the OSHA Excavation Competent Person. Slope per site specific stability requirements. Inspect excavation daily. Use only properly trained workers for excavation activities. Manufactured protective systems to be used per OSHA requirements. Ensure all underground features have been identified in area per site subsurface clearance procedure prior to commencement of excavation activities. Provide proper ingress and egress per OSHA requirements. Provide warning system when mobile equipment is operated near the edge of an excavation and the operator does not have a clear, direct view of the edge of the excavation. Stay out of excavation if at all possible. When entry is necessary, excavation must: be properly sloped, benched or shored; be properly ventilated; not have free-standing water or have water entering the excavation; have adequate entry/egress pathways per applicable OSHA and state requirements; use agreed-upon hand signals with equipment operators; and, monitor air in and around excavation. Dust control as needed. Place barricades and signs as required to warn/direct personnel not involved in the work. Cover or barricade and post wells, sumps, pits and holes as appropriate Refer to task specific JSAs for additional details.
General hazards	Work performed in accordance with Countywide specific procedures and OSHA Regulations. Level D PPE Maintain safe walkways for ground employees Ground personnel limited to necessary personnel only. Unnecessary personnel will stay out of the drilling or excavation areas. Particular attention paid to sloping site conditions. Excavation contractors may supplement JSA with specific hazard controls. Operators to stay in enclosed cabs. Wear appropriate PPE in case of airborne debris
Equipment operation	Ensure windows and mirrors are clean and adjusted for visibility. Adjust seat and controls so that they are easily operated. Fasten seat belt before beginning work. Check travel routes and work area before starting work. If loading trucks, ensure excavator is on level working surface and adequate space is allowed. Ensure bucket is out of truck route. Signal the dump truck by horn when in place. Ensure bucket does not contact truck when loading. Do not overload trucks. Place excavator bucket or loader on ground before turning off machine. Check ground surrounding machine for trip hazards. Heavy equipment shall be equipped with back-up alarm. Do not allow personnel to stand or walk within the swing radius of booms/arms of operating equipment. Stay clear of operating or moving equipment. Establish and maintain eye contact with operator when walking up to or around heavy equipment.
Falling equipment	No workers under suspended loads. Verify clear pathway to excavation and stockpiling locations. Provide as-needed hand signals and guidance to drive during rig placement. Visually inspect equipment (fire extinguisher on board, no fluid leaks, cables and associated equipment in good condition, pressurized hoses secured and out-riggers in good condition.

Potential Hazard	Controls
Fire/Explosion	No smoking near borehole. Post “No Smoking” signs if appropriate. No smoking (or other ignition sources) during fueling or near borehole. Equipment to be turned off during fueling. Allow gasoline-powered equipment to cool prior to fueling. Place fire extinguisher rated 2A and 5BC (serviced annually and inspected monthly) in all fuel handling areas. If combustible gas concentration in atmosphere in work zone exceeds 25% LEL, cease operations and allow contaminants to dissipate before resuming operations. If combustible gas concentration in atmosphere in work zone remain above 25% LEL, provide additional active ventilation to reduce concentration below 25% LEL. Standby equipment and materials available for use in managing small fires. Extinguish small fires by smothering with soil from the stockpile maintained in close proximity to the drilling and excavation areas. If attempts to extinguish the fire are unsuccessful, implementation of the Incident Management System Plan (IMSP). No electric arc welding shall take place within safety or exclusion zones.
Lifting (musculoskeletal injuries)	If equipment is to be moved, an evaluation of potential pinch points and/or weight strain will be conducted. Clear area of all unnecessary equipment and slip/trip hazards. Additional help will be obtained by workers or mechanical assistance used onsite if equipment to be moved is unwieldy, has a weight >50 lbs or has to be moved by maneuvering through awkward positioning. Ensure gloves are available and used. Know the weight of loads before commencing lifting activities. Bend and lift with legs and arms keeping back straight.
Lighting	Artificial lighting must provide a minimum of 5 ft-candles of even lighting in the work area for work conducted before sunrise and after twilight.
Noise	Use hearing protection when monitoring indicates that noise levels are equal to or greater than 85 decibels.
Pinch hazards	Keep hands clear of all articulated or moving parts. Position hands/fingers to avoid pinching/crushing during work activities. Guards shall be maintained for all machinery representing a pinch hazard. Maintenance on equipment with articulating or moving parts shall be performed only after control keys have been put under control by competent mechanics/operators only. Ensure all hands are clear of potentially moving part before energizing equipment. Tie back long hair.
Risk of being struck by vehicles	Face line of danger with respect to being struck by vehicles. Establish and maintain eye contact with operator when walking up to or around heavy equipment. Use hand signals if necessary. Stay out of swing range. Heavy Equipment equipped with functional backup alarm.
Rotating and/or moving equipment	Avoid loose fitting gloves around rotating equipment. Allow all moving parts to stop before handling. Tie back long hair.
Slips, trips and falls	Keep work area free of excess material and debris. Remove all trip hazards by keeping materials/objects organized and out of walkways. Keep work surfaces dry when possible. Wear appropriate PPE including non-slip rubber boots if working on wet or slick surfaces. Install rough work surface covers where possible. Stay aware of footing and do not run.
Slips/falls from equipment	Always use 3-point mount/dismount. Do not jump from equipment. Utilize approved mounting steps, brackets, hand-holds, or rails.

Potential Hazard	Controls
Struck by moving/mobile equipment	Operators required to have documented training and 1 year of experience operating the type of equipment to be used. Periodic safety inspection of equipment at frequency given in operator manual to be performed by operator. Functional backup alarms required on all mobile equipment. Operator manual onsite at all times. Workers will maintain a safe distance equivalent to the full, extended reach of all moving/mobile equipment. Approach mobile/moving equipment only after getting permission of the operator. Use hand signals if necessary. Maintain visual contact with equipment operators at all times. Personnel shall not place themselves between Heavy Equipment and fixed objects.
Temperature stress	If temperature is above 80°F or below 40°F, administrative controls will be implemented (cooled or warmed drinks, routine breaks in heated or shaded area, provisions, for emergency heating or cooling). Dress appropriately for weather. Take breaks if feeling overheated, faint or overexerted
Tipping over hazards	Load limits and capacities for loading and hauling equipment strictly adhered to. Always dump on level ground. Do not move equipment with masts or beds raised. Cross hills and obstructions head on. Set outriggers (when applicable) with mast or boom down. If soils appear unstable, make proper assessment using qualified personnel prior to setting rig.
Severe weather/sunburn	Work will cease during severe weather (lightning, extremely high winds, etc.) and under other conditions detrimental to H&S of personnel. SPF 15 sunblock will be worn during performance of outdoor activities.
Vehicle Accidents	All Countywide traffic laws including speed limits and use of seat belts strictly adhered to. Only licensed drivers to operate vehicles. Vehicles and heavy equipment inspected weekly. Vehicle and Equipment traffic must be controlled and directed.
Visibility	If condensation is produced in significant quantities to affect worker visibility, ventilation will be used to clear the area to ensure visibility is maintained. Cease work if visibility is compromised due to debris, inadequate light, etc.
Working alone	The buddy system will be incorporated at all times. Personnel working in the field shall either work with a “buddy” who can provide immediate support in case of an emergency or if working along, make office personnel aware of where field work is scheduled to be performed and use radios to check in on a regular basis with time increment determined prior to commencing field activities.

Approved By:

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OM&M Manager Date

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H&S Representative Date

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Subcontractor Supervisor Date

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Drilling and Well Installation Activities JOB SAFETY ANALYSIS FOR COUNTYWIDE WORK ACTIVITIES		
Personal Protective Equipment (PPE)	**Selected**	**Comments**
Safety Shoes (Steel-toed boots)	X	Required
Hard Hat	X	Required
Safety Glasses With Side Shields	X	Required
High Visibility Clothing or Traffic Vest	X	Required
Hearing Protection	X	As required
Air Purifying Respirator	X	If site-specific monitoring indicated use is necessary
Supplied Air – Level B	X	If site-specific monitoring indicated use is necessary
Gloves	X	Use contaminant-specific glove type (Nitrile, PVC, Leather) when handling contaminated material. Heavy duty work gloves for material handling
Other	X	Four-gas meter capable of monitoring O2, LEL, CO, and H2S and other meter(s) as directed by H&SR or his designee
Other	X	PID capable of monitoring hydrocarbons as directed by the H&SR or his designee
Other	X	Ammonia meter capable of monitoring ammonia as directed by the H&SR or his designee

Potential Hazard	**Controls**
Chemical exposure	Refer to General Work Activities JSA
Contact with overhead structures or utilities	Refer to General Work Activities JSA
Buried utilities	Refer to General Work Activities JSA
Electric shock	Refer to General Work Activities JSA
Excavation safety	Refer to General Work Activities JSA
Equipment operation	Refer to General Work Activities JSA
Lifting (musculoskeletal injuries)	Refer to General Work Activities JSA
Lighting	Refer to General Work Activities JSA
Noise	Refer to General Work Activities JSA
Pinch hazards	Refer to General Work Activities JSA
Risk of being struck by vehicles	Refer to General Work Activities JSA
Rotating and/or moving equipment	Refer to General Work Activities JSA
Slips, trips and falls	Refer to General Work Activities JSA
Slips/falls from equipment	Refer to General Work Activities JSA
Struck by moving/mobile equipment	Refer to General Work Activities JSA
Temperature stress	Refer to General Work Activities JSA
Tipping over hazards	Refer to General Work Activities JSA
Severe weather/sunburn	Refer to General Work Activities JSA
Vehicle accidents	Refer to General Work Activities JSA
Visibility	Refer to General Work Activities JSA
Working alone	Refer to General Work Activities JSA
Lightning	Operation of drilling rig will cease when driller recognizes conditions that present a risk of lightning, including severe weather warnings, visible lightning or audible thunder.

Potential Hazard	**Controls**
Atmospheric Monitoring	If directed by the HS&R or his designee, employees will continuously monitor air quality during field activities using a 4-gas meter. Ensure personnel using monitoring equipment are trained on the instrument(s) being used. Verify that equipment calibration is up to date. If it is not, calibrate accordingly. If vapors are expected, approach area of concern from upwind direction and stay upwind/crosswind of potential vapor sources. Should 4-gas meter alarms sound indicating an atmospheres containing less than 19.5% oxygen or having a lower explosive limit greater than 25%, proceed in accordance with the 4-gas Meter Operation procedure included in Section 6 of the OM&M HASP. The same procedure will be followed if employees are exposed to hazardous substances including: - Hydrogen sulfide at 10 ppm or higher in the worker breathing zone - Carbon monoxide levels at 25 ppm or higher in the worker breathing zone - Ammonia levels at 25 ppm or higher in the worker breathing zone - VOC concentrations higher than 1 ppm (or greater than 10 ppm if benzene is not present) in worker breathing zone Maintaining combustible gas concentrations below 25% LEL will generally maintain VOC concentrations below action level. If instructed by PHSO, monitor for VOCs. If VOC concentrations in breathing zone exceed action level of 10 ppm, cease operations and allow contaminants to dissipate. If combustible VOC concentrations in breathing zone in exclusion zone remain above the 10 ppm action level, provide additional active ventilation to reduce concentration below action level. Consider air-purifying respirator (APR) depending on type of contaminant and O_2 concentration. If ventilation is not successful in reducing VOC concentrations in breathing zone below action level, implement Level B supplied air PPE. Review in tailgate meeting. *Notes:* *1. Incorporation of engineering controls for bucket-auger drilling including the use of vacuum box with activated carbon filter and ventilation fans result in this activity being performed in non-exclusion zone conditions. The H&SR or his designee may be on site full-time during the initial day of bucket-auger drilling to monitor conditions and verify that the engineered controls are in place and operating properly. Should monitoring results indicate that atmospheric conditions are not being controlled at the levels described herein, additional engineering controls may be required.* *2. Incorporation of engineering controls for the temperature monitoring probe installation including ventilation fans and blow-out prevention devices if the coring method is utilized or use of the direct push method result in this activity being performed in non-exclusion zone conditions. The H&SR or his designee may be site full-time during the initial day of temperature monitoring probe drilling to monitor conditions and verify that the engineered controls are in place and operating properly. Should monitoring results indicate that atmospheric conditions are not being controlled at the levels described herein, additional engineering controls may be required.*

Potential Hazard	**Controls**
Falling equipment and set-up of heavy equipment	No workers under suspended loads. Verify clear pathway to excavation and stockpiling locations. Provide as-needed hand signals and guidance to drive during rig placement. Visually inspect equipment (fire extinguisher on board, no fluid leaks, cables and associated equipment in good condition, pressurized hoses secured and out-riggers in good condition.
General hazards	Work performed in accordance with Countywide specific procedures and OSHA Regulations. Level D PPE, minimum. Establish safety in vicinity of borehole. Ground personnel limited to necessary personnel only. Unnecessary personnel will stay out of the drilling or excavation safety zone area. Particular attention paid to sloping site conditions. Operators to stay in enclosed cabs where available. Take sufficient breaks if feeling faint, overheated or overexerted.
Fire/Explosion: methane, hydrogen, carbon monoxide, acetylene, hydrogen sulfide	No smoking near borehole. Post “No Smoking” signs if appropriate. No smoking (or other ignition sources) during fueling or near borehole. Equipment to be turned off during fueling. Allow gasoline-powered equipment to cool prior to fueling. Place fire extinguisher rated 2A and 5BC (serviced annually and inspected monthly) in all fuel handling areas. If combustible gas concentration in atmosphere in work zone exceeds 25% LEL, cease operations and allow contaminants to dissipate before resuming operations. If combustible gas concentration in atmosphere in work zone remain above 25% LEL, provide additional active ventilation to reduce concentration below 25% LEL. Standby equipment and materials available for use in managing small fires. Extinguish small fires by smothering with soil from the stockpile maintained in close proximity to the drilling and excavation areas. If attempts to extinguish the fire are unsuccessful, implementation of the Incident Emergency Response Plan.

Definition of Exclusion Zone: An exclusion zone will be defined as an area within 3’ of the borehole if any of the following conditions exist:

- Forceful emissions that cannot be controlled with engineering controls
- Contact with reacting, smoldering or burning material
- Presence of ejected solids or liquids from borehole

In addition to the procedures described herein, if an area is defined as an exclusion zone by the H&SR or his designee, Section 6 of the Agreement HASP must be implemented.

