BRIDGETON LANDFILL

NORTH QUARRY CONTINGENCY PLAN – PART 1

Submitted Pursuant to Section 17.A and 22.A of Agreed Order
Case No. 13SL-CC01088, Effective May 13, 2013

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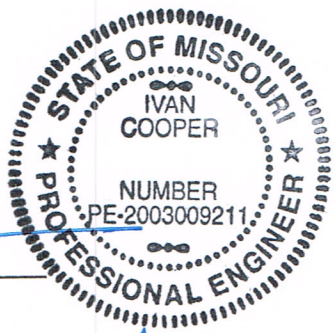
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North Quarry Contingency Plan – Part 1
Bridgeton Landfill
August 13, 2013

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1.0 INTRODUCTION

1.1 BACKGROUND

Bridgeton Landfill LLC (Bridgeton Landfill) is located on a 214-acre parcel, of which approximately 52 acres has been permitted for municipal solid waste disposal under the conditions of Permit #118912. In accordance with the permit, waste was placed in former limestone quarries which were reportedly about 240 feet deep. The landfill ceased accepting waste at the end of 2004.

In December 2010 Bridgeton Landfill detected changes in gas extraction well conditions; specifically, elevated temperatures and elevated carbon monoxide levels. Further investigation indicated that the landfill was experiencing an exothermic subsurface reaction which, among other effects, increases fugitive emissions and odors from the facility.

Since the time that the subsurface reaction was confirmed, Bridgeton Landfill has worked with the Missouri Department of Natural Resources (MDNR) along with other local, state and federal agencies to respond. The State has defined this reaction as a "subsurface smoldering event" (SSE), and that term shall be adopted in this Plan to refer to the subsurface reaction.

1.2 PREVIOUS EVALUATIONS AND RESPONSES

The shared goals of Bridgeton Landfill and MDNR are that sufficient information be collected and evaluated to provide a basis for planning and response, and that plans be prepared and implemented to minimize and mitigate negative impacts. In addition, it is agreed that the SSE should be prevented from entering radiologically-impacted material in West Lake OU-1 Area 1.

Consistent with those goals, MDNR directed Bridgeton Landfill in July 2012 to develop plans to "conduct adequate monitoring, develop adequate data to assess the depth, extent and progression of the SSE, and respond proactively to the situation." Hence, Bridgeton Landfill has worked under the direction of the regulating agencies to evaluate, develop, and implement extensive measures including gas extraction, covering and capping, and heat removal as described in Section 3 of this Plan.

Previously, Bridgeton Landfill has submitted the following relevant documents: "North Quarry Heat Barrier System," dated January 4, 2013 (submitted in DRAFT form), "Bridgeton Landfill – Gas Interceptor Well Design," dated January 10, 2013, "Gas Interceptor Well Design – Expanded System" dated February 6, 2013, and a letter-report submitted to Ms. Charlene Fitch of the MDNR on March 29, 2013. In those reports, Bridgeton Landfill evaluated numerous additional options for the control and mitigation of the SSE. These plans are attached to this Plan as Appendix A. This North Quarry Contingency Plan is intended to incorporate and supersede these prior plans and form the basis for agreed evaluation and response processes moving forward.

1.3 CURRENT EVALUATION AND RESPONSE EFFORTS

On May 13, 2013, Bridgeton Landfill entered into an Agreed Order with the State of Missouri which requires actions to address the SSE. One of the requirements of the Agreed Order is the preparation of a "North Quarry Contingency Plan" (Plan). The Plan is intended to build from the prior contingency and response evaluations and put in place defined triggers and response actions to allow prompt and proactive response to the SSE. The Plan, when finalized, will become part of the obligations under the Agreed Order and is intended to guide Bridgeton Landfill's response moving forward to meet the shared goals of ongoing assessment and effective response. The Agree Order requirements are:

Part 1 – Agreed Order Section 22.A

A) Within forty-five days of entry of this Agreed Order, Bridgeton Landfill shall submit Part 1 which shall include:
   i) Establishment of trigger criteria for installation of additional Temperature Monitoring Probes in the North Quarry, along with a plan and schedule for such installation, if triggered;
   ii) Establishment of trigger criteria for installing interceptor wells within the North Quarry to control further migration of the Subsurface Smoldering Event, along with a schedule for such well installation, if triggered; and
   iii) Establishment of trigger criteria for capping the North Quarry with an EVOH geomembrane cap, along with a schedule for such capping, if triggered.

Part 2 – Agreed Order Section 22.B

B) Within seventy-five days of entry of this Agreed Order, Bridgeton Landfill shall submit Part 2 which shall include:
   i) Construction Plans for the installation of additional interceptor wells in the North Quarry, if triggered;
   ii) Construction Plans for installation of an EVOH geomembrane cap over the North Quarry, if triggered;
   iii) Establishment of trigger criteria for an isolation break between the North Quarry and radiological materials contained in West Lake Landfill Site OU-1 Area 1, along with a schedule for such break, if triggered.

This Plan is intended to meet the requirements of the Agreed Order Section 22.A. In addition, as a voluntary measure, Bridgeton Landfill has incorporated the requirements of Agreed Order Section 22.B.iii (establishment of trigger criteria for an isolation barrier between the North Quarry and the OU-1 Area 1) into this Plan so that all triggers and actions are defined in one document.

Bridgeton Landfill understands that approval of this Plan will result in mutually-agreed triggers and response actions intended to further the shared goal of proactive response and allow

Bridgeton Landfill to mobilize quickly to address any changed conditions and prevent or mitigate resulting negative impacts.

This Plan is presented in sections as described below:

2.0 Current Conditions at the Bridgeton Landfill
3.0 Isolation, Containment, and Monitoring Features
4.0 Evaluation of Potential Trigger Criteria
5.0 Proposed and Contingent Future Actions

The Plan and its requirements will be part of the Bridgeton Landfill closure and post closure operations until it is determined that the SSE is no longer presenting operational challenges or Bridgeton Landfill has been released from the requirements of the Agreed Order.

A DRAFT of this Plan was submitted on June 27, 2013. Following that submission, Bridgeton Landfill participated in several meetings and discussions with the MDNR to further evaluation and assessment of mutually-agreed triggers and response actions. Bridgeton landfill also received and reviewed MDNR's written comments, a response to which is submitted concurrent with this revised Plan. This document comprises a revised Plan that is submitted as a FINAL form document.

Part 2 of the North Quarry Contingency Plan was submitted on July 26, 2013 and contained construction plans and implementation schedules as directed by the Agreed Order Section 22.B. The purpose of Part 2 of the Plan is to confirm that approved work plans are prepared, approved, and available in advance of any triggering conditions.

2.0 CURRENT CONDITIONS AT THE BRIDGETON LANDFILL

2.1 LANDFILL AREAS

The permitted landfill is generally described in two sections which refer directionally to the landfilled areas: the North Quarry, and the South Quarry which comprise approximately 52 acres of the property. The remainder of the 214 acre site includes several inactive landfill units, including the West Lake Landfill Operational Unit 1, where soils contaminated with radiologically-impacted materials were deposited in 1973. See Figure 1 for a general overview of the facility.

The North and South Quarry areas are contiguous and waste material that was placed therein is connected by a relatively thin "neck" area which is about 300 feet wide at the top and narrows as it approaches the bottom at a depth of about 250 feet. A 3-D rendering illustrating the relationship of these two areas is presented on Figure 2. West Lake OU-1 Area 1 abuts the North Quarry area but not any of the other landfill areas. The depth of the waste material shallows significantly moving from the South Quarry toward West Lake OU-1 Area 1 as seen on the cross section on Figure 2.

2.2 EXISTING SUBSURFACE SMOLDERING EVENT (SSE) AREA

Bridgeton Landfill has been addressing an SSE that is occurring in the South Quarry portion of the landfill and which has resulted in elevated temperatures and accelerated decomposition of waste. The impacts have included increased rate of settlement along with odorous emissions. Efforts have focused on establishing the necessary infrastructure to isolate, contain, and monitor the SSE, with an emphasis on preventing the SSE from moving into the North Quarry area.

For these efforts, the facility has implemented extensive modifications to the gas collection and control system (GCCS) and leachate collection system, and installed an additional capping system over the South Quarry. Additionally, Bridgeton Landfill has installed monitoring and containment features at the northwest edge of the impacted area including temperature monitoring probes (TMPs) and Gas Interceptor Wells (GIWs). These measures can be seen in Appendix B which contains drawings that show their extensive nature.

As discussed in more detail in Section 3 and in the approved plans included in Appendix A, the gas interceptor well system is designed to remove heat energy from the SSE zone in order to limit the propagation. Monitoring of the gas interceptor well system is part of ongoing site activities and results are included in the recent reports included in Appendices C and D.

2.3 CONDITIONS CAUSED BY THE SSE

The Bridgeton quarry fills are deep and, as a result, contain dense, compact waste with very little pore space. This results in: slow heat dissipation (heat is retained much in the same way insulation holds heat), confinement of pressure caused by water to vapor phase changes, and resistance to conveyance of heat front and propagation of the SSE.

At the Bridgeton Landfill, the primary manifestations of the SSE include:

- Curtailment of methane production in portions of the waste mass where temperature is elevated above 160° F (which exceed conditions survivable by the bacteria responsible for methanogenesis);
- Elevated temperatures (currently recorded up to about 300° F) which require special construction materials for gas and liquid handling features;
- Production of hydrogen, carbon dioxide, volatile organics, and carbon monoxide; some of which migrate outward and away from the reacting waste materials;
- Creation of odorous emissions;
- Generation of pressure within the waste mass resulting from the phase change of liquid entrained in the waste mass to vapor phase;
- Increased gas capture complexity due to the pressure increases at depth that release upward within the waste mass due to the increasing density of the waste with depth;
- Heating of waste which results in a steam/water vapor front moving out, up, and away from the SSE, which then condenses in the cooler surrounding waste mass and gas extraction wells resulting in higher localized leachate generation;
- Leachate characteristic changes including elevated constituents such as BOD, volatile organic compounds, and dissolved and suspended solids that result from liberation of constituents from the as-received waste material and from thermal degradation of biological material; and
- Greater than normal settlement at the location of and/or proximate to reacting waste mass (see Figure 2 for the current area of greater than normal settlement caused by the SSE). This settlement results from the significantly reduced volume of waste mass.

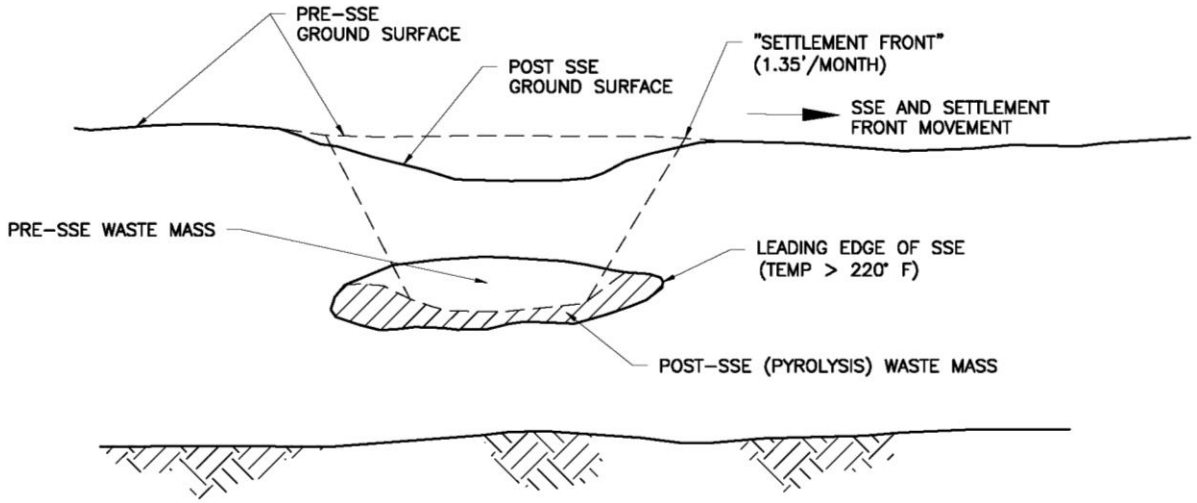
The above-listed manifestations are monitored and are reported in a Weekly and/or Monthly Data Submittal; recent reports are included as Appendices C and D of this Plan.

2.4 PROGRESSION OF THE SSE

Subsurface smoldering events caused by reactions within a landfill begin at a point of origin, and then spread slowly into adjacent areas until conditions cease to be favorable for the SSE to continue.

Visual evidence of a deep SSE appears as surface settlement. The surface settlement occurs because the liquid entrained within the waste mass is converted to steam and removed from the waste while the waste undergoes volume reduction as a result of pyrolysis (thermochemical decomposition of organic material at elevated temperatures in the absence of oxygen). The material that exists above the pyrolyzing waste settles into the resulting void such that it is readily evident at the surface. In fact, when the settlement is due to a deep pyrolysis event the cone-like shape of settlement causes the surface manifestation to be wider than the zone of actual settlement, as illustrated below:

SETTLEMENT CAUSED BY PYROLYSIS AND SETTLEMENT FRONT



NOT TO SCALE

While settlement has been monitored for some time at the Bridgeton Landfill, in January 2013 the facility developed a more detailed, repeatable, grid-point settlement monitoring approach so that comparable monthly settlement evaluations can be developed. Figure 3 shows the progression of a surface boundary line referred to as the "settlement front." The settlement front has been defined as the outward boundary of the rate of vertical settlement of 1.35 feet over a one-month period. This rate of vertical settlement has been assigned based on analyses (see Appendix A) so that the settlement front is near the estimated limits of volume-reduction mechanisms (i.e. pyrolysis) as shown on the illustration above.

Examination of settlement front movement suggests that heat generated by the SSE is expanding radially outward, including movement at a very slow rate toward the North Quarry. It is possible that this slow movement may continue, and it is possible that the SSE may slow even further or cease as the mitigative measures succeed and conditions in the area become unfavorable to sustain the SSE; these phenomena have been observed at other sites

experiencing similar issues. Based on the recent twenty weeks of settlement front movement (January 31 to June 21, 2013), the corresponding rates of movement of the settlement front and SSE toward the North Quarry have been calculated for three vectors toward the North Quarry area as provided in Appendix H.

As can be seen in Appendix H, settlement front location and rate of advancement appears to fluctuate. While it is likely that variable subsurface conditions produce some of these fluctuations, there are many factors that may influence the apparent settlement, and therefore settlement front interpretation at each measurement. Some of these variables are due to ground surface conditions (including events where soil material is added to, or cut away from, a monitored area), barometric pressure and/or pressure conditions in the landfill, precipitation, or other factors. So, when determining rate of movement, it can be useful to look at several months previous data to eliminate the month-to-month variables. Based on the above analyses the overall average settlement front advancement toward the North Quarry is about 0.49 feet per day.