Approved By:

______________________ OM&M Manager	____________ Date
______________________ H&S Representative	____________ Date
______________________ Subcontractor Supervisor	____________ Date

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HDPE Pipe Fusing and Misc. Pipe Installation Activities **JOB SAFETY ANALYSIS FOR COUNTYWIDE WORK ACTIVITIES**		
Personal Protective Equipment (PPE)	**Selected**	**Comments**
Safety Shoes	X	Required
Hard Hat	X	Required
Safety Glasses With Side Shields	X	Required
Hearing Protection	X	As required
High Visibility Clothing or Traffic Vest	X	Required
Air Purifying Respirator	X	If site-specific monitoring indicated use is necessary
Gloves	X	Use of contaminant specific glove (i.e. Nitrile, PVC, leather, etc.) when handling contaminated material. Heavy duty work gloves for material handling. Leather for clearing vegetation
Other	X	Four-gas meter capable of monitoring O2, LEL, CO, and H2S at the discretion of the H&SR or his designee
Other	X	PID capable of monitoring hydrocarbons as directed by the H&SR or his designee
Other	X	Ammonia meter capable of monitoring ammonia as directed by the H&SR or his designee

Potential Hazard	**Controls**
Chemical exposure	Refer to General Work Activities JSA
Excavation atmospheric monitoring	If directed by the H&SR or his designee, employees will continuously monitor air quality during field activities using a 4-gas meter. Ensure personnel using monitoring equipment are trained on the instrument(s) being used. Verify that equipment calibration is up to date. If it is not, calibrate accordingly. If vapors are expected, approach area of concern from upwind direction and stay upwind/crosswind of potential vapor sources. Should 4-gas meter alarms sound indicating an atmospheres containing less than 19.5% oxygen or having a lower explosive limit greater than 25%, proceed in accordance with the 4-gas Meter Operation procedure included in Section 6 of the OM&M HASP. The same procedure will be followed if employees are exposed to hazardous substances including: - Hydrogen sulfide at 10 ppm or higher in the worker breathing zone - Carbon monoxide levels at 25 ppm or higher in the worker breathing zone - Ammonia levels at 25 ppm or higher in the worker breathing zone - VOC concentrations higher than 1 ppm (or greater than 10 ppm if benzene is not present) in worker breathing zone *Note; Incorporation of engineering controls during HDPE pipe welding and miscellaneous pipe installation activities in areas of exposed waste including but not limited to placement of fans and blowers with odor control to blow air away from workers results in this activity being performed in non-exclusion zone conditions. The H&SR or his designee may be on site full-time during the first day of HDPE pipe welding and installation activities in areas of exposed waste to monitor conditions and verify that the engineered controls are in place and operating properly. Should monitoring results indicate that atmospheric conditions are not being controlled at the levels described herein, additional engineering controls may be required.*
Contact with overhead structures or utilities	Refer to General Work Activities JSA
Buried utilities	Refer to General Work Activities JSA
Electric Shock	Refer to General Work Activities JSA

Potential Hazard	Controls
Excavation safety	Refer to General Work Activities JSA
General hazards	Refer to General Work Activities JSA
Equipment operation	Refer to General Work Activities JSA
Falling equipment	Refer to General Work Activities JSA
Fire/Explosion	Refer to General Work Activities JSA
Lifting (musculoskeletal injuries)	Refer to General Work Activities JSA
Lighting	Refer to General Work Activities JSA
Noise	Refer to General Work Activities JSA
Pinch hazards	Refer to General Work Activities JSA
Risk of being struck by vehicles	Refer to General Work Activities JSA
Rotating and/or moving equipment	Refer to General Work Activities JSA
Slips, trips and falls	Refer to General Work Activities JSA
Slips/falls from equipment	Refer to General Work Activities JSA
Struck by moving/mobile equipment	Refer to General Work Activities JSA
Temperature stress	Refer to General Work Activities JSA
Tipping over hazards	Refer to General Work Activities JSA
Severe weather/sunburn	Refer to General Work Activities JSA
Vehicle accidents	Refer to General Work Activities JSA
Visibility	Refer to General Work Activities JSA
Working alone	Refer to General Work Activities JSA
Fusion welder operation/pipe handling	Wear proper PPE at all times. Make sure all guards are in place and operating as designed. Check all electrical cords for fraying and wear. Check winch cables for fraying. Ensure ground surfaces are level for lifting equipment. Check all straps and cables before use for damage or wear. Make sure ground personnel are clear before lifting or moving pipe. Remove any obstacle that may be present before moving pipe. Secure pipe in machine and level before operating machine. Ensure hands are clear of machine before operating machine. Keep work area clear of HDPE cuttings. Make sure all machines are shut down and clear at the end of the day. Properly store all cables and straps.

Approved By:

OM&M Manager	Date
H&S Representative	Date
Subcontractor Supervisor	Date
Subcontractor Supervisor	Date

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Geosynthetics Installation Work Activities **JOB SAFETY ANALYSIS FOR COUNTYWIDE WORK ACTIVITIES**		
Personal Protective Equipment (PPE)	**Selected**	**Comments**
Safety Shoes	X	Required
Hard Hat	X	Required
Safety Glasses With Side Shields	X	Required
Hearing Protection	X	As required
High Visibility Clothing or Traffic Vest	X	Required
Air Purifying Respirator	X	If site-specific monitoring indicated use is necessary
Gloves	X	Use of contaminant specific glove (i.e. Nitrile, PVC, leather, etc.) when handling contaminated material. Heavy duty work gloves for material handling. Use cut-resistant gloves when using knives.
Other	X	Four-gas meter capable of monitoring O2, LEL, CO, and H2S at the discretion of the H&SR or his designee.

Potential Hazard	**Controls**
Chemical exposure	Refer to General Work Activities JSA
Excavation atmospheric monitoring	Refer to General Work Activities JSA
Contact with overhead structures or utilities	Refer to General Work Activities JSA
Buried Utilities	Refer to General Work Activities JSA
Electric shock	Refer to General Work Activities JSA
General hazards	Refer to General Work Activities JSA
Equipment operation	Refer to General Work Activities JSA
Falling equipment	Refer to General Work Activities JSA
Fire/Explosion	Refer to General Work Activities JSA
Lifting (musculoskeletal injuries)	Refer to General Work Activities JSA
Lighting	Refer to General Work Activities JSA
Noise	Refer to General Work Activities JSA
Pinch hazards	Refer to General Work Activities JSA.
Risk of being struck by vehicles	Refer to General Work Activities JSA
Rotating and/or moving equipment	Refer to General Work Activities JSA
Slips, trips and falls	Refer to General Work Activities JSA
Slips/falls from equipment	Refer to General Work Activities JSA
Struck by moving/mobile equipment	Refer to General Work Activities JSA
Temperature stress	Refer to General Work Activities JSA
Tipping over hazards	Refer to General Work Activities JSA
Severe weather/sunburn	Refer to General Work Activities JSA
Vehicle accidents	Refer to General Work Activities JSA
Visibility	Refer to General Work Activities JSA
Working alone	Refer to General Work Activities JSA

Potential Hazard	**Controls**
Equipment safety	Make sure all equipment is turned off before inspection. Check mobile equipment inspection forms. Inspect extension cords for fraying or bare wires. Make sure generators are in good condition and working properly. Check to ensure knives have sharp blades and are working properly. Always use knives in cutting motion away from body. Use cut-resistant gloves when using knives.
Atmospheric Monitoring	If directed by the H&SR or his designee, employees will continuously monitor air quality during field activities using a 4-gas meter. Ensure personnel using monitoring equipment are trained on the instrument(s) being used. Verify that equipment calibration is up to date. If it is not, calibrate accordingly. If vapors are expected, approach area of concern from upwind direction and stay upwind/crosswind of potential vapor sources. Should 4-gas meter alarms sound indicating an atmospheres containing less than 19.5% oxygen or having a lower explosive limit greater than 25%, proceed in accordance with the 4-gas Meter Operation procedure attached herewith. The same procedure will be followed if employees are exposed to hazardous substances including: - Hydrogen sulfide at 10 ppm or higher in the worker breathing zone - Carbon monoxide levels at 25 ppm or higher in the worker breathing zone - Ammonia levels at 25 ppm or higher in the worker breathing zone - VOC concentrations higher than 1 ppm (or greater than 10 ppm if benzene is not present) in worker breathing zone *Note; Incorporation of engineering controls during geosynthetics installation activities in areas of exposed waste including but not limited to placement of fans and blowers with odor control to blow air away from workers results in this activity being performed in non-exclusion zone conditions. The H&SR or his designee will likely be on site full-time during the first day of geosynthetics activities which in areas of exposed waste to monitor conditions and verify that the engineered controls are in place and operating properly. Should monitoring results indicate that atmospheric conditions are not being controlled at the levels described herein, additional engineering controls may be required.*
Material deployment	Lift material with mechanical equipment. Check all lifting straps to verify they are in good condition. If using vise grips for deployment, make sure the grip is tight and secure. Make sure footing is secure when pulling material. Forklift or highlift operators must watch out for obstacles and ground personnel. Operate forklifts and highlifts on level ground as much as possible. Mobile equipment must be kept away from the anchor trench. Wear proper gloves when handling materials. Use cut-resistant gloves when cutting materials with knives. Beware of knife blades and watch out for others while cutting away from body. Do not attempt to manually arrest moving rolls of material.
Seaming geomembrane, geotextiles and geocomposites	Keep work area clean and free of debris. Pay attention to footing when working on slopes. Use knives properly and make sure blade retracts when finished cutting. Wear proper gloves when operating seaming equipment to prevent burns. Make sure all guards are in place and operating. Do not step on or run over extension cords.

Potential Hazard	Controls
Housekeeping	Keep area clean, placing trash in proper receptacles. Keep storage, staging, and work areas, along with walkways on the job site free of obstructions. Use proper lifting techniques. Store all tools properly at the end of the day.

Approved By:

OM&M Manager	Date
H&S Representative	Date
Subcontractor Supervisor	Date
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Electrical Installation Activities **JOB SAFETY ANALYSIS FOR COUNTYWIDE WORK ACTIVITIES**		
Personal Protective Equipment (PPE)*	**Selected**	**Comments**
*Electrical Protective Equipment Standard (29 CFR 1910.137)	X	See Addendum A at end of document.
Safety Shoes (Steel-toed boots)	X	Required
Hard Hat (Class E – Eletrical)	X	As required (non-conductive hard hats- Class E (electrical) tested to withstand 20,000 volts) per ANSI/ISEA Z89.1-2003
Safety Glasses With Side Shields	X	Required
Hearing Protection	X	Required
High Visibility Clothing or Traffic Vest	X	Required
Air Purifying Respirator	X	If site-specific monitoring indicated use is necessary
Supplied Air – Level B	X	If site-specific monitoring indicated use is necessary
Gloves	X	Insulating gloves made of seamless rubber as required. Leather and/or cut-resistant gloves depending on task.
Other	X	-Four-gas meter capable of monitoring O_2, LEL, CO, and H_2S at the discretion of the H&SR or his designee. -Use insulating blankets, matting, covers, line hose, gloves, and sleeves made of rubber as necessary. Make sure all electrical PPE conforms to the Electrical Protective Equipment Standard (29 CFR 1910.137)
Training		All employees performing electrical work should be properly trained per the applicable federal, state and local standards and guidelines before performing work. They should also thoroughly review the OM&M HASP and all applicable JSA documents.

Potential Hazard	**Controls**
Chemical exposure	Refer to General Work Activities JSA
Contact with overhead structures or utilities	Refer to General Work Activities JSA
Excavation atmospheric monitoring	Refer to general Work Activities JSA
Buried utilities	Refer to general Work Activities JSA
Electric shock	Refer to general Work Activities JSA
Excavation safety	Refer to General Work Activities JSA
General hazards	Refer to general Work Activities JSA
Falling equipment	Refer to General Work Activities JSA
Fire/Explosion	Refer to General Work Activities JSA
Lifting (musculoskeletal injuries)	Refer to General Work Activities JSA
Lighting	Refer to General Work Activities JSA
Noise	Refer to General Work Activities JSA
Pinch hazards	Refer to General Work Activities JSA
Risk of being struck by vehicles	Refer to General Work Activities JSA
Rotating and/or moving equipment	Refer to General Work Activities JSA
Slips, trips and falls	Refer to General Work Activities JSA
Slips/falls from equipment	Refer to General Work Activities JSA
Struck by moving/mobile equipment	Refer to General Work Activities JSA

Potential Hazard	Controls
Temperature stress	Refer to General Work Activities JSA
Tipping over hazards	Refer to General Work Activities JSA
Severe weather/sunburn	Refer to General Work Activities JSA
Vehicle accidents	Refer to General Work Activities JSA
Visibility	Refer to General Work Activities JSA
Working alone	Refer to General Work Activities JSA
Energized equipment, stored energy	All activities being performed where stored energy may result in injury to personnel or damage to equipment must be managed in accordance with the CWRDF Electrical Safety Procedure and Lockout/Tagout procedure attached herewith. Utilize proper PPE when performing electrical work.
Ladder related injuries	All use of ladders must conform with the CWRDF Portable Ladder Standard attached herewith.
Confined spaces	All activities being performed in areas that meet the conditions of a confined space must be conducted in accordance with the CWRDF Confined Space procedure attached herewith.
Cuts, abrasions, puncture wounds	Use the correct tool for the job. Wear the appropriate PPE (leather/cut-resistant gloves, insulated gloves, pants, hard hat, safety glasses, etc.).
Muscle strains and pulls	Pulling wires, moving pumps and electrical equipment without taking proper steps may cause muscle strains and pulls. When pulling wires through conduit and into control panels use pulleys, rope, come-alongs, etc. as appropriate to provide mechanical assistance. Use the buddy system when physically lifting/moving heavy loads.
Electrical burns and shocks	Inspect tools/equipment prior to use. Defective tools/equipment shall be tagged and set aside for repairs. Use the correct tool/piece of equipment for the job. Use Lockout/Tagout procedures to de-energize equipment that workers may come in contact with. Maintain a safe working distance from energized equipment/parts. If this is not possible, place guards/shielding between energy source and workers. Work involving electrical wires, control panels, wiring pumps, electrical systems shall be conducted in accordance with the 1) CWRDF Electrical Safety procedure and the 2) Hilscher-Clarke Electrical Safety procedure, respectively. The CWDRF and Hilscher-Clarke Electrical Safety procedures are attached herewith. Only authorized and qualified individuals are permitted to perform electrical work.

ADDENDUM A

29CFR 1910.137
Electrical Protective Equipment Standard

(a) Design requirements. Insulating blankets, matting, covers, line hose, gloves, and sleeves made of rubber shall meet the following requirements:

(1) Manufacture and marking.

(i) Blankets, gloves, and sleeves shall be produced by a seamless process.

(ii) Each item shall be clearly marked as follows:

[A] Class 0 equipment shall be marked Class 0.
[B] Class 1 equipment shall be marked Class 1.
[C] Class 2 equipment shall be marked Class 2.
[D] Class 3 equipment shall be marked Class 3.
[E] Class 4 equipment shall be marked Class 4.
[F] Non-ozone-resistant equipment other than matting shall be marked Type I.
[G] Ozone-resistant equipment other than matting shall be marked Type II.

[H] Other relevant markings, such as the manufacturer's identification and the size of the equipment, may also be provided.

(iii) Markings shall be nonconducting and shall be applied in such a manner as not to impair the insulating qualities of the equipment.

(iv) Markings on gloves shall be confined to the cuff portion of the glove.

(2) Electrical requirements.

(i) Equipment shall be capable of withstanding the a-c proof-test voltage specified in Table I-2 or the d-c proof-test voltage specified in Table I-3.

[A] The proof test shall reliably indicate that the equipment can withstand the voltage involved.

[B] The test voltage shall be applied continuously for 3 minutes for equipment other than matting and shall be applied continuously for 1 minute for matting.

[C] Gloves shall also be capable of withstanding the a-c proof-test voltage specified in Table I-2 after a 16-hour water soak. (See the note following paragraph (a)(3)(ii)[B] of this section.)