However such averaging may not provide the best assessment of future advancement. Measurements taken after the newly installed control features such as the GIWs and expansion of the GCCS, as illustrated by the period April 15, 2013 to June 21, 2013, show no forward movement of the settlement front along two of the three northern vectors. Additionally, the recently-completed capping system will provide for enhanced operation of the liquids and gas collection systems, which may help further reduce the rate of movement. As such, relying upon the average rate from January31-June 21, 2013 should provide a conservative calculation of the rate of migration.

3.0 ISOLATION, CONTAINMENT, AND MONITORING FEATURES

The main strategies for responding to an SSE include:

- Isolation – Physical separation or conditional separation of the waste that is experiencing the SSE from other potentially-impacted areas;
- Containment – Actions that are designed to collect and prevent the negative manifestations of the SSE from impacting the environment; and
- Monitoring – Observation of the SSE to determine its direction and rate of movement so that appropriate isolation and containment features can be implemented.

At the present time, Bridgeton Landfill has implemented and considered several isolation, monitoring, and containment features as described in the following sections.

3.1 ISOLATION FEATURES

In cooperation with MDNR and the Missouri Attorney General's Office, Bridgeton Landfill assessed both the existing and previously-evaluated isolation features in order to select the elements best suited for inclusion in the North Quarry Contingency Plan.

3.1.1 Existing Isolation Features

Heat removal can be used to isolate pyrolysis associated with an SSE. If the amount of heat removed from a particular portion of the landfill can balance the heat added by local subsurface reaction, the advancement of the SSE can be curtailed and effectively isolated.

At the Bridgeton Landfill, special gas extraction wells, known as Gas Interceptor Wells (GIWs) have been installed specifically to stop movement of heat and to disrupt the subsurface migration of SSE-impacted gas. The GIWs are positioned in a manner that allow for removal of gas heat and pressure that is exerted laterally. See Figure 2, and the drawings contained in Appendix B for location and details of the existing GIWs. These features are constructed with high temperature-resistant materials as they are expected to draw significant heat energy. Appendix A includes the detailed GIW work plans approved by MDNR. Monitoring of this system's operation is part of ongoing efforts and results are included in the weekly and monthly reports attached as Appendices C and D.

3.1.2 Screening of Additional Isolation Options

As part of the extensive evaluation of isolation and containment options, Bridgeton Landfill has prepared two prior reports (which are contained in Appendix A). These reports considered three primary types of isolation options: physical barriers, excavated isolation barriers, and heat removal.

Physical Barriers

As discussed in more detail in the reports contained in Appendix A, deep, thin barriers of material (soil, concrete, or slurry) can prove to be ineffective when settlement caused by pyrolysis on the SSE side of the barrier creates deformations and breaches in the barrier. This situation is exacerbated by depth because the bending and overturning stress increase rapidly with increasing depth.

Depending on the type of physical barrier, construction at the neck area would take from one to two years and result in associated challenges related to managing odors, minimizing environmental impacts, and controlling nuisance issues like birds and truck traffic. Physical barrier construction in the "neck" area of the landfill is also complicated by the need to accommodate certain airport covenants given the extensive volume of waste that would be disturbed by construction of a barrier to that depth. Therefore, a physical barrier at the neck area between the South and North Quarry areas, at depths of 250 feet for a full barrier, is extremely problematic and is not being considered for further development.

A physical barrier between the North Quarry and OU-1 Area 1 where waste may be about 40 feet thick may be feasible as discussed in the next section.

Excavated Isolation Barriers

Complete, excavated breaks, or "isolation barriers" can be created by excavating completely through waste materials resulting in a full, structurally-stable permanent feature which isolates the reacting waste mass; this has been effectively employed at another facility where conditions (waste thickness, moisture conditions, and geometry of non-waste materials) were favorable.

A deep excavated isolation barrier between the South and North Quarry would not be feasible due to many of the same issues as discussed for a physical barrier. Excavation at the neck area would take a substantial amount of time and involve handling large quantities of decomposed and wet waste with associated challenges related to managing odors, minimizing environmental impacts, and controlling nuisance issues like birds and truck traffic. Additionally, a large open excavation would not allow passive drainage of surface water and would require perpetual pumping of accumulated precipitation. A large excavation in the neck area of the landfill is also complicated by the need to accommodate certain airport covenants given the extensive volume of waste that would be disturbed by construction of a barrier to that depth.

Bridgeton Landfill has evaluated the possibility of an excavated isolation barrier to prevent the SSE from advancing into the radiologically-impacted material in West Lake OU-1 Area 1. Specifically, Bridgeton Landfill evaluated the excavation of waste to create an isolation barrier south of the southern limit of radiologically-impacted material. Such an approach would also limit the volume of waste excavation, consistent with concerns raised by the Airport Authority. Unlike an isolation break or physical barrier at the neck, this location would also serve to protect the radiologically impacted material from an SSE originating in the North Quarry. Finally the

relative speed of construction allows such a system to be implemented quickly. This isolation barrier would provide the physical barrier that MDNR has requested.

Therefore, the northern isolation barrier contingency as directed by the Agreed Order is preferable to physical barrier systems located in the "neck area of the landfill" because it offers superior protection with reduced construction time that can be organized to more easily comply with the airport easement and covenants.

Heat Removal

It is known that pyrolysis requires added heat energy to exist. If more heat can be removed from the location of pyrolysis than is added, the advancing front may be effectively stalled. Three types of heat removal have been considered at the Bridgeton Landfill as described below.

Landfill Gas Extraction

As discussed in Section 3.1.1, Bridgeton Landfill has already implemented heat removal as an isolation measure in the form of gas interceptor wells (GIWs) and, to date, these appear to be having the desired effect (refer to Section 2.4). Additional GIWs could be provided to increase heat removal.

Inert Gas Injection

Bridgeton Landfill has considered the viability of an injection system wherein cold material (typically inert gas like carbon dioxide or nitrogen) would be injected to crowd out oxygen and/or absorb heat. Since there is currently no evidence of free oxygen at depth, the only effect of inert gas injection would be to remove heat.

There are no reported uses of inert gas in landfills other than at fires that are quite shallow (less than 50 feet) and isolated in nature. There is no evidence that such injections could enter the waste mass at the depths of this SSE due to the high density of the waste material and pressures that exist at depth as described in Section 2.3.

Discussions with technology application specialists with Airgas, Inc. (Airgas is the United States' largest supplier of industrial, medical, and specialty gases, products and services to industrial and commercial markets) revealed that they were not aware of any applications in a similar setting (i.e. depth and composition of material). Further, they acknowledged that cryogenic gas injection may not be possible in the conditions that exist and would not be necessary unless the target temperature was below freezing (the MDNR has indicated that the target temperature is in the 150° F to 170° F range.)

Given this level of uncertainty and the demonstrated success of the gas interceptor wells, and the lack of need to cool to very low temperatures, inert gas injection systems for large-scale heat removal have not been selected for further evaluation. However, certain applications (temporary and local spot cooling or extinguishment of a local subsurface SSO) may still be considered and implemented as appropriate.