(ii) When the a-c proof test is used on gloves, the 60-hertz proof-test current may not exceed the values specified in Table I-2 at any time during the test period.

[A] If the a-c proof test is made at a frequency other than 60 hertz, the permissible proof-test current shall be computed from the direct ratio of the frequencies.

[B] For the test, gloves (right side out) shall be filled with tap water and immersed in water to a depth that is in accordance with Table I-4. Water shall be added to or removed from the glove, as necessary, so that the water level is the same inside and outside the glove.

[C] After the 16-hour water soak specified in paragraph (a)(2)(i)[C] of this section, the 60-hertz proof-test current may exceed the values given in Table I-2 by not more than 2 milliamperes.

(iii) Equipment that has been subjected to a minimum breakdown voltage test may not be used for electrical protection. (See the note following paragraph (a)(3)(ii)[B] of this section.)

(iv) Material used for Type II insulating equipment shall be capable of withstanding an ozone test, with no visible effects. The ozone test shall reliably indicate that the material will resist ozone exposure in actual use. Any visible signs of ozone deterioration of the material, such as checking, cracking, breaks, or pitting, is evidence of failure to meet the requirements for ozone-resistant material. (See the note following paragraph (a)(3)(ii)[B] of this section.)

(3) Workmanship and finish.

(i) Equipment shall be free of harmful physical irregularities that can be detected by the tests or inspections required under this section.

(ii) Surface irregularities that may be present on all rubber goods because of imperfections on forms or molds or because of inherent difficulties in the manufacturing process and that may appear as indentations, protuberances, or imbedded foreign material are acceptable under the following conditions:

[A] The indentation or protuberance blends into a smooth slope when the material is stretched.

[B] Foreign material remains in place when the insulating material is folded and stretches with the insulating material surrounding it.

Note: Rubber insulating equipment meeting the following national consensus standards is deemed to be in compliance with paragraph (a) of this section:

American Society for Testing and Materials (ASTM) D 120-87, Specification for Rubber Insulating Gloves.

ASTM D 178-93 (or D 178-88), Specification for Rubber Insulating Matting.

ASTM D 1048-93 (or D 1048-88a), Specification for Rubber Insulating Blankets.

ASTM D 1049-93 (or D 1049-88), Specification for Rubber Insulating Covers.

ASTM D 1050-90, Specification for Rubber Insulating Line Hose.
ASTM D 1051-87, Specification for Rubber Insulating Sleeves.
These standards contain specifications for conducting the various tests required in paragraph (a) of this section. For example, the a-c and d-c proof tests, the breakdown test, the water soak procedure, and the ozone test mentioned in this paragraph are described in detail in the ASTM standards.

(b) In-service care and use.

(1) Electrical protective equipment shall be maintained in a safe, reliable condition.

(2) The following specific requirements apply to insulating blankets, covers, line hose, gloves, and sleeves made of rubber:

(i) Maximum use voltages shall conform to those listed in Table I-5.

(ii) Insulating equipment shall be inspected for damage before each day's use and immediately following any incident that can reasonably be suspected of having caused damage. Insulating gloves shall be given an air test, along with the inspection.

(iii) Insulating equipment with any of the following defects may not be used:

[A] A hole, tear, puncture, or cut.

[B] Ozone cutting or ozone checking (the cutting action produced by ozone on rubber under mechanical stress into a series of interlacing cracks).

[C] An embedded foreign object.

[D] Any of the following texture changes: swelling, softening, hardening, or becoming sticky or inelastic.

[E] Any other defect that damages the insulating properties.

(iv) Insulating equipment found to have other defects that might affect its insulating properties shall be removed from service and returned for testing under paragraphs (b)(2)(viii) and (b)(2)(ix) of this section.

(v) Insulating equipment shall be cleaned as needed to remove foreign substances.

(vi) Insulating equipment shall be stored in such a location and in such a manner as to protect it from light, temperature extremes, excessive humidity, ozone, and other injurious substances and conditions.

(vii) Protector gloves shall be worn over insulating gloves, except as follows:

[A] Protector gloves need not be used with Class 0 gloves, under limited-use conditions, where small equipment and parts manipulation necessitate unusually high finger dexterity.

Note: Extra care is needed in the visual examination of the glove and in the avoidance of handling sharp objects.

[B] Any other class of glove may be used for similar work without protector gloves if the employer can demonstrate that the possibility of physical damage to the gloves is small and if the class of glove is one class higher than that required for the voltage involved. Insulating gloves that have been used without protector gloves may not be used at a higher voltage until they have been tested under the provisions of paragraphs (b)(2)(viii) and (b)(2)(ix) of this section.

(viii) Electrical protective equipment shall be subjected to periodic electrical tests. Test voltages and the maximum intervals between tests shall be in accordance with Table I-5 and Table I-6.

(ix) The test method used under paragraphs (b)(2)(viii) and (b)(2)(ix) of this section shall reliably indicate whether the insulating equipment can withstand the voltages involved.
Note: Standard electrical test methods considered as meeting this requirement are given in the following national consensus standards:
American Society for Testing and Materials (ASTM) D 120-87, Specification for Rubber Insulating Gloves.
ASTM D 1048-93, Specification for Rubber Insulating Blankets.
ASTM D 1049-93, Specification for Rubber Insulating Covers.
ASTM D 1050-90, Specification for Rubber Insulating Line Hose.
ASTM D 1051-87, Specification for Rubber Insulating Sleeves.
ASTM F 478-92, Specification for In-Service Care of Insulating Line Hose and Covers.

ASTM F 479-93, Specification for In-Service Care of Insulating Blankets.
ASTM F 496-93b, Specification for In-Service Care of Insulating Gloves and Sleeves.
(x) Insulating equipment failing to pass inspections or electrical tests may not be used by employees, except as follows:

[A] Rubber insulating line hose may be used in shorter lengths with the defective portion cut off.
[B] Rubber insulating blankets may be repaired using a compatible patch that results in physical and electrical properties equal to those of the blanket.
[C] Rubber insulating blankets may be salvaged by severing the defective area from the undamaged portion of the blanket. The resulting undamaged area may not be smaller than 22 inches by 22 inches (560 mm by 560 mm) for Class 1, 2, 3, and 4 blankets.
[D] Rubber insulating gloves and sleeves with minor physical defects, such as small cuts, tears, or punctures, may be repaired by the application of a compatible patch. Also, rubber insulating gloves and sleeves with minor surface blemishes may be repaired with a compatible liquid compound. The patched area shall have electrical and physical properties equal to those of the surrounding material. Repairs to gloves are permitted only in the area between the wrist and the reinforced edge of the opening.

(xi) Repaired insulating equipment shall be retested before it may be used by employees.
(xii) The employer shall certify that equipment has been tested in accordance with the requirements of paragraphs (b)(2)(viii), (b)(2)(ix), and (b)(2)(xi) of this section. The certification shall identify the equipment that passed the test and the date it was tested. Note: Marking of equipment and entering the results of the tests and the dates of testing onto logs are two acceptable means of meeting this requirement.

Table I-2 - A-C Proof-Test Requirements

Class of equipment	**Proof-test voltage rms V**	**Maximum proof-test current, mA (gloves only)**			
		267 mm (10.5 in.) glove	**356 mm (14 in.) glove**	**406 mm (16 in.) glove**	**457 mm (18 in.) glove**
0	5,000	8	12	14	16
1	10,000		14	16	18
2	20,000		16	18	20
3	30,000		18	20	22
4	40,000			22	24

Table I-3 - D-C Proof-Test Requirements

Class of equipment	Proof-test voltage
0	20,000
1	40,000
2	50,000
3	60,000
4	70,000

Note: The d-c voltages listed in this table are not appropriate for proof test- ing rubber insulating line hose or covers. For this equipment, d-c proof tests shall use a voltage high enough to indicate that the equipment can be safely used at the voltages listed in Table I-4. See ASTM D 1050-90 and ASTM D 1049-88 for further information on proof tests for rubber insulating line hose and covers.

Table I-4 - Glove Tests - Water Level 1,2

Class of glove	AC proof test		DC proof test	
	mm.	in.	mm.	in.

0	38	1.5	38	1.5
1	38	1.5	51	2.0
2	64	2.5	76	3.0
3	89	3.5	102	4.0
4	127	5.0	153	6.0

1 The water level is given as the clearance from the cuff of the glove to the water line, with a tolerance of ±13 mm. (±0.5 in.).
2 If atmospheric conditions make the specified clearances impractical, the clearances may be increased by a maximum of 25 mm. (1 in.).

Table I-5 - Rubber Insulating Equipment Voltage Requirements			
Class of equipment	Maximum use voltage[1] a-c — rms	Retest voltage[2] a-c — rms	Retest voltage[2] d-c — avg
0	1,000	5,000	20,000
1	7,500	10,000	40,000
2	17,000	20,000	50,000
3	26,500	30,000	60,000
4	36,000	40,000	70,000

1 The maximum use voltage is the a-c voltage (rms) classification of the protective equipment that designates the maximum nominal design voltage of the energized system that may be safely worked. The nominal design voltage is equal to the phase-to-phase volt- age on multiphase circuits. However, the phase-to-ground potential is considered to be the nominal design voltage:
(1) If there is no multiphase exposure in a system area and if the voltage exposure is limited to the phase-to-ground potential, or
(2) If the electrical equipment and devices are insulated or isolated or both so that the multiphase exposure on a grounded wye circuit is removed.
2 The proof-test voltage shall be applied continuously for at least 1 minute, but no more than 3 minutes.

Table I-6 - Rubber Insulating Equipment Test Intervals	
Type of equipment	When to test
Rubber insulating line hose.	Upon indication that insulating value is suspect.
Rubber insulating covers.	Upon indication that insulating value is suspect.
Rubber insulating blankets.	Before first issue and every 12 months thereafter.[1]
Rubber insulating gloves.	Before first issue and every 6 months thereafter.[1]
Rubber insulating sleeves.	Before first issue and every 12 months thereafter.[1]

1 If the insulating equipment has been electrically tested but not issued for service, it may not be placed into service unless it has been electrically tested within the previous 12 months.

Approved By:

OM&M Manager	Date
H&S Representative	Date
Contractor Supervisor	Date
Contractor Supervisor	Date

Contractor Supervisor	Date
Contractor Supervisor	Date
Contractor Supervisor	Date
Contractor Supervisor	Date
Contractor Supervisor	Date
Contractor Supervisor	Date
Contractor Supervisor	Date

APPENDIX J

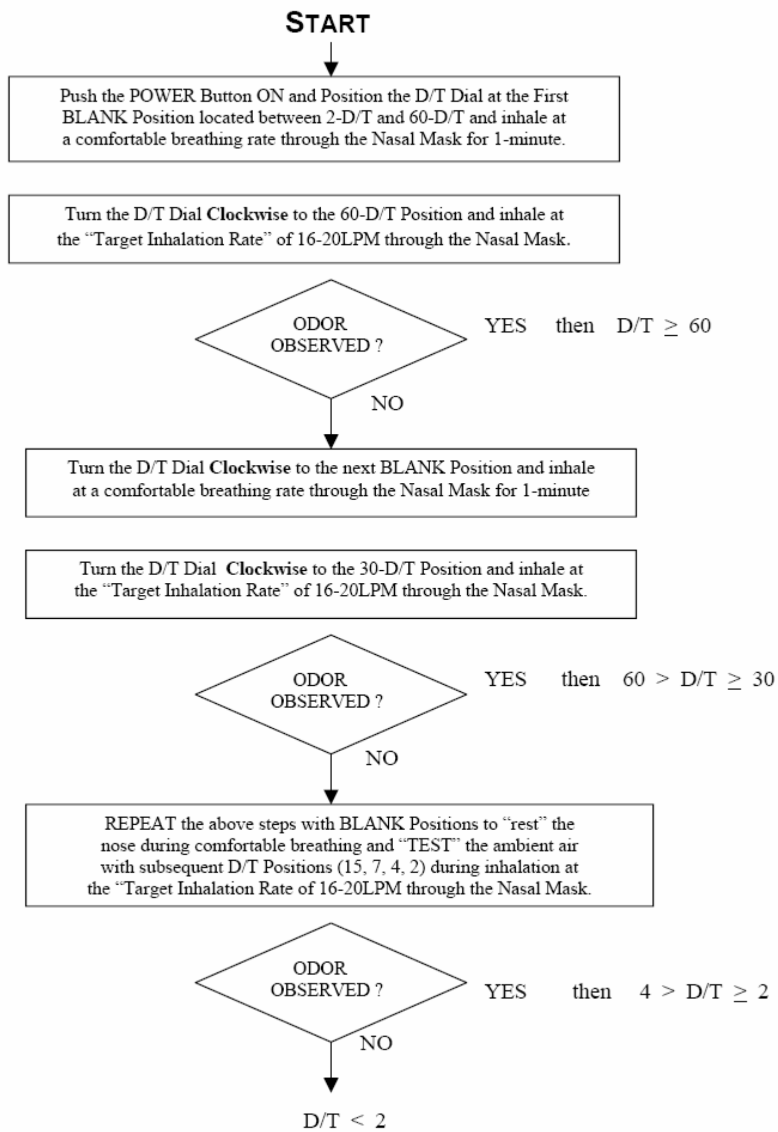
Nasal Ranger Operation

APPENDIX J

NASAL RANGER MANUFACTURERS DATA

NASAL RANGER® FIELD OLFACTOMETER

TEST PROCEDURE FLOW CHART



Nasal Ranger® Field Olfactometer

QUICK START GUIDE

The Nasal Ranger® Field Olfactometer, a portable odor detecting and measuring device developed by St. Croix Sensory, Inc., is the "state-of-the-art" in field olfactometry for confidently measuring and quantifying odor strength in the ambient air using the Operating Principle of mixing odorous ambient air with odor-free filtered air in discrete volume ratios called "Dilution-to-Threshold" ratios (D/T ratios).

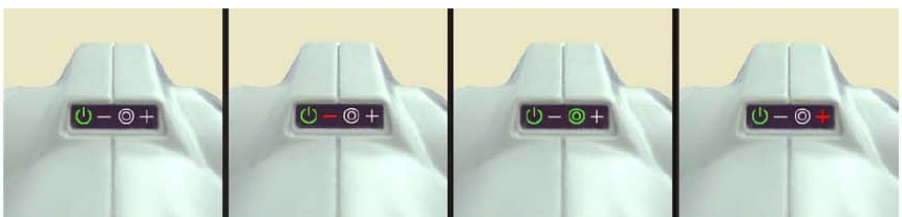
Field olfactometry with the Nasal Ranger® Field Olfactometer is a cost effective means to quantify odor strength. Facility operators, community inspectors, and neighborhood citizens can confidently monitor odor strength at specific locations around a facility's property line and within the community.

The following information allows an informed user to quickly understand the operation of the Nasal Ranger Field Olfactometer. It assumes the user has some familiarity with field olfactometry and odor monitoring concepts. [See also "Operation Principles" and "Application Guide"]

1. Hold the Nasal Ranger Field Olfactometer parallel to the ground and press the power button which is located below the nasal mask. All four LED lights should illuminate for one second, and then the 1st (left) Power LED will stay illuminated.