Cooling within Existing Gas Collection Wells

Near the SSE front, most of the gas extraction wells (GEWs) and gas interceptor wells (GIWs) have some accumulation of liquid within the well due to condensation from warm gasses. The level of liquid in these wells is maintained as low as practical using pumps. Cooling within existing gas collection wells could be performed by cooling the remaining liquid that exists in the lower portions. Tubing inserted in a gas well would circulate cooled water in a closed-loop system, lowering the temperature of the liquid in the gas well and correspondingly lowering the temperature of the surrounding waste in contact with the cooled liquid. Appendix I of this Plan includes preliminary design and analyses demonstrating the viability of cooling within existing gas collection wells.

Dedicated Cooling Points

Special, new, dedicated cooling points could be added as spot treatment for warm areas, and/or as a large multi-point deployment to arrest movement of the SSE. These points would consist of drilled or driven sealed steel casings that are used for circulation of cooled water. Cooled water in the sealed casings would conduct heat from the surrounding waste mass. Appendix I of this Plan includes preliminary design and analyses demonstrating the viability of the use of dedicated cooling points.

3.2 CONTAINMENT FEATURES

Bridgeton Landfill has constructed a number of containment features directed at preventing the negative manifestations of the SSE from impacting the environment. These features are shown in detail on the drawings contained in Appendix B and include:

- Expanded and enhanced gas collection and control systems (GCCS) including additional gas extraction wells and gas destruction devices (flares), to allow for a greater removal of gas and pressure that is exerted upward by the SSE and enhance the preferential upward motion of the steam such that less pressure is exerted laterally;
- Synthetic capping to prevent fugitive emissions from the landfill cover and help improve operation of gas and liquids collection systems; and
- Subcap liquid and gas collection systems.

Successful use of these three containment measures at other facilities experiencing subsurface reactions validates continued employment at the Bridgeton Landfill.

3.3 MONITORING FEATURES

Bridgeton Landfill utilizes numerous features to observe, monitor, and to determine its direction and rate of movement of the SSE so that appropriate isolation and/or containment features can be implemented:

- Monitoring of the gas temperature and composition at gas extraction wellheads (primarily the Gas Extraction Well or GEW series);
- Measurement of in situ waste temperature with buried thermocouples (known as Temperature Monitoring Probes or TMPs); and
- Mapping of landfill surface settlement.

These features are shown in detail on the drawings contained in Appendix B and monitoring results are contained in Appendices C and D. Successful use of these three monitoring measures at other facilities experiencing deep subsurface reactions validates continued employment at the Bridgeton Landfill. Detailed discussion of data that results from these monitoring efforts, and selection of the most appropriate monitoring for continued use at the facility is presented in Section 4 of this Plan.

3.4 CONTINGENT ISOLATION, CONTAINMENT, AND MONITORING FEATURES

As contemplated by the Agreed Order, isolation, containment, and monitoring features to be deployed on a contingent basis include:

- Installation of additional temperature monitoring probes (TMPs);
- Installation of additional gas interceptor wells (GIWs);
- Construction of EVOH cap over the North Quarry; and
- Construction of an isolation barrier between the North Quarry and the West Lake OU-1 Area 1 radiologically-impacted material.

In addition to these, and consistent with recent discussions with the MDNR, other features which were not specified in the Agreed Order may be deployed on a contingent basis as described in Section 5 of this Plan.

4.0 EVALUATION OF POTENTIAL TRIGGER CRITERIA

The intent of trigger criteria is to identify where the SSE is occurring and the rate at which it is advancing toward a pre-agreed location in order to evaluate the appropriateness and best timing for contingent isolation, containment, and monitoring features. Properly established and utilized, such triggers should allow Bridgeton Landfill to determine when an additional mitigative measure should be initiated to help prevent adverse impacts (further movement of the SSE, odor, and fugitive emissions) from developing in the North Quarry, and to prevent the SSE from ever being able to affect waste contained in the West Lake OU-1 Area 1.

4.1 CHARACTERISTICS OF RELIABLE TRIGGERS

Data used as a trigger should have the following characteristics:

- Readily obtained –Data that is measured with field instruments is preferred;
- Easily confirmed – Unusual or questionable results can be quickly confirmed with a follow-up reading; and
- Confidently interpreted – Results should directly reflect a physical condition that is known to be associated with the SSE or related heat generation.

4.2 POTENTIAL TRIGGER PARAMETERS

The primary candidates for trigger parameters, along with current monitoring frequency are listed below.

Parameter	Measure Frequency	Comments
Wellhead Gas Temperature	Weekly	Obtained with handheld field instrument. Results immediately available. Obtains average gas temperature of flowing gas in a well column.
Field Gas Quality	Weekly	Methane, oxygen, carbon dioxide, and "balance gas." Obtained with handheld field instrument, immediately available.
Lab Gas Quality	Monthly	Carbon monoxide, hydrogen, methane, oxygen, carbon dioxide. Takes three weeks to get results after decision to sample.
In Situ Waste Temperature	Weekly	Buried thermocouples referred to as temperature monitoring probes (TMPs). Results immediately available. Gives discrete temperature data.
Ground Settlement	Monthly or Quarterly	Takes up to one week to compile and analyze results. Provides direct physical evidence of location and direction of movement of SSE.

Triggers can be made using any of these parameters independently, or in combination, or as ratios of one parameter with another. A detailed assessment of these parameters and their applicability for use as triggers is presented in Appendix E.

4.3 EVALUATION OF POTENTIAL TRIGGER PARAMETERS

Data has been collected for each of the items listed in Section 4.2 at the site in the past, so the efficacy of the various data at predicting the onset and motion of the byproducts of the SSE can be evaluated specifically for the Bridgeton Landfill. The following data evaluation is divided into those values that are point measurements, and those that represent larger zones of waste (non-point measurements).

4.3.1 Point Measurements

Point measurements at the Bridgeton Landfill consist of in situ waste temperatures using thermocouples, referred to as temperature monitoring probes or TMPs. The TMPs are comprised of thermocouples installed at 20-foot intervals typically through the full depth of waste. Temperature data that is obtained is representative of a zone of waste around an individual thermocouple at a particular depth. Recent TMP data is included in Appendix C of this Plan.

As a direct temperature measurement at a specific location, TMPs are very effective. However, there are some shortcomings of the TMPs and these include:

- The units are adversely affected by the lateral strains associated with settlement in the adjacent areas. This results in the thermocouples' wire being strain-hardened, causing the resistance to rise and making the readings inaccurate;
- The design of the TMPs results in the Kevlar sleeve acting as a conduit when the temperature exceeds the stable temperature of the bentonite grout used in the unit placement. This can result in false indications of rapid vertical temperature migration;
- Teflon insulation on the wires can abrade, causing the units to be in electrical contact with the waste and leachate, making the readings not valid; and
- The units are impacted by minor RFI (radio frequency interference) causing reading fluctuations.

Nevertheless, as long as they are intact, TMP readings provide a very good indicator of specific subsurface conditions at a specific location. When aberrant readings are suspected, or when certain measurements need to be confirmed or verified, there are procedures to verify the data and to determine if the TMP is compromised as presented in Appendix F.

4.3.2 Non-Point Measurements

Landfill Gas System Measurements

Non-point measurements include any data collected from gas wells, gas collection headers, or other common points. The types of data available from gas wells are listed as the first three items in the table contained in Section 4.2.

Data values from gas wells represent a composite value for a zone from which the gas well is collecting. Given that the flow of gas into the well can occur along variable pathways, and that the performance of a gas well depends on many factors, it is not possible to attribute data collected therein as a strong indicator of temporal, specific conditions. Instead, the gas well is useful as an effective indicator of temporal, general conditions. At Bridgeton Landfill, the denser-than-normal spatial distribution of gas extraction wells allows these indicators of temporal general conditions to be used in comparison to one another for site wide assessments of trends.

Experience at other sites where subsurface reactions are occurring has shown that some SSE process-related gasses, such as hydrogen and carbon monoxide, can occur in gas wells far in advance of significantly elevated temperatures within the waste. This is attributable to the "projection effect", or "halo effect" wherein warmed vapor produced at the SSE front is pushed ahead and carries with it the gasses associated with the SSE. This has been observed to occur well over 100 feet from the SSE area.

Elevated levels of carbon monoxide and hydrogen have been observed in gas wells where the maximum temperature in proximate TMP devices indicate that temperature in the nearby waste mass is lower than that which can cause pyrolysis. Examples of these phenomena are provided in Appendix E. Gas well head temperatures are also subject to variables of this type.

Gas well head temperatures and laboratory-analyzed gas constituents were examined to look for trends and correlations. The data, as presented in Appendix E, indicates that well head temperature, hydrogen and the carbon monoxide (CO) can be easily used to *rule out* the presence of alteration of waste by heat generated by the SSE, but are less helpful to *confirm* the location of an SSE.

Comparisons of settlement rate to CO levels or the ratio of CO_2/CO show that either measure can be a good predictor of temperature levels high enough to cause waste alteration by heat. However, these measures can over predict the presence of high in situ temperature due to the projection effect. The data also suggests that, in the case of a slowly advancing heat front, the length of time that a well is proximate to the heat front increases the over prediction using gas constituents.

Other gas ratios, such as those using methane, can be effective at evaluating conditions where in situ temperature approaches 165° F but do not appear to be useful in predicting the

occurrence of temperatures above that (as methane ceases to be generated at about 160° F). As such, wells within the areas between TMP 13 and the TMP 1 through 4 line collect very little methane yet show no predictable relationship in gas ratio, well head temperature, or TMP temperatures (see Appendix E).

Settlement Front Data

Waste which has been heated to temperatures in excess of 220 °F is found at depths of between 80 feet and 150 feet deep at the Bridgeton Landfill (see TMP data in Appendix A). When heated to these temperatures, pyrolyzation and significant reduction in volume of the waste occurs. The surface expression of this volume reduction extends beyond the limit of significant volume reduction (as previously discussed and illustrated in Section 2.4 of this Plan).

The term "settlement front" refers to a zone where settlement rate is exceeding a selected value expressed in feet per month. The selected rate was identified using statistical analysis of the monthly surveys performed in 2012. The rate, while it could be adjusted from the current value of 1.35 feet of vertical settlement per month, is a measure of the leading edge of volume reduction associated with the pyrolizing of waste. An illustration of the settlement front was provided in Section 2.4 of this Plan.

Advantages of the settlement front as a measure of the location of the heat front are:

- Strongly correlated to all indicators of an SSE;
- Can be easily observed at the ground surface;
- Does not require insertion of devices and can be measured whenever the need arises;
- Large areas of the site can be covered in the survey for a complete record;
- Correlation to the subsurface conditions can be re-assessed and re-demonstrated by using gas well and or TMP data at routine intervals; and
- Rate of movement and direction of movement can be determined.

Starting in January 2013, settlement front data collection methods were modified from the use of general topographic surface comparisons based on monthly GPS surveys to the use of point-specific location GPS surveys. The change to a point to point comparison method has greatly reduced the scatter of data and indicated a more consistent settlement front diagram. Plots of settlement rate, gas constituents and wellhead temperatures are included in Appendix E. The data shows that the settlement rate associated with the settlement front limits is a good predictor of the rise in CO and CO_2/CO ratios.

Settlement front limits since January 3, 2013 are also shown to enclose the majority of wells that show CO values above 4,500 ppm (or CO_2/CO ratio of less than 132). This information is included in Appendix E.

4.4 SELECTION OF TRIGGER PARAMETERS

4.4.1 Data-Supported Triggers

Based on the site-specific evaluation of potential trigger criteria, and the discussion contained in Appendix E, Bridgeton Landfill proposes three parameters for identifying the presence, location, and estimating the rate and direction of movement of the SSE. These trigger parameters and associated values have been demonstrated to meet the criteria described in Section 4.1: readily obtained, easily confirmed, and confidently interpreted, and are representative of a proximate SSE. Based upon this evaluation of data, the proposed parameters and trigger values are:

- TMP maximum temperature above 220° F,
- Location and velocity of movement of the settlement front (defined as the line at which settlement equals 1.35 feet per month); and
- Combination of wellhead temperature greater than 170° F and laboratory carbon monoxide (CO) above 3,000 ppm.

4.4.2 MDNR Suggested Triggers

In a June 17, 2013 report prepared by Todd Thalhamer, Table 5 - Proposed Sentry Criteria for the Construction of the Isolation Break" was provided "as a starting point for the criteria discussion." This table only addressed trigger criteria for installation of a contingent isolation barrier and did not consider trigger criteria for the other contingent actions contemplated by the Agreed Order.

The trigger parameters included the use of TMP maximum temperature, and gas wellhead carbon monoxide and temperature data. Recommended trigger values were used in different combinations and varied depending on detection in one well or multiple wells.

4.4.3 Selected Trigger Parameters

Selected trigger parameters and associated values have been chosen after considering both the data-supported triggers, MDNR suggested triggers, the July 24, 2013 MDNR comment letter, and discussions and meetings held since the June submittal of this document. As such, settlement monitoring has been dropped as a trigger, while maximum TMP temperature, wellhead carbon monoxide values, and wellhead temperature readings have been selected.

Proposed values, locations, and uses for these trigger criteria, including validation procedures to prevent false or inadvertent triggering, are described in Sections 5.0 of this Plan.

5.0 PROPOSED AND CONTINGENT FUTURE ACTIONS

Based on the discussions of the previous sections, we propose future actions categorized as:

- Proposed Non-Triggered Actions – Certain actions are proposed that either improve the strength of monitoring or provide additional isolation capabilities. These could be implemented as soon as practical for greatest desired effect.

- South Quarry Monitoring Triggered Actions – Monitoring in the South Quarry will provide information for triggered installation of cooling capacity (enhanced GIWs and/or dedicated cooling points as well as capping with enhanced GCCS actions in the North Quarry.

- North Quarry Monitoring Triggered Actions – Monitoring in the North Quarry will provide information for triggered capping with enhanced GCCG and construction of an isolation barrier between the North Quarry and radiologically-impacted material in the OU-1 area.

These three different categories of actions are described in the following sections.

5.1 PROPOSED NON-TRIGGERED ACTIONS

5.1.1 Additional Temperature Monitoring Probes (TMPs)

Based on verbal comments from the MDNR regarding possible coverage gaps in the existing lines of TMPs, we proposed to install three new TMP locations near the quarry wall edges as shown on Figure 3. These TMPs could be installed within four weeks of MDNR approval of their location.

5.1.2 Enhancement of Existing Gas Interceptor and Gas Extraction Wells

The DRAFT version of this report proposed installation of additional gas interceptor wells (GIWs) as required by the Agreed Order. However, subsequent discussions and comments from the MDNR have indicated that installation of similar additional GIWs would not be approved.

Although the existing GIWs appear to be effective and performing as designed to date, the MDNR is requiring that additional forms of heat removal be implemented. As discussed in Section 3.1.2 of this Plan, other than by adding more GIWs for additional gas collection capacity, additional heat removal can most effectively and practically be accomplished by heat exchange using cool water in contact with conductive piping in gas well casing.