2. Follow the Test Procedure Flow Chart for the sequenced testing procedure.

3. The LED's on the Nasal Ranger Field Olfactometer provide feedback for the user to inhale at the "factory calibration flow rate". The LED's are labeled as follows:



1st	2nd	3rd	4th
Power ON	Inhalation Rate too low Need to increase Inhalation Rate	Correct Inhalation Rate 16-20 LPM	Inhalation Rate too high Need to decrease Inhalation Rate

4. After 45 seconds of non-use, the 1st LED will blink slowly in a "Power Save" mode.

5. After five minutes of non-use, the Power will automatically turn OFF.

6. To turn off the Nasal Ranger Field Olfactometer manually, press and hold the power button for 3 seconds. All four LEDS will illuminate and then power off. The Nasal Ranger Field Olfactometer is now OFF.

Thank you for joining the ranks of Nasal Ranger® owners. The Nasal Ranger® Field Olfactometer is a precision calibrated tool and will yield reliable odor strength results for your monitoring and measurement needs.

APPENDIX K

Odor Complaint Log

Tracking Number: _________

Countywide Recycling and Disposal Facility
Investigated Complaint Form

Date: _________ Time of Complaint: __________ Time of Inspection: ___________

Name of Inspector: ____

Name of Complainant: ____

Age: ________ Sex: _______

Address: ____

GPS Location: ______________________________ N ___________________________________W

Vector to Landfill ____

Subjective Level of Odor (Complainant) Scale 0-4 ____

Nasal Ranger Reading ______________________________________

Duration of Odor: ________ days ________ hours ________ minutes

Characteristic of Odor: ____

Weather Conditions:

Temperature: ___________

Barometric Pressure: ___________

Wind Direction: ___________

Wind Speed: __________mph

Precipitation: __________

Humidity: __________%

Did an investigation of the source of odors occur? Yes / No

If no investigation occurred explain why: ____

Results of the investigation: ____

Summarize corrective actions planned or taken by Countywide:

____

Notes: ____

____

____

APPENDIX L

Odor Neutralizer Product Specifications

Countywide Remediation Area

Odor Neutralizer Information

June 15, 2009

Manufacturer:	Clean World Industries, Inc. 471 Second Street Reynolds Industrial Park Transfer, PA 16154 (724) 962-0720
Product Name:	CWI – Lotus
Mix Ratio:	4000 gallons water:1 gallon product for general odor 3000 gallons water:1 gallon product for intense odors
Application:	Spray through nozzles designed to deliver fine mist in air. Space nozzles to form uniform, merged cloud about 20 feet from nozzles. Set neutralizer delivery to be downwind of odor source to let odor move through neutralizer plume when possible. Neutralizer will work, but not as effectively if set upwind of odor source.

APPENDIX M

West Berm Stability Analyses

Stability of the West Berm

1. Existing Conditions shown in Plan view (Sheet C-1) the legend explains the various surfaces show.
    a. Bedrock is based on the PTI explorations and was developed by Eagon and Associates
    b. Topography represents current topography
    c. Baseliner elevation is based on the asbuilt survey data included in the certification reports
    d. Existing monitoring wells are shown in the plan view
2. Drawings XS-1 through XS 5 depict cross sectional views for a N-S alignment at East 42000.
    a. The X axis is the offset left or right of the East 42000 line, negative being to the west.
    b. The X sections are to scale with no exaggeration.
    c. Surfaces shown are listed in the legend
    d. The stationing call outs represent the Northing of the cross section
    e. These northings correspond to those identifying the stability analyses
3. Stability Analyses
    a. Analyses were performed at cross sections along N23794, N24207, and N24500, representing sections where the soil thickness is deep to those where bedrock is quite shallow.
    b. The analyses were performed to determine the approximate piezometric levels corresponding to Factors of Safety for failure surfaces extending to downward to the west and intersecting at least the western edge of the perimeter road.
    c. Figures 1-9 depict the analyses performed. The Sensitivity feature of the Geostudio program was used to evaluate the impact of the piezometric surfaces on the berm stability. In all cases the analyses determined that the berm stability was not sensitive to the strength assigned to the waste mass or the water surface within the waste mass. All failure surfaces impacted by the piezometric surfaces with factors of safety lower than 1.6 were found to be located totally to the west of the limit of waste.
    d. Piezometric levels corresponding to the factors of safety of 1.5 and 1.2 are depicted on the figures. The resulting values are shown below.

Section Northing	Water Table Elevation at west edge of crest of berm for FS 1.5	Water Table Elevation at west edge of crest of berm for FS 1.2
23794	1048	1102
24027	1081	1120
24500	1095	1116

All elevations in feet.

    e. The above values can be adopted for the trigger levels requested by the OH EPA for initiating various actions.

4. Proposed Piezometers
    a. Three piezometers locations along the west edge of the berm are proposed. These are shown in on Drawing C-1. They are labeled WBPZ-*. These piezometers would be installed at either 5 feet below the existing ground water or the top of rock, whichever is less in depth.
    b. Vibrating Wire Piezometers are recommended as the site already possesses the instruments to read them and they are quite robust and show little drift with time.
5. Parameters Chosen for Stability Analyses
    a. Heat impacted waste was assigned an effective friction angle (ϕ') of 20° to be consistent with the analysis provided by the State. Countywide does not endorse this value in any way but as it did not impact results negatively it was used.
    b. The compacted mine spoils and rock fill in the berm were assigned shear strengths that were developed in the work at the site during the last expansion project. These strengths were based on tests run on completely saturated soils with the coarse fraction removed. They are consistent with reported in the literature. No reduction was assigned for inundation, as the tests were run on totally saturated samples. The assigned strength was ϕ'=32°, c'=200 psf.
    c. The insitu mine spoil materials were assigned a lower strength (ϕ'=29°, c'=0) again reflecting testing performed at the site and submitted to the State as part of the PTI's
    d. Density of the compacted spoils was assignded as 135 pcf, slightly under the average 136 pcf reported during the construction of the berm in the certification report (the mean of approximately 500 tests in situ during construction).
    e. No reduction for heat impact was assigned to the berm soils. There is no plausible way for the landfill mass to raise the temperature of the soils in the berm sufficiently to impact the shear strength. No evidence of heat impact on shear strength of the soils has been observed anywhere on site.
    f. Parameter details are provided in each of the runs, printed directly from the software.

COUNTYWIDE RDF

WEST SLOPE STABILITY EVALUATION

INDEX OF DRAWINGS

SHT No.	DWG ID	DRAWING DESCRIPTION
1	C-1	WEST BERM PLAN SHEET
2	XS-1	XS N236+69.81 & N237+94.82
3	XS-2	XS N239+12.94 & N240+27.15
4	XS-3	XS N241+66.31 & N242+96.18
5	XS-4	XS N245+00 & 246+88.10
6	XS-5	XS 248+26.79

REPUBLIC SERVICES
OF OHIO II, LLC

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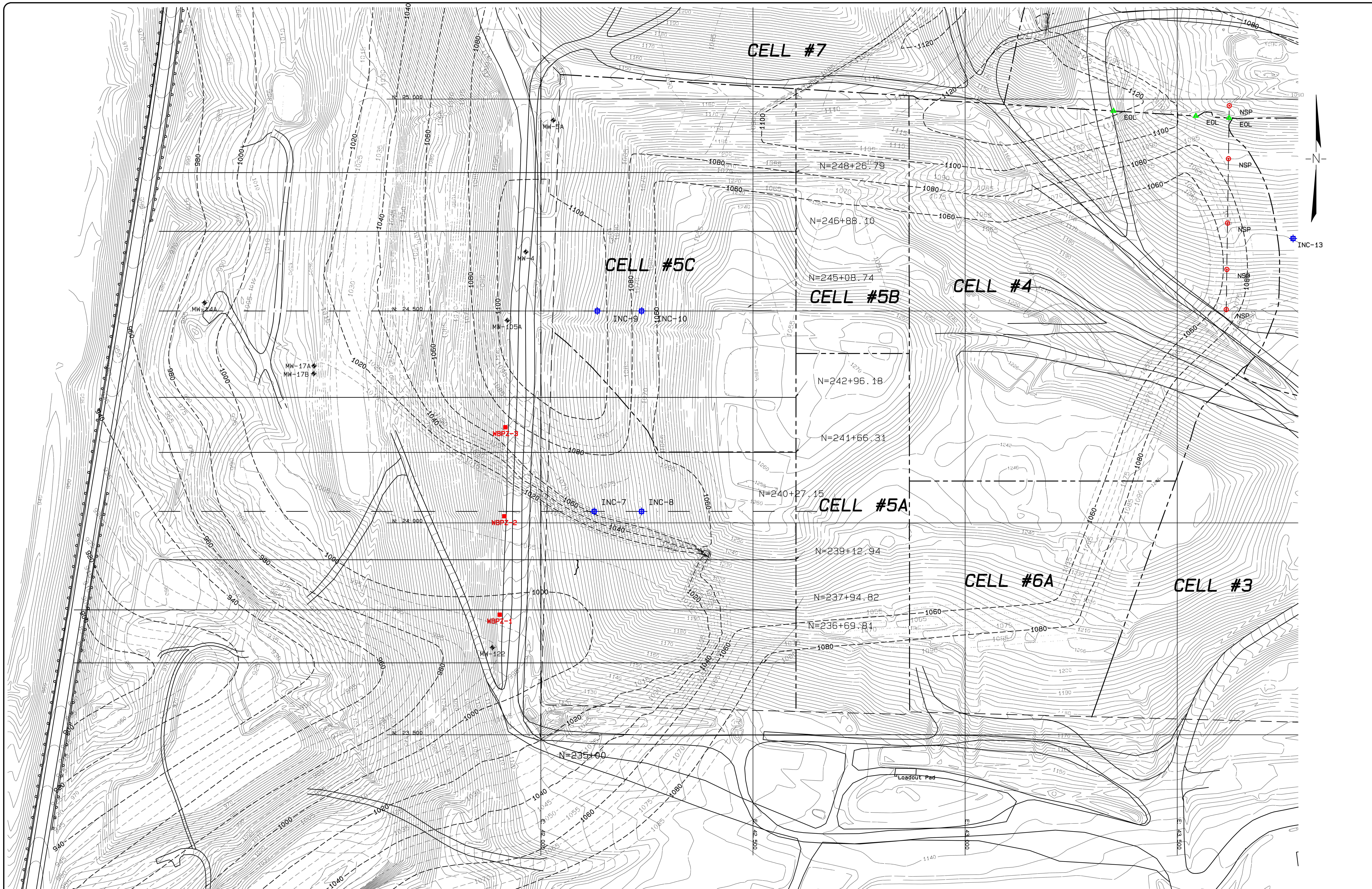
EAST SPARTA, OH 44626
330-874-3855

P. J. CAREY & ASSOCIATES, P.C.
5878 Valine Way
Sugar Hill, GA 30518
Tel: 678 482-5193
www.pjcarey.com



LEGEND

MW-106A	MONITORING WELL
	5' CONTOUR - EXISTING GROUND
	5' CONTOUR - BEDROCK
	CELL LIMIT
INC-5	INCLINOMETER
	EXISTING WASTE BOUNDARY

NOTE:
SOLID LINES REPRESENT 3-07 TOPOGRAPHY
OUTSIDE OF LIMITS OF 07 TOPOGRAPHY 2002 TOPO IS USED
DASHED LINES REPRESENT BASE LINER GRADES
HIDDEN GRAY TONE REPRESENTS BEDROCK CONTOURS

GRAPHIC SCALE 1"=100'
0 100 200 300

REPUBLIC SERVICES OF OHIO II, LLC

DATE | REVISION

P. J. CAREY & ASSOCIATES, P.C.
5878 VALINE WAY, SUGAR HILL, GA. 30518

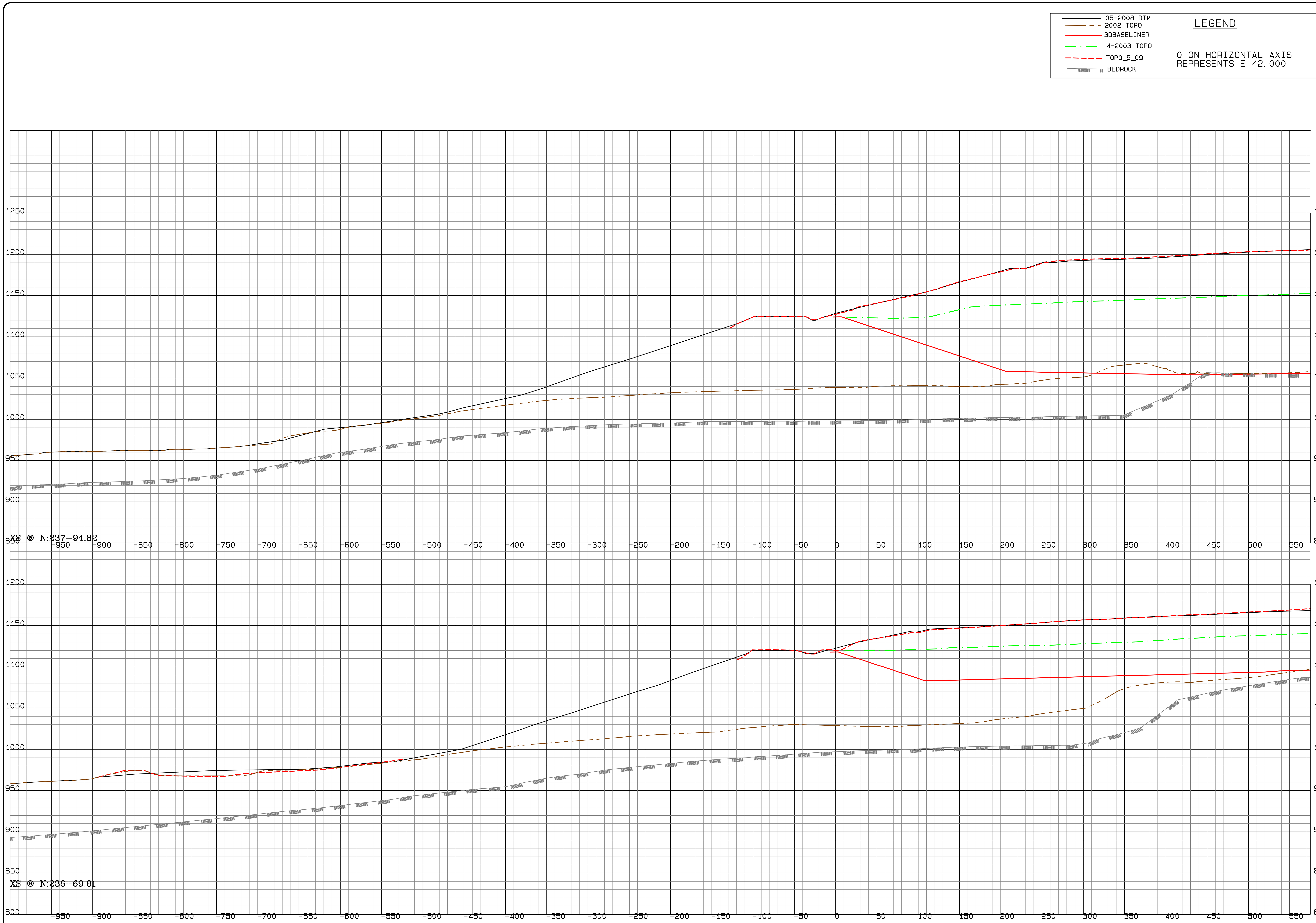
PROJ. NO.: 131.014
DATE: 7/21/2009
DESIGNED BY:
DRAWN BY:
CHECKED BY:
APPROVED BY:

WEST BERM PLAN SHEET

COUNTYWIDE RDF
WEST SLOPE STABILITY EVALUATION
(PROJ_proj_name2)

DRAWING
C-1

SHEET 1
OF 6



REPUBLIC SERVICES OF OHIO II, LLC

REVISION	DATE
1	
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P. J. CAREY & ASSOCIATES, P.C.
5878 VALINE WAY, SUGAR HILL, GA. 30518

PROJ. NO.: 131.014
DATE: 7/21/2009
DESIGNED BY: Peter Carey
DRAWN BY: Peter Carey
CHECKED BY:
APPROVED BY:

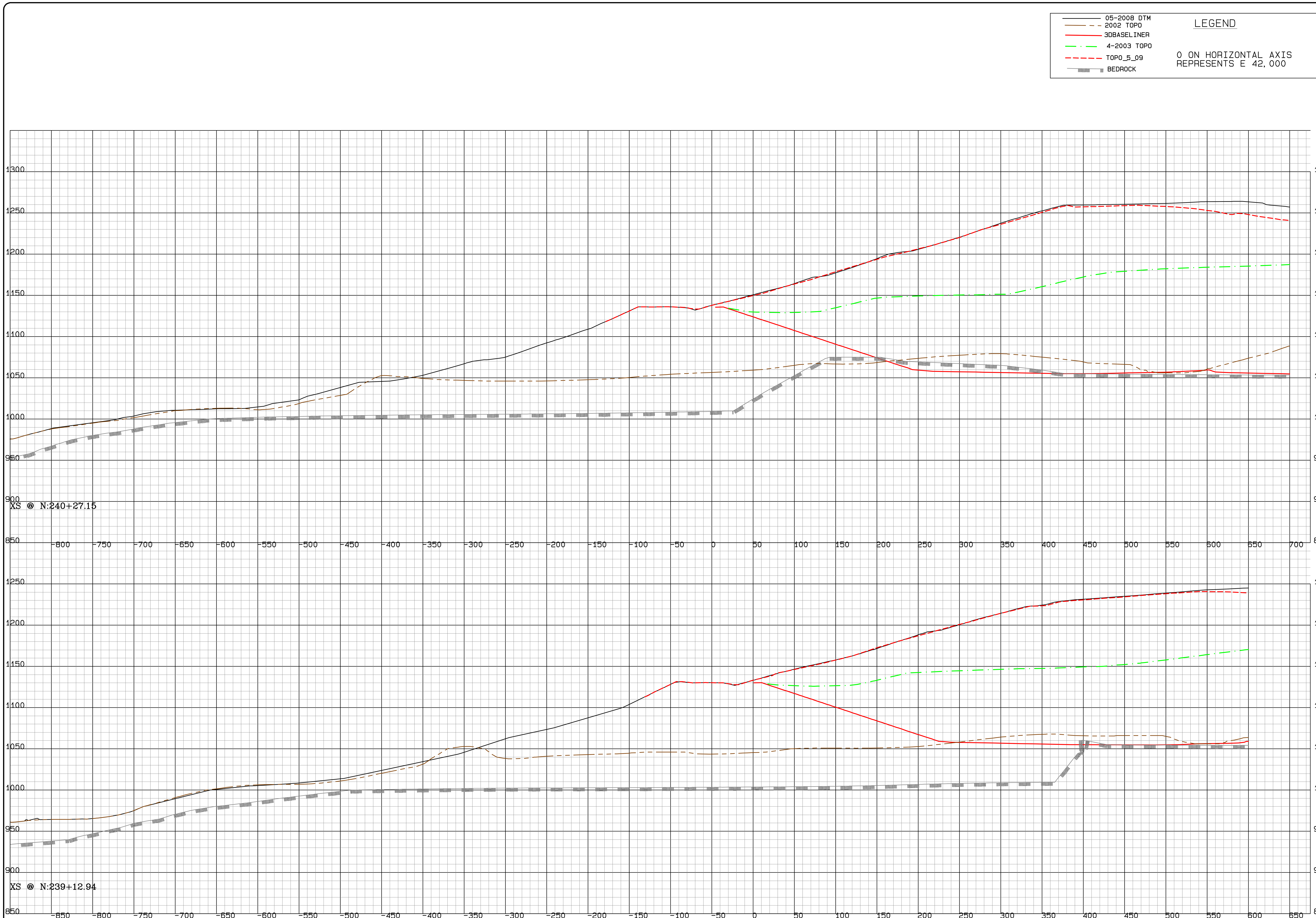
XS N236+69.81 & N237+94.82

COUNTYWIDE RDF
WEST SLOPE STABILITY EVALUATION
(PRJD_proj_name2)

DRAWING
XS-1

SHEET 2 OF 6

Project Desc.: Prototype Drawing for 24 x 36 Sheet Path: N:\Countywide\F&O Confidential\inclinometers\WSLOPE_STEVAL_7-09.pro Plot Date/Time: Tue Jul 21, 2009 / 19:08:16



REPUBLIC SERVICES OF OHIO II, LLC

REVISION	DATE
1	
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3	
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P. J. CAREY & ASSOCIATES, P.C.
5878 VALINE WAY, SUGAR HILL, GA. 30518

PROJ. NO.: 131.014
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DRAWN BY: Peter Carey
CHECKED BY:
APPROVED BY:

XS N239+12.94 & N240+27.15

COUNTYWIDE RDF
WEST SLOPE STABILITY EVALUATION
(PRJD_proj_name2)

DRAWING XS-2

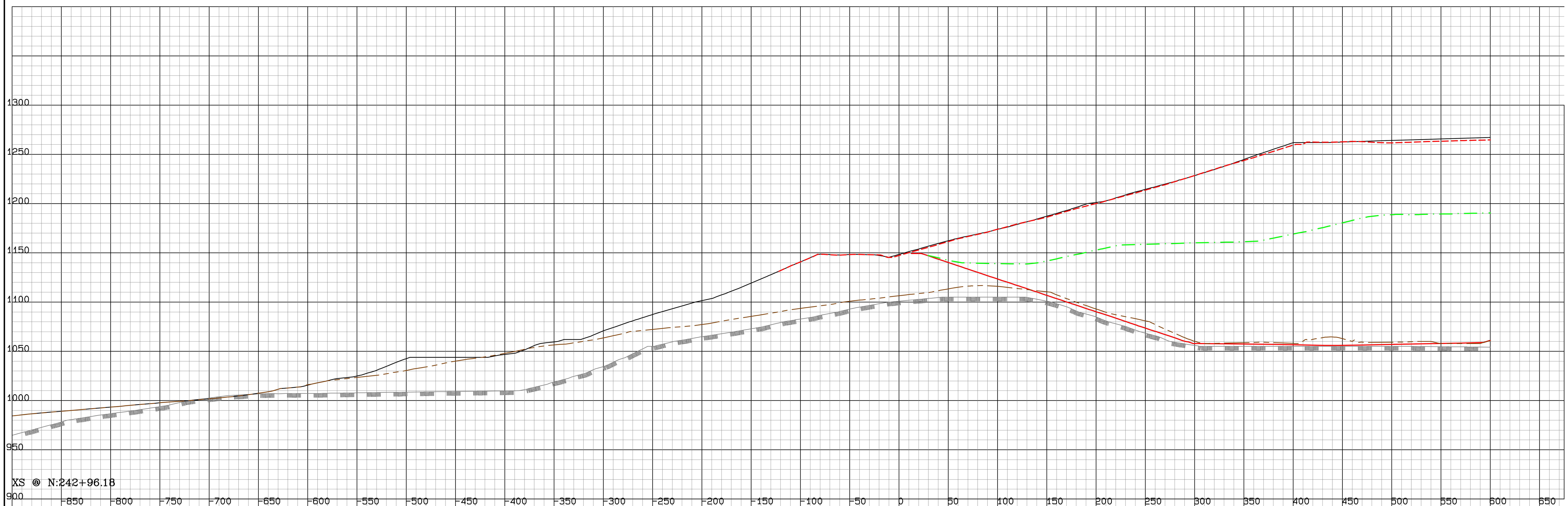
SHEET 3 OF 6

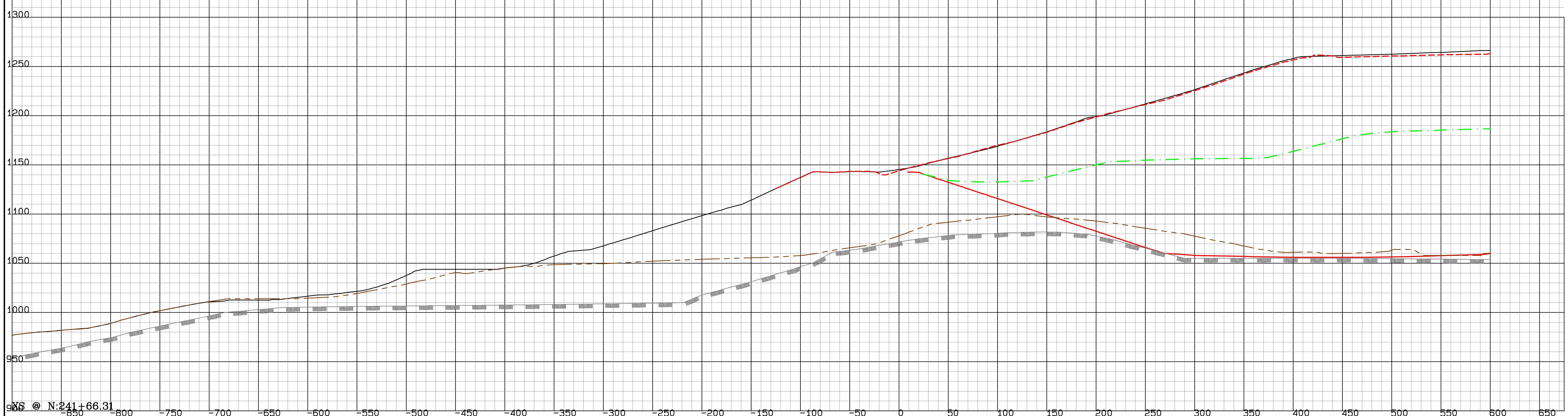
Project Desc.: Prototype Drawing for 24 x 36 Sheet Path: N:\Countywide\PSO Confidential\inclinometers\SLOPE_STEVAL_7-09.pro Plot Date/Time: Tue Jul 21, 2009 / 10:08:19

LEGEND

- 05-2008 DTM
- 2002 TOPO
- 3DBASELINER
- 4-2003 TOPO
- TOPO_5_09
- BEDROCK

0 ON HORIZONTAL AXIS REPRESENTS E 42,000





REPUBLIC SERVICES OF OHIO II, LLC

DATE	REVISION
	1
	2
	3
	4
	5

P. J. CAREY & ASSOCIATES, P.C.

5870 VALINE WAY, SUGAR HILL, GA. 30518

PROJ. NO.: 131.014
DATE: 7/21/2009
DESIGNED BY: Peter Carey
DRAWN BY: Peter Carey
CHECKED BY:
APPROVED BY:

XS N241+66.31 & N242+96.18

COUNTYWIDE RDF
WEST SLOPE STABILITY EVALUATION
(PRJD_proj_name2)

DRAWING
XS-3

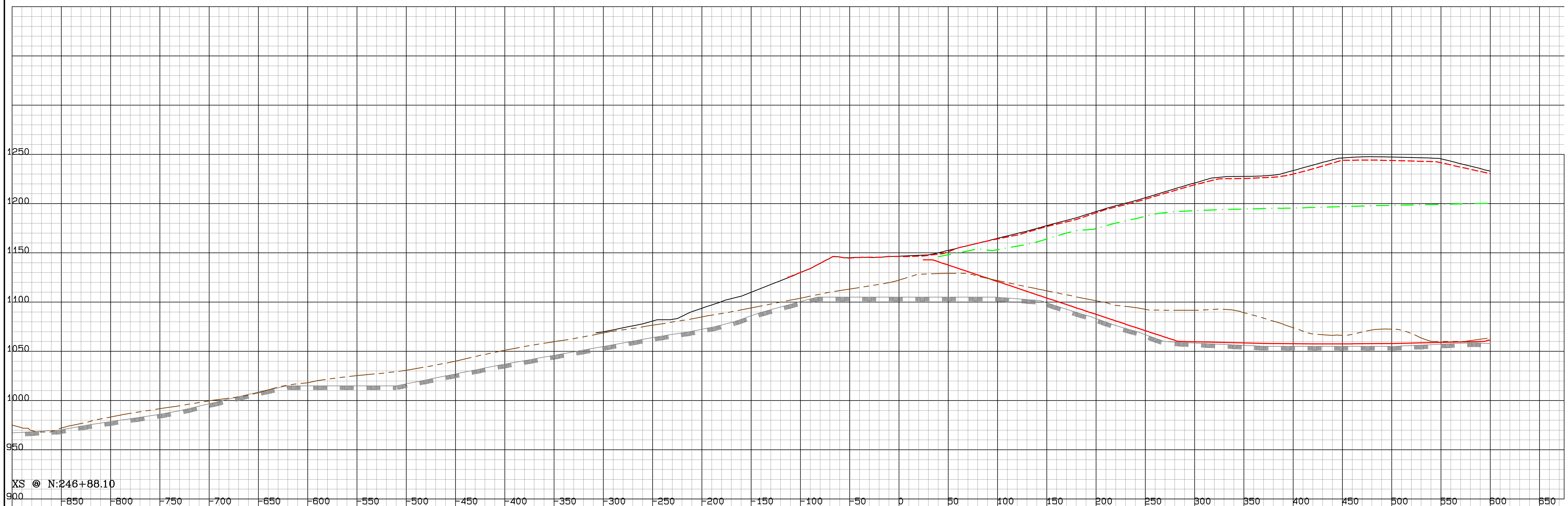
SHEET 4 OF 6

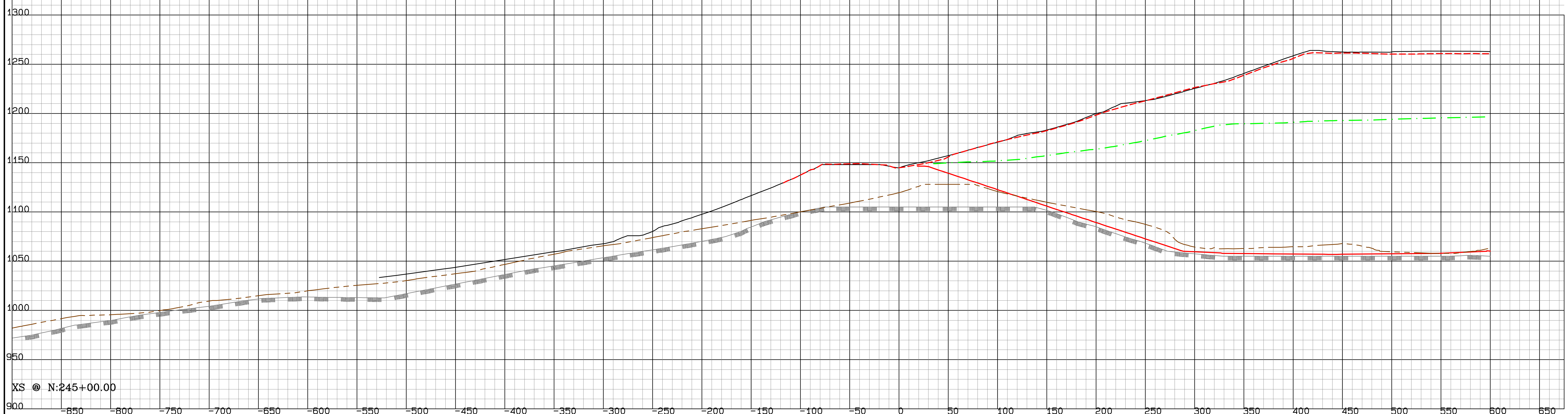
Project Desc.: Prototype Drawing for 24 x 36 Sheet Path: N:\Countywide\VSO Confidential\inclinometers\WSLOPE_STEVAL_7-09.pro Plot Date/Time: Tue Jul 21, 2009 / 19:08:21