It is proposed that two existing GEWs and/or GIWs be selected for near-term enhancement with the installation of cooling mechanisms. Selection of appropriate existing gas wells for this purpose will be made by mutual agreement between Bridgeton Landfill and the MDNR. The

enhancement will be performed as described in Appendix I of this Plan. Data gathered from implementation of this enhancement will be used for detailed design of potential future GIW enhancement or design of dedicated cooling points.

5.2 SOUTH QUARRY MONITORING TRIGGERED ACTIONS

The trigger parameter of maximum TMP temperature will be monitored along a Trigger Line 1 as shown on Figure 3. The trigger line, associated mitigative actions, and schedules for implementation are described in the following sections. A schematic diagram of the steps in this process is provided as Table 1 of this Plan.

Trigger Line 1 is formed by an arc connecting TMP-6, -14, -13, and -5. When a verified (procedures for reading and verifying readings are provided in Appendix F) maximum TMP temperature at any of these TMPs exceeds 200° F, Bridgeton Landfill will notify the MDNR SWMP Engineering Section Chief within one business day. The MDNR may wish to observe confirmatory testing or perform independent testing to confirm the trigger reading.

When Bridgeton Landfill and the MDNR mutually agree that the trigger has been reached, the triggered actions may be implemented as required by the MDNR. These actions include installation of additional enhanced GIWs and/or cooling points south of the neck area and construction of additional cap and enhanced GCCS (North Phase 1A) as shown on Figure 4.

A detailed plan for location and construction features of the new enhanced GIWs and/or cooling points will be submitted with a revised Part 2 of the Plan; an approximate location for a series of dedicated cooling points is indicated on Figure 4 of this Plan. A set of construction plans for the installation of EVOH geomembrane cap and enhanced gas collection system over the North Quarry area was provided with the July 27, 2013 submittal of Part 2 of the North Quarry Contingency Plan. Approximate location of the proposed cap is shown on Figure 4.

The timeline for constructing the new enhanced GIWs and/or cooling points and North Phase 1A cap and enhanced GCCS is presented on Table 1.

5.3 NORTH QUARRY MONITORING TRIGGERED ACTIONS

Conditions will be monitored in the entire North Quarry area using gas wellhead temperature and carbon monoxide (CO) values as appropriate. If any gas extraction well exhibits wellhead temperature greater than 145°F, monthly CO laboratory testing and weekly field Draeger tube testing will be performed on that gas well.

Then, a combination of wellhead temperature greater than 180° F and CO greater than 1,500 ppm, at any GEW gas well in the North Quarry will initiate a verification and further investigation process as indicated below:

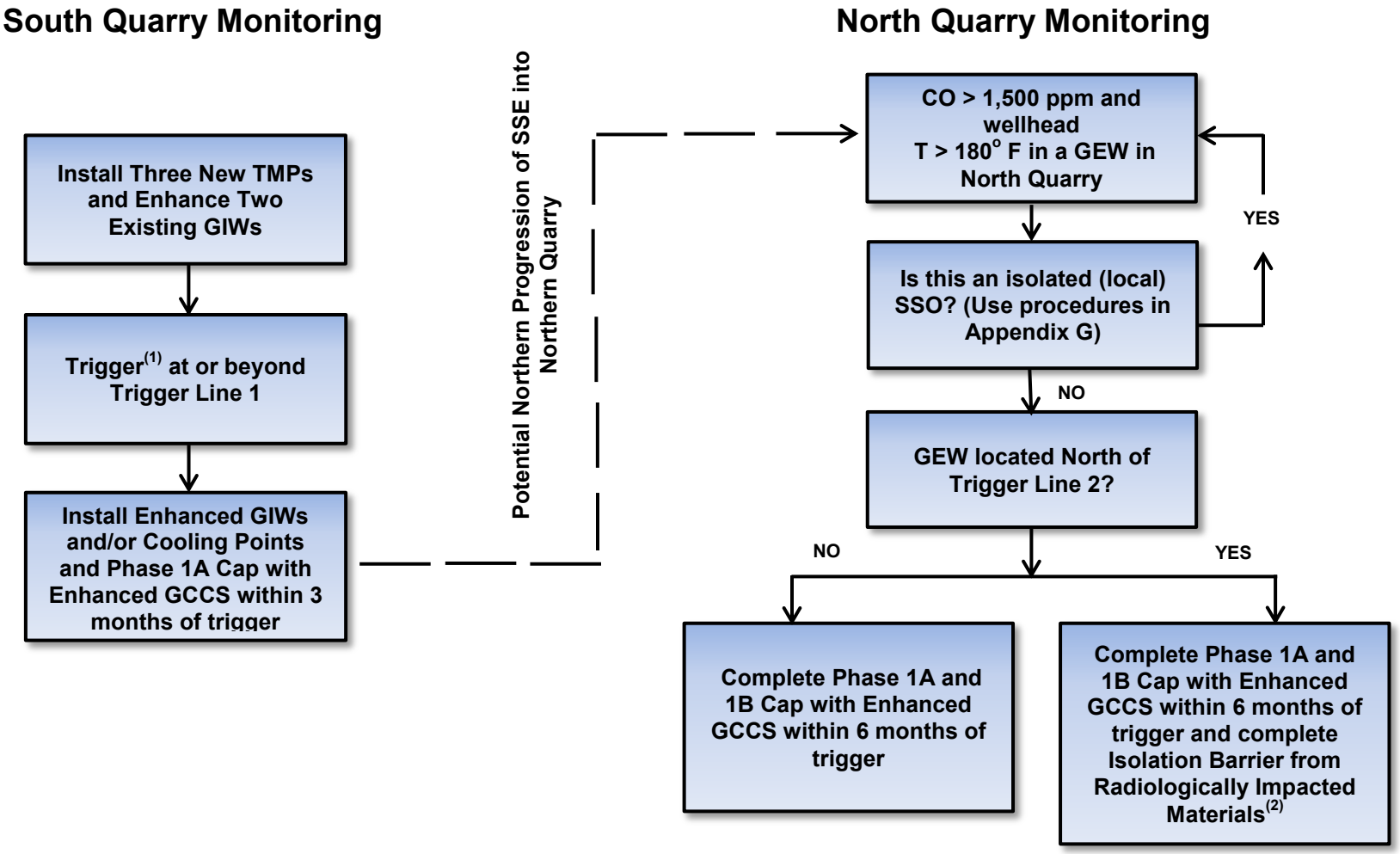
1. Carbon monoxide shall be resampled and sent to a laboratory for expedited testing and results within one week of receipt of the initial Draeger tube or laboratory CO data that indicated over 1,500 ppm;
2. Daily wellhead temperature readings will be made at the GEW to confirm the initial reading over 180° F and observe trends;
3. Procedures to address the possibility of a common, localized subsurface oxidation (SSO) event will be implemented as set forth in the "Standard Operating Procedure for Management of a Local Subsurface Oxidation Event" which is included in Appendix G of this Plan.

If the above steps confirm sustained readings above 180° F and CO greater than 1,500 ppm at the GEW well, and suggest that the readings are not the result of a localized SSO that can be managed and controlled to that specific location, then Bridgeton Landfill will notify the MDNR SWMP Engineering Section Chief within one business day. The MDNR may wish to observe confirmatory testing or perform independent testing to confirm the trigger reading.