LEGEND

- 05-2008 DTM
- 2002 TOPO
- 3DBASELINER
- 4-2003 TOPO
- TOPO_5_09
- BEDROCK

0 ON HORIZONTAL AXIS
REPRESENTS E 42,000





REPUBLIC SERVICES OF OHIO II, LLC

DATE	REVISION
	1
	2
	3
	4
	5

P. J. CAREY & ASSOCIATES, P.C.
5878 VALINE WAY, SUGAR HILL, GA. 30518

PROJ. NO.: 131.014
DATE: 7/21/2009
DESIGNED BY: Peter Carey
DRAWN BY: Peter Carey
CHECKED BY:
APPROVED BY:

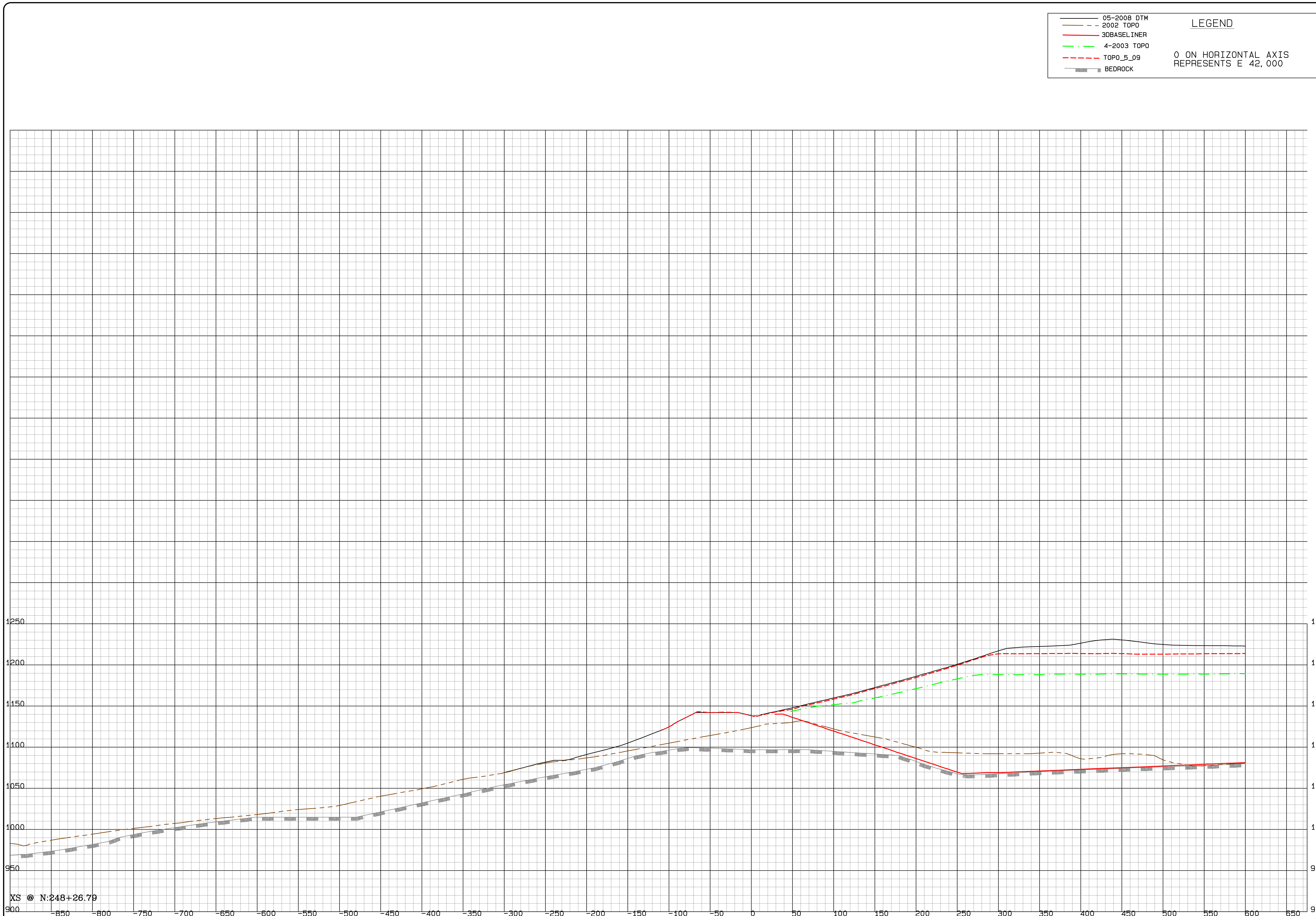
XS N245+00 & 246+88.10

COUNTYWIDE RDF
WEST SLOPE STABILITY EVALUATION
(PROJ_proj_name2)

DRAWING XS-4

SHEET 5 OF 6

Project Desc.: Prototype Drawing for 24 x 36 Sheet Path: N:\Countywide\VSO Confidential\inclinometers\WSLOPE_STEVAL_7-09.pro Plot Date/Time: Tue Jul 21, 2009 / 19:08:24



Project Desc.: Prototype Drawing for 24 x 36 Sheet   Path: N:\Countywide\F&O Confidential\inclinometers\WSLOPE_STEVAL_7-09.pro   Plot Date/Time: Tue Jul 21, 2009 / 19:08:27

REPUBLIC SERVICES OF OHIO II, LLC

REVISION	DATE
1	
2	
3	
4	
5	

P. J. CAREY & ASSOCIATES, P.C.

5878 VALINE WAY, SUGAR HILL, GA. 30518

PROJ. NO.: 131.014
DATE: 7/21/2009
DESIGNED BY: Peter Carey
DRAWN BY: Peter Carey
CHECKED BY:
APPROVED BY:

XS 248+26.79

COUNTYWIDE RDF
WEST SLOPE STABILITY EVALUATION
(PRJD_proj_name2)

DRAWING
XS-5

SHEET 6 OF 6

Title: Countywide West Slope - N 23794
Comments: Analysis to evaluate berm sensitivity to piezometric head
Name: Current Conditions
Description: EXPLORES SENSITIVITY OF CRITICAL FAILURE SURF TO WATER TABLE ELEVATION
Name: N23794.gsz
Date: 7/21/2009Time: 3:10:29 PM
Directory: N:\Countywide\Master_O&M\geoslopewestslp\
Method: Spencer
Optimization: Yes
PWP Option: PWP Conditions Source: Piezometric Line

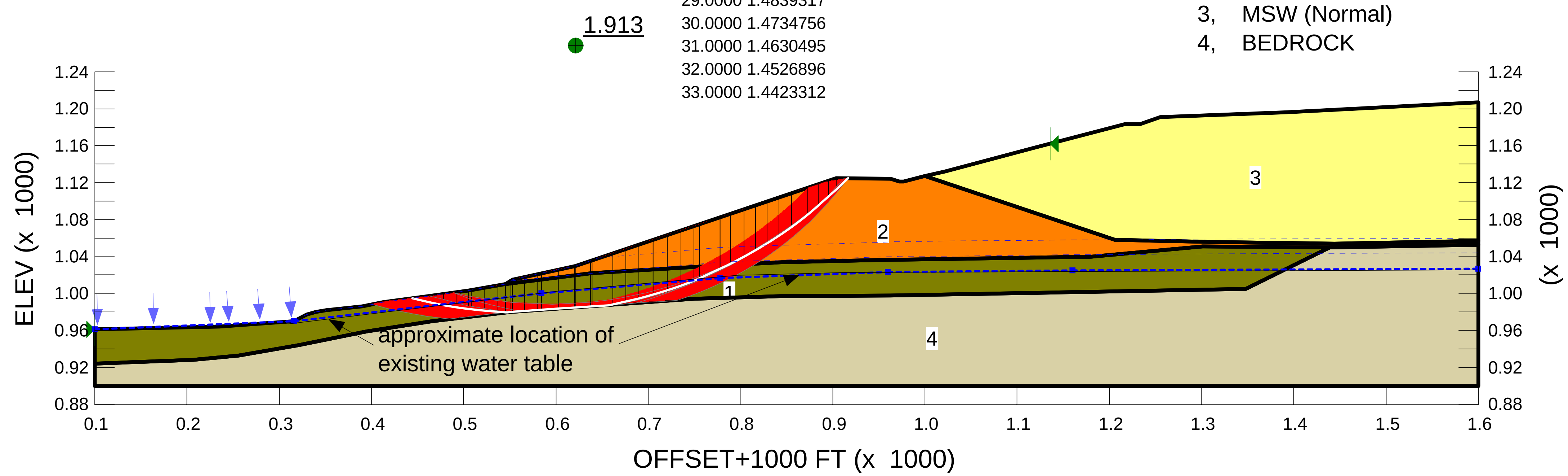
Sensitivity to Fluctuation in Water Table from Existing Location - note rise limited to ground surface at any location

delta H	Factor of Safety
17.0000	1.6339714
18.0000	1.6202842
19.0000	1.6057865
20.0000	1.5918535
21.0000	1.5783418
22.0000	1.5654087
23.0000	1.5526272
24.0000	1.5408466
25.0000	1.5291199
26.0000	1.5179468
27.0000	1.5065926
28.0000	1.4951580
29.0000	1.4839317
30.0000	1.4734756
31.0000	1.4630495
32.0000	1.4526896
33.0000	1.4423312

FACTOR OF SAFETY MAPPING SETTINGS
Contour levels: 1
Increment size: 0.05
Max. level: 1.966

Note: Factor of Safety of Critical Failure Surface approaches 1.5 with water table at elevation 1021 + 27 ft or el1048 at outer edge of road surface and daylighting at elevation 1038

Region No.,Material No.
1, IN-SITU MIN SPOIL
2, COMPACTED BERM
3, MSW (Normal)
4, BEDROCK



Name: MSW (Normal) Model: Mohr-Coulomb Unit Weight: 70 pcf Unit Wt. Above Water Table: 65 pcf Cohesion: 400 psf Phi: 34 °
Name: COMPACTED BERM Model: Mohr-Coulomb Unit Weight: 135 pcf Cohesion: 200 psf Phi: 32 ° Piezometric Line: 1
Name: IN-SITU MIN SPOIL Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion: 0 psf Phi: 29 ° Piezometric Line: 1
Name: BEDROCK Model: Bedrock (Impenetrable) Piezometric Line: 1

PREPARED BY
PJ CAREY & ASSOCIATES

FIGURE 1

Title: Countywide West Slope - N 23794
Comments: Analysis to evaluate berm sensitivity to piezometric head
Name: Elevated WT in Berm w Red WStrngth (2)
Description: Explore sensitivity of berm FS to piezometric surface in waste force failures to exit in waste
Name: N23794.gsz
Date: 7/21/2009Time: 4:17:11 PM
Directory: N:\Countywide\Master_O&M\geoslopewestslp\
Method: Spencer
Optimization: Yes
PWP Option: PWP Conditions Source: Piezometric Line

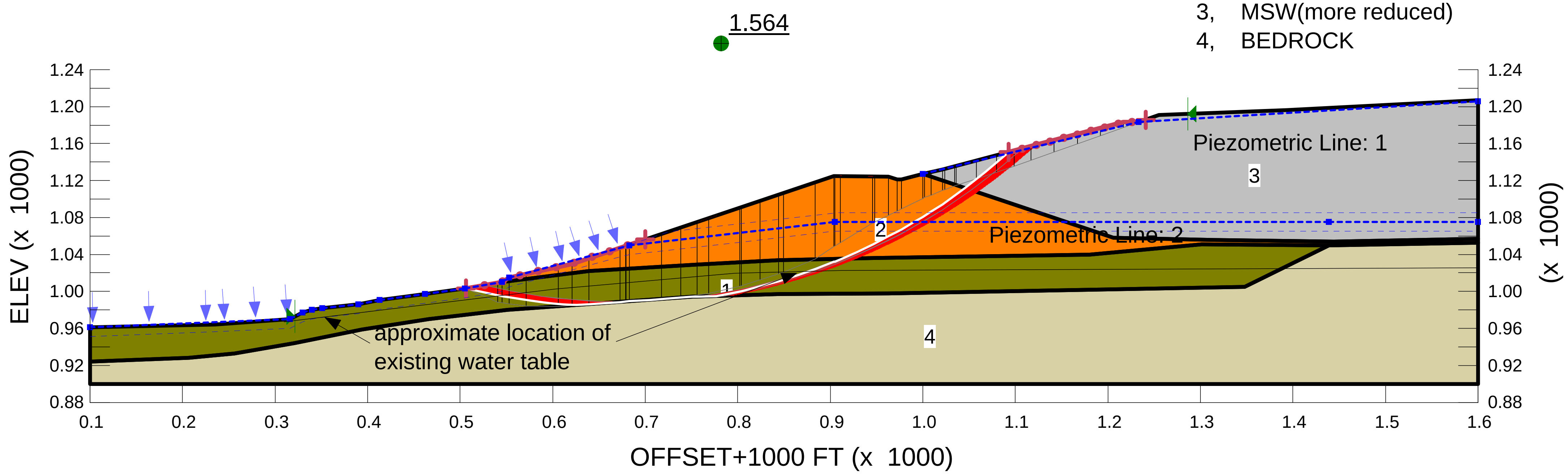
Sensitivity of Critical Surface to fluctuation in P. Line 2

Delta H	Factor of Safety
-10.0000	1.7263560
-8.0000	1.6916387
-6.0000	1.6568549
-4.0000	1.6219994
-2.0000	1.5886009
0.0000	1.5638840
2.0000	1.5434314
4.0000	1.5229320
6.0000	1.5034437
8.0000	1.4846334
10.0000	1.4656961

note: Factor of safety for failures involving any significant waste never reach 1.5 with water table rises in berm to over 1080
FS BASE RUN WT AT 1075 UNDER CREST

FACTOR OF SAFETY MAPPING SETTINGS
Contour levels: 1
Increment size: 0.05
Max. level: 1.768

Region No.,Material No.
1, IN-SITU MIN SPOIL
2, COMPACTED BERM
3, MSW(more reduced)
4, BEDROCK



Name: COMPACTED BERM Model: Mohr-Coulomb Unit Weight: 135 pcf Cohesion: 200 psf Phi: 32 ° Piezometric Line: 2
Name: IN-SITU MIN SPOIL Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion: 0 psf Phi: 29 ° Piezometric Line: 2
Name: BEDROCK Model: Bedrock (Impenetrable)
Name: MSW(more reduced) Model: Mohr-Coulomb Unit Weight: 70 pcf Cohesion: 0 psf Phi: 20 ° Piezometric Line: 1

PREPARED BY
PJ CAREY & ASSOCIATES

FIGURE 2

Title: Countywide West Slope - N 23794
Comments: Analysis to evaluate berm sensitivity to piezometric head
Name: Elevated WT in Berm w Red WStrngth (3)
Description: Explore sensitivity of berm FS to piezometric surface in waste force failures to exit in waste
Name: N23794.gsz
Date: 7/21/2009Time: 3:27:37 PM
Directory: N:\Countywide\Master_O&M\geoslopewestslp\
Method: Spencer
Optimization: Yes
PWP Option: PWP Conditions Source: Piezometric Line

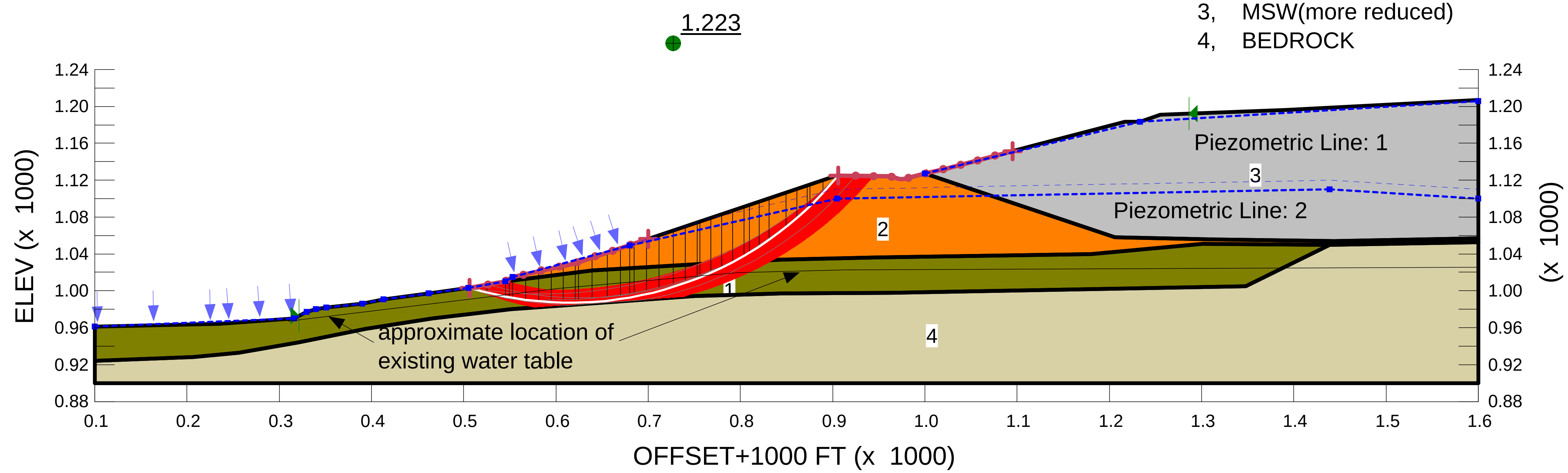
Sensitivity of Critical Surface to fluctuation in P. Line 2

Delta H	Factor of Safety
0.0000	1.2228370
1.0000	1.2095039
2.0000	1.1967963
3.0000	1.1852635
4.0000	1.1739829
5.0000	1.1631326
6.0000	1.1529902
7.0000	1.1424871
8.0000	1.1325209
9.0000	1.1232805
10.0000	1.1146163

note: Factor of safety drops to 1.2 for water table approximately 1 foot higher than shown. El at crest is 1102, daylight at 1054.

FACTOR OF SAFETY MAPPING SETTINGS
Contour levels: 1
Increment size: 0.05
Max. level: 1.281

Region No.,Material No.
1, IN-SITU MIN SPOIL
2, COMPACTED BERM
3, MSW(more reduced)
4, BEDROCK



Name: COMPACTED BERM Model: Mohr-Coulomb Unit Weight: 135 pcf Cohesion: 200 psf Phi: 32 ° Piezometric Line: 2
Name: IN-SITU MIN SPOIL Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion: 0 psf Phi: 29 ° Piezometric Line: 2
Name: BEDROCK Model: Bedrock (Impenetrable)
Name: MSW(more reduced) Model: Mohr-Coulomb Unit Weight: 70 pcf Cohesion: 0 psf Phi: 20 ° Piezometric Line: 1

PREPARED BY
PJ CAREY & ASSOCIATES

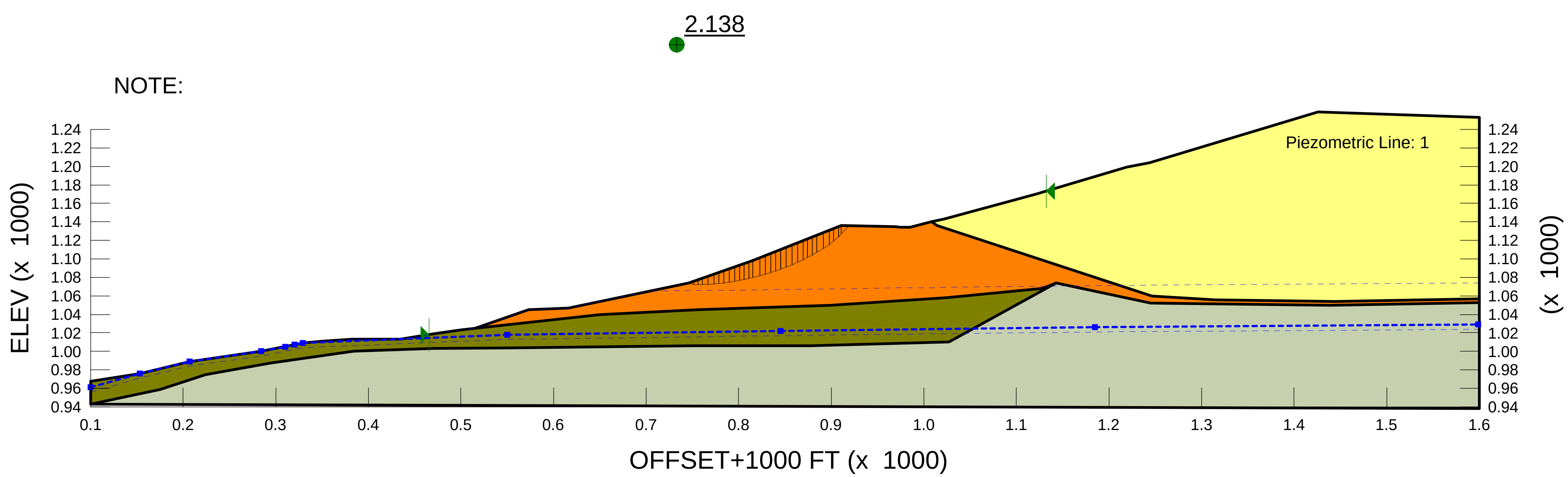
FIGURE 3

Title: Countywide West Slope - N 24027
Comments: Analysis to evaluate berm sensitivity to piezometric head
Name: Current Conditions
Description: EXPLORES SENSITIVITY OF CRITICAL FAILURE SURF TO WATER TABLE ELEVATION
Name: N24027.gsz
Date: 7/21/2009Time: 5:51:53 PM
Directory: N:\Countywide\Master_O&M\geoslopewestslp\
Method: Spencer
Optimization: Yes
PWP Option: PWP Conditions Source: Piezometric Line

FACTOR OF SAFETY MAPPING SETTINGS
Contour levels: 1
Increment size: 0.05
Max. level: 1.#INF

Region No.,Material No.
1, IN-SITU MIN SPOIL
2, COMPACTED BERM
3, MSW (Normal)
4, BEDROCK

NOTE:



Name: MSW (Normal) Model: Mohr-Coulomb Unit Weight: 70 pcf Unit Wt. Above Water Table: 65 pcf Cohesion: 400 psf Phi: 34 °
Name: COMPACTED BERM Model: Mohr-Coulomb Unit Weight: 135 pcf Cohesion: 200 psf Phi: 32 ° Piezometric Line: 1
Name: IN-SITU MIN SPOIL Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion: 0 psf Phi: 29 ° Piezometric Line: 1
Name: BEDROCK Model: Bedrock (Impenetrable) Piezometric Line: 1

PREPARED BY
PJ CAREY & ASSOCIATES

FIGURE 4

Title: Countywide West Slope - N 24027
Comments: Analysis to evaluate berm sensitivity to piezometric head
Name: Elevated WT in Berm &Waste RED WASTE-FORCED IN WASTE (2)
Description: Explore sensitivity of berm FS to piezometric surface in waste
Name: N24027.gsz
Date: 7/21/2009Time: 5:51:53 PM
Directory: N:\Countywide\Master_O&M\geoslopewestslp\
Method: Spencer
Optimization: Yes
PWP Option: PWP Conditions Source: Piezometric Line

SENSITIVITY OF CRITICAL SURFACE TO PZ-1
DELTA H - FACTOR OF SAFETY

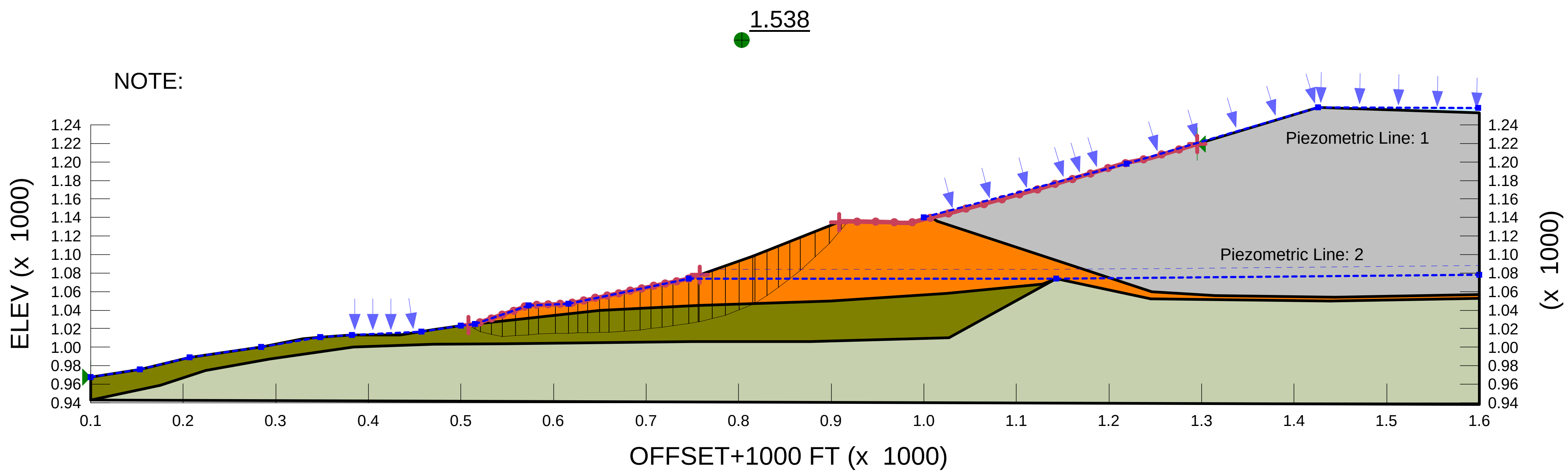
0.0000	1.5382771
1.0000	1.5293939
2.0000	1.5207186
3.0000	1.5126215
4.0000	1.5045605
5.0000	1.4961492
6.0000	1.4871553
7.0000	1.4787524
8.0000	1.4708477
9.0000	1.4629509
10.0000	1.4550621

FACTOR OF SAFETY MAPPING SETTINGS
Contour levels: 1
Increment size: 0.05
Max. level: 1.#INF

Region No.,Material No.
1, IN-SITU MIN SPOIL
2, COMPACTED BERM
3, MSW - MORE DEGRADED
4, BEDROCK

FACTOR OF SAFETY OF 1.5 IS ACHIEVED
WITH WT ELEVATION OF 1081 UNDER
CREST AND DAYLIGHTING ON FACE

NOTE:



Name: COMPACTED BERM Model: Mohr-Coulomb Unit Weight: 135 pcf Cohesion: 200 psf Phi: 32 ° Piezometric Line: 2
Name: IN-SITU MIN SPOIL Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion: 0 psf Phi: 29 ° Piezometric Line: 2
Name: MSW - MORE DEGRADED Model: Mohr-Coulomb Unit Weight: 70 pcf Cohesion: 0 psf Phi: 20 ° Piezometric Line: 1
Name: BEDROCK Model: Bedrock (Impenetrable) Piezometric Line: 1

PREPARED BY
PJ CAREY & ASSOCIATES

FIGURE 5

Title: Countywide West Slope - N 24027
Comments: Analysis to evaluate berm sensitivity to piezometric head
Name: Elevated WT in Berm &Waste RED WASTE-FORCED IN WASTE (3)
Description: Explore sensitivity of berm FS to piezometric surface in waste
Name: N24027.gsz
Date: 7/21/2009Time: 5:51:53 PM
Directory: N:\Countywide\Master_O&M\geoslopewestslp\
Method: Spencer
Optimization: Yes
PWP Option: PWP Conditions Source: Piezometric Line

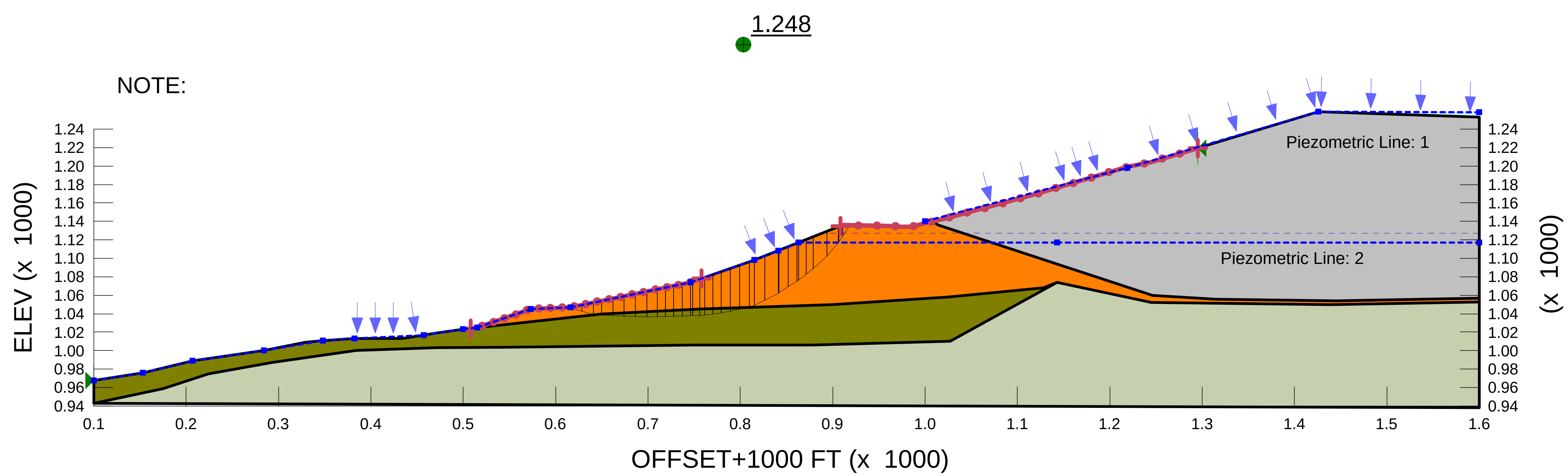
SHOWS THAT WATER TABLE EL OF 1120 AT THE
OUTSIDE CREST IN PZ-2 RESULTS IN A FS OF 1.2
IF THE DAYLIGHTING ELEVATION IS ALSO 1120