When Bridgeton Landfill and the MDNR mutually agree that the trigger has been reached, and whether the triggered occurred north or south of Trigger Line 2, the triggered actions may be implemented as required by the MDNR. These actions include capping and enhanced GCCS and/or construction of an isolation barrier depending on the location of the verified trigger gas well (north or south of Trigger Line 2), as indicated on Table 1 and Figure 4 of this Plan.

TABLES

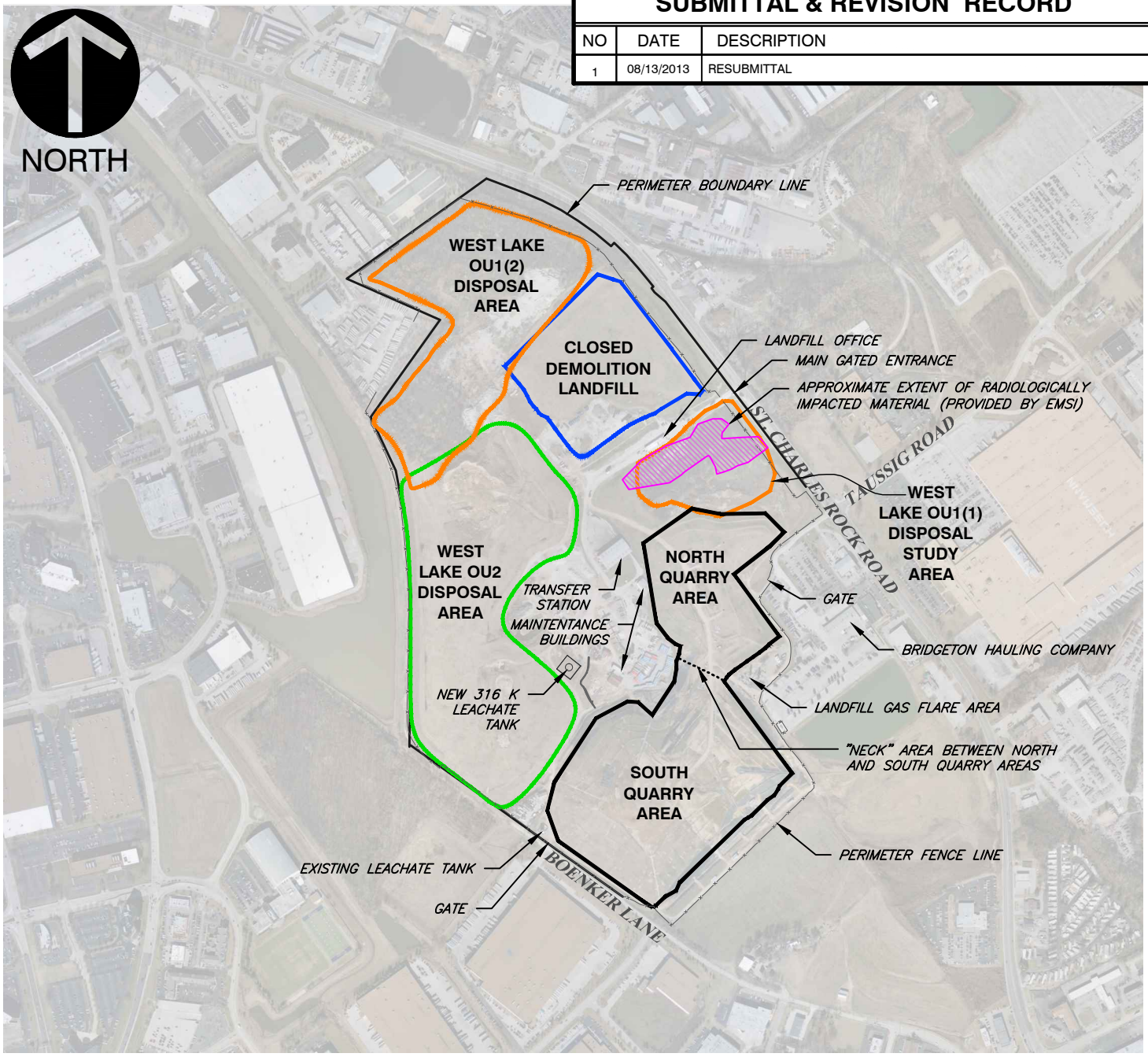
TABLE 1
NORTH QUARRY CONTINGENCY PLAN ACTIONS



(1) Any verified TMP interval > 200° F
(2) After completion of Isolation Barrier, Complete Phase 2 of Cap with Enhanced GCCS

FIGURES

SUBMITTAL & REVISION RECORD		
NO	DATE	DESCRIPTION
1	08/13/2013	RESUBMITTAL



REFERENCE

1. AERIAL IMAGERY PROVIDED BY EAST WEST GATEWAY COORDINATING COUNCIL OF MISSOURI AND ILLINOIS, COLLECTED IN LATE FEBRUARY AND EARLY MARCH OF 2012.
2. BOUNDARY INFORMATION PROVIDED BY SHERBUT-CARSON & ASSOCIATES, P.C. DRAWING NAME-1111 LEASE EXHIBIT.DWG RECEIVED ON 03/04/2013

SCALE IN FEET

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BRIDGETON LANDFILL, LLC
13570 ST. CHARLES ROCK ROAD
BRIDGETON, MISSOURI

FACILITY MAP

DRAWN BY:	MSP	CHECKED BY:	MRB	APPROVED BY:	IAC	FIGURE NO.:	1
DATE:	JUN. 2013	DWG SCALE:	1"=1000'	PROJECT NO:	131-178.0001		

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NORTH

WEST LAKE OU2

WEST LAKE OU2

WEST LAKE OU1(2)

CLOSED DEMOLITION LANDFILL

BOENKER LANE

QUARRY WALL

QUARRY WALL

SOUTH QUARRY AREA

NORTH QUARRY AREA

FORMER ACTIVE SANITARY LANDFILL SOLID WASTE BOUNDARY

ESTIMATED EXTENT OF RADIOLOGICALLY IMPACTED MATERIAL (PROVIDED BY EMSI)

WEST LAKE OU1(1)

SITE ENTRANCE

ST. CHARLES ROCK ROAD

SOLID WASTE PERMIT BOUNDARY

A

A'

0+00

10+00

20+00

30+00

34+13

APPROX. NORTH

OU-1 BOUNDARY

SOUTH QUARRY BOUNDARY

ALIGNMENT

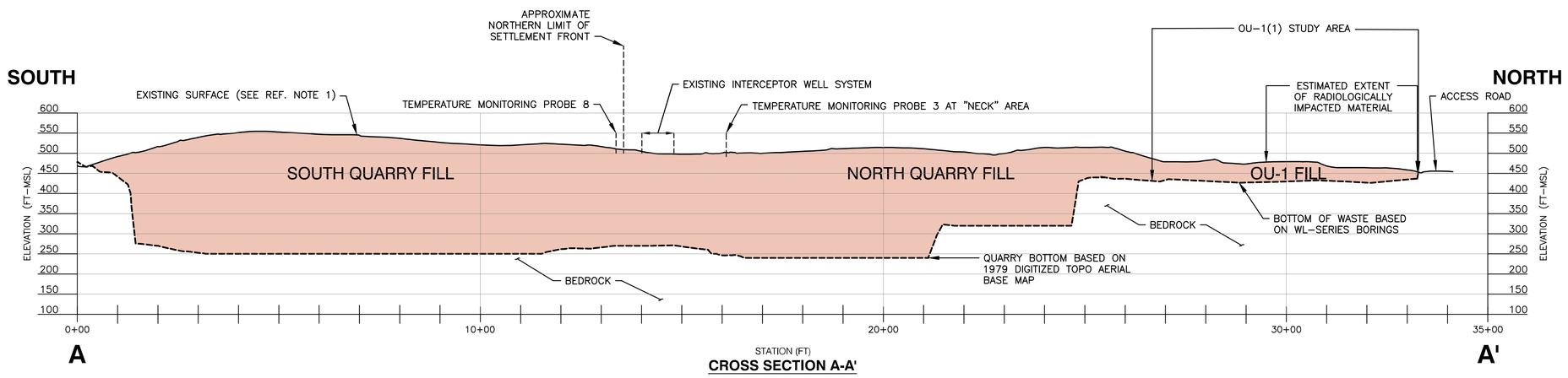
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LEGEND