SENSITIVITY OF CRITICAL SURFACE TO PZ-1

DELTA H	FACTOR OF SAFETY
0.0000	1.2481948
1.0000	1.2428069
2.0000	1.2378047
3.0000	1.2333650
4.0000	1.2292297
5.0000	1.2244474
6.0000	1.2203560
7.0000	1.2162750
8.0000	1.2122044
9.0000	1.2081442
10.0000	1.2055200

FACTOR OF SAFETY MAPPING SETTINGS
Contour levels: 1
Increment size: 0.05
Max. level: 1.#INF

Region No.,Material No.
1, IN-SITU MIN SPOIL
2, COMPACTED BERM
3, MSW - MORE DEGRADED
4, BEDROCK



Name: COMPACTED BERM Model: Mohr-Coulomb Unit Weight: 135 pcf Cohesion: 200 psf Phi: 32 ° Piezometric Line: 2
Name: IN-SITU MIN SPOIL Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion: 0 psf Phi: 29 ° Piezometric Line: 2
Name: MSW - MORE DEGRADED Model: Mohr-Coulomb Unit Weight: 70 pcf Cohesion: 0 psf Phi: 20 ° Piezometric Line: 1
Name: BEDROCK Model: Bedrock (Impenetrable) Piezometric Line: 1

PREPARED BY
PJ CAREY & ASSOCIATES

FIGURE 6

Title: Countywide West Slope - N 24500
Comments: Analysis to evaluate berm sensitivity to piezometric head
Name: Current Conditions
Description: EXPLORES SENSITIVITY OF CRITICAL FAILURE SURF TO WATER TABLE ELEVATION
Name: N24500.gsz
Date: 7/21/2009Time: 6:07:37 PM
Directory: N:\Countywide\Master_O&M\geoslopewestslp\
Method: Spencer
Optimization: Yes
PWP Option: PWP Conditions Source: Piezometric Line

SENSITIVITY OF CRITICAL SURFACE TO PZ-1
DELTA H - FACTOR OF SAFETY

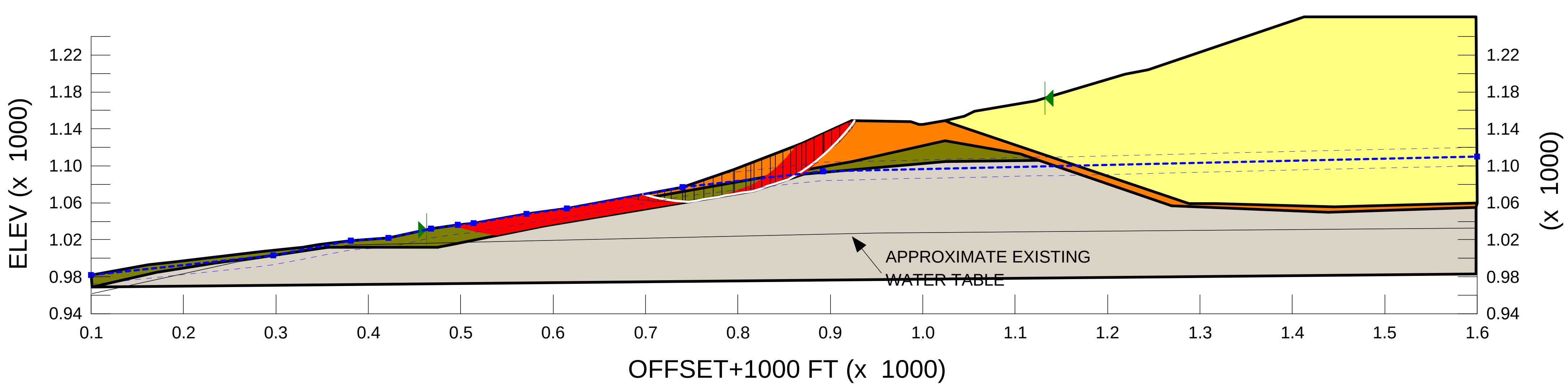
-10.0000	1.7603059
-8.0000	1.7175353
-6.0000	1.6698408
-4.0000	1.6155745
-2.0000	1.5581064
0.0000	1.4941287
2.0000	1.4521192
4.0000	1.4113546
6.0000	1.3730827
8.0000	1.3359143
10.0000	1.2994153

FACTOR OF SAFETY MAPPING SETTINGS
Contour levels: 1
Increment size: 0.05
Max. level: 1.561

Region No.,Material No.
1, IN-SITU MIN SPOIL
2, COMPACTED BERM
3, MSW (Normal)
4, BEDROCK

FACTOR OF SAFETY OF 1.5 IS ACHIEVED WITH WT OF 1095 AT CREST AND DAYLIGHTING AT 1083

1.494



Name: MSW (Normal) Model: Mohr-Coulomb Unit Weight: 70 pcf Unit Wt. Above Water Table: 65 pcf Cohesion: 400 psf Phi: 34 °
Name: COMPACTED BERM Model: Mohr-Coulomb Unit Weight: 135 pcf Cohesion: 200 psf Phi: 32 ° Piezometric Line: 1
Name: IN-SITU MIN SPOIL Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion: 0 psf Phi: 29 ° Piezometric Line: 1
Name: BEDROCK Model: Bedrock (Impenetrable) Piezometric Line: 1

PREPARED BY
PJ CAREY & ASSOCIATES

FIGURE 7

Title: Countywide West Slope - N 24500
Comments: Analysis to evaluate berm sensitivity to piezometric head
Name: REDUCED WASTE STRENGTH
Description: EXPLORES SENSITIVITY OF CRITICAL FAILURE SURF TO WATER TABLE ELEVATION
Name: N24500.gsz
Date: 7/21/2009Time: 6:07:37 PM
Directory: N:\Countywide\Master_O&M\geoslopewestslp\
Method: Spencer
Optimization: Yes
PWP Option: PWP Conditions Source: Piezometric Line

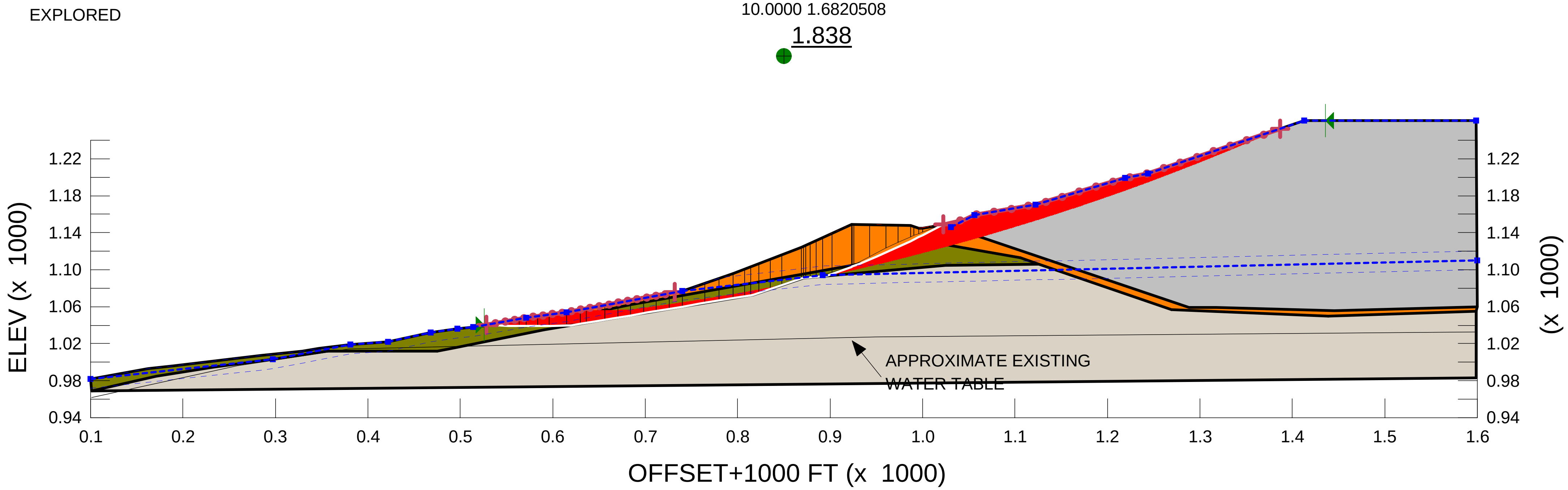
SENSITIVITY OF CRITICAL SURFACE TO PZ-1
DELTA H - FACTOR OF SAFETY

-10.0000	2.1611309
-8.0000	2.1040467
-6.0000	2.0431317
-4.0000	1.9794383
-2.0000	1.9105349
0.0000	1.8375539
2.0000	1.8055506
4.0000	1.7741421
6.0000	1.7442825
8.0000	1.7124128
10.0000	1.6820508

FACTOR OF SAFETY MAPPING SETTINGS
Contour levels: 1
Increment size: 0.05
Max. level: 1.951

Region No.,Material No.
1, IN-SITU MIN SPOIL
2, COMPACTED BERM
3, MSW - MORE DEGRADED
4, BEDROCK

SHOWS THE BERM STABILITY
IS INDEPENDANT OF THE
WATER SURFACE IN THE WASTE
OR THE WASTE STRENGH FOR THE RANGE
EXPLORED



Name: COMPACTED BERM Model: Mohr-Coulomb Unit Weight: 135 pcf Cohesion: 200 psf Phi: 32 ° Piezometric Line: 1
Name: IN-SITU MIN SPOIL Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion: 0 psf Phi: 29 ° Piezometric Line: 1
Name: MSW - MORE DEGRADED Model: Mohr-Coulomb Unit Weight: 70 pcf Cohesion: 0 psf Phi: 20 ° Piezometric Line: 2
Name: BEDROCK Model: Bedrock (Impenetrable) Piezometric Line: 1

PREPARED BY
PJ CAREY & ASSOCIATES

FIGURE 8

Title: Countywide West Slope - N 24500
Comments: Analysis to evaluate berm sensitivity to piezometric head
Name: REDUCED WASTE STRENGTH (1.2 TARGET)
Description: LOOK FOR BERM WATER TABLE ELEVATION TO GET FS 1.2
Name: N24500.gsz
Date: 7/21/2009Time: 6:07:37 PM
Directory: N:\Countywide\Master_O&M\geoslopewestslp\
Method: Spencer
Optimization: Yes
PWP Option: PWP Conditions Source: Piezometric Line

SENSITIVITY OF CRITICAL SURFACE TO PZ-1
DELTA H - FACTOR OF SAFETY

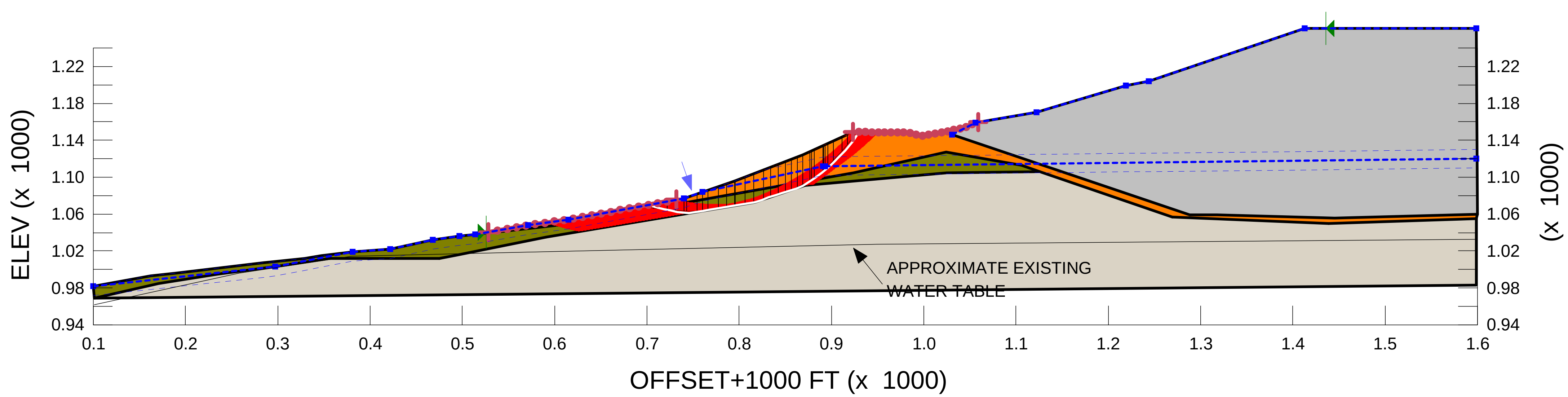
-10.0000	1.5850727
-8.0000	1.5287185
-6.0000	1.4655174
-4.0000	1.3993243
-2.0000	1.3307746
0.0000	1.2559744
2.0000	1.2096352
4.0000	1.1674083
6.0000	1.1292981
8.0000	1.0956804
10.0000	1.0663768

FACTOR OF SAFETY MAPPING SETTINGS
Contour levels: 1
Increment size: 0.05
Max. level: 1.32

Region No.,Material No.
1, IN-SITU MIN SPOIL
2, COMPACTED BERM
3, MSW - MORE DEGRADED
4, BEDROCK

SHOWS THE A FACTOR OF SAFTEY OF 1.2
IS ACHIEVED WHEN THE WT AT CREST IS 1116
AND DAYLIGHTING AT 1086

1.256



Name: COMPACTED BERM Model: Mohr-Coulomb Unit Weight: 135 pcf Cohesion: 200 psf Phi: 32 ° Piezometric Line: 1
Name: IN-SITU MIN SPOIL Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion: 0 psf Phi: 29 ° Piezometric Line: 1
Name: MSW - MORE DEGRADED Model: Mohr-Coulomb Unit Weight: 70 pcf Cohesion: 0 psf Phi: 20 ° Piezometric Line: 2
Name: BEDROCK Model: Bedrock (Impenetrable) Piezometric Line: 1

PREPARED BY
PJ CAREY & ASSOCIATES

FIGURE 9