- SW — EXISTING SOLID WASTE PERMIT BOUNDARY
- OU-1 — EXISTING OU1 STUDY AREA BOUNDARY
- OU-2 — EXISTING OU2 BOUNDARY
- CD&D — EXISTING CLOSED DEMOLITION BOUNDARY
- EXISTING QUARRY HIGHWALL
- ⊕GEW-81 — EXISTING LFG EXTRACTION WELL (GEW)
- TMP-6 — EXISTING TEMPERATURE MONITORING PROBE (TMP)
- GIW-10 — EXISTING GAS INTERCEPTOR WELL (GIW)

REFERENCE

1. TOPOGRAPHIC INFORMATION BASED UPON BRIDGETON LANDFILL–DTM.DWG PROVIDED BY COOPER AERIAL SURVEYS CO., DATED FEB. 2013. SURVEY FIELD SUPPLEMENTED BY WEAVER BOOS CONSULTANTS.
2. AERIAL IMAGERY PROVIDED BY EAST WEST GATEWAY COORDINATING COUNCIL OF MISSOURI AND ILLINOIS, COLLECTED IN LATE FEBRUARY AND EARLY MARCH OF 2012.



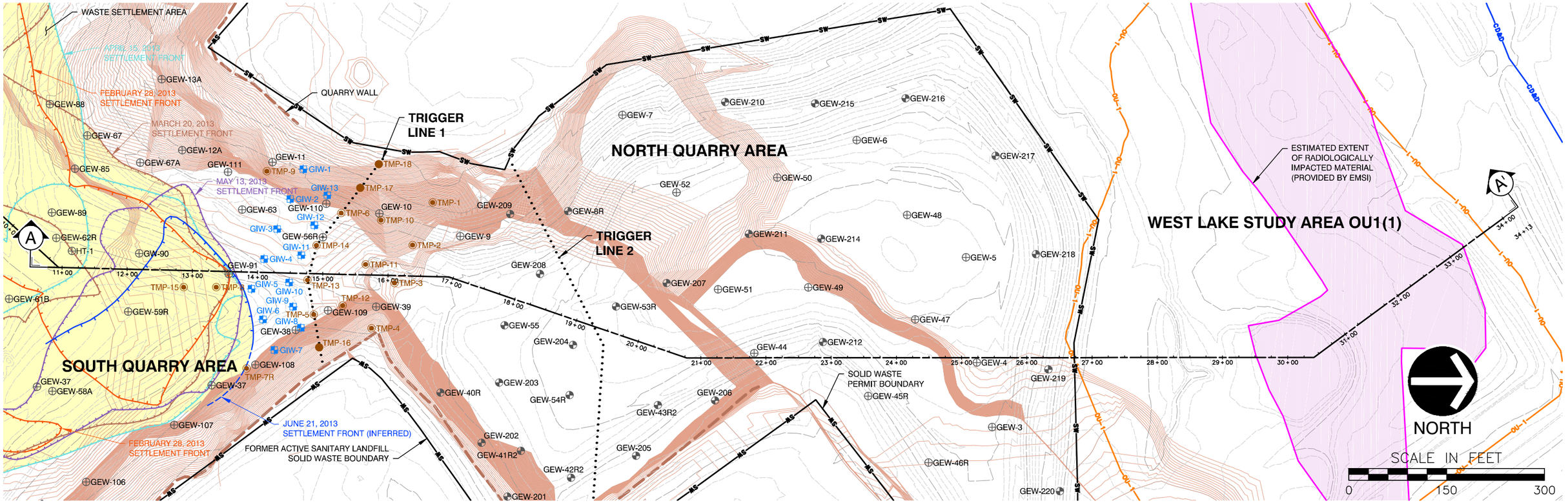
CROSS SECTION A-A'

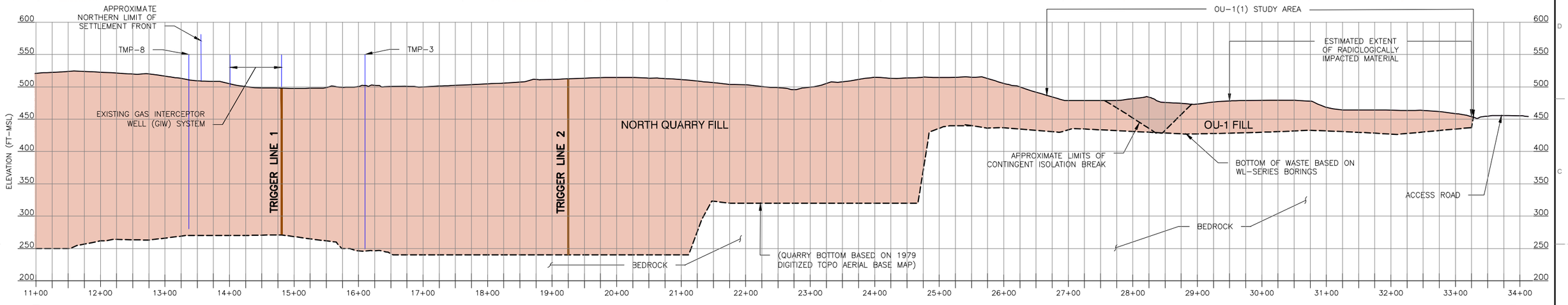
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BRIDGETON LANDFILL - EXISTING CONDITIONS

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DATE:	JUN. 2013	DWG SCALE:	1"=150'	PROJECT NO:	131-178.0001		

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CROSS SECTION A-A'

LEGEND

- EXISTING SOLID WASTE BOUNDARY
- EXISTING OU1 BOUNDARY
- EXISTING CLOSED DEMOLITION BOUNDARY
- EXISTING QUARRY HIGHWALL
- EXISTING QUARRY BOTTOM CONTOURS
- GEW-81 EXISTING LFG EXTRACTION WELL (GEW)
- GEW-200 CONTINGENT NEW OR REPLACED LFG EXTRACTION WELL (GEW)
- TMP-6 EXISTING TEMPERATURE MONITORING PROBE (TMP)
- TMP-16 PROPOSED TEMPERATURE MONITORING PROBE (TMP)
- GIW-10 EXISTING GAS INTERCEPTOR WELL (GIW)

REFERENCE

1. TOPOGRAPHIC INFORMATION BASED UPON BRIDGETON LANDFILL– DTM.DWG PROVIDED BY COOPER AERIAL SURVEYS CO., DATED FEB. 2013. SURVEY FIELD SUPPLEMENTED BY WEAVER BOOS CONSULTANTS.
2. QUARRY BOTTOM CONTOURS BASED ON A 1979 DIGITIZED AERIAL BASE MAP.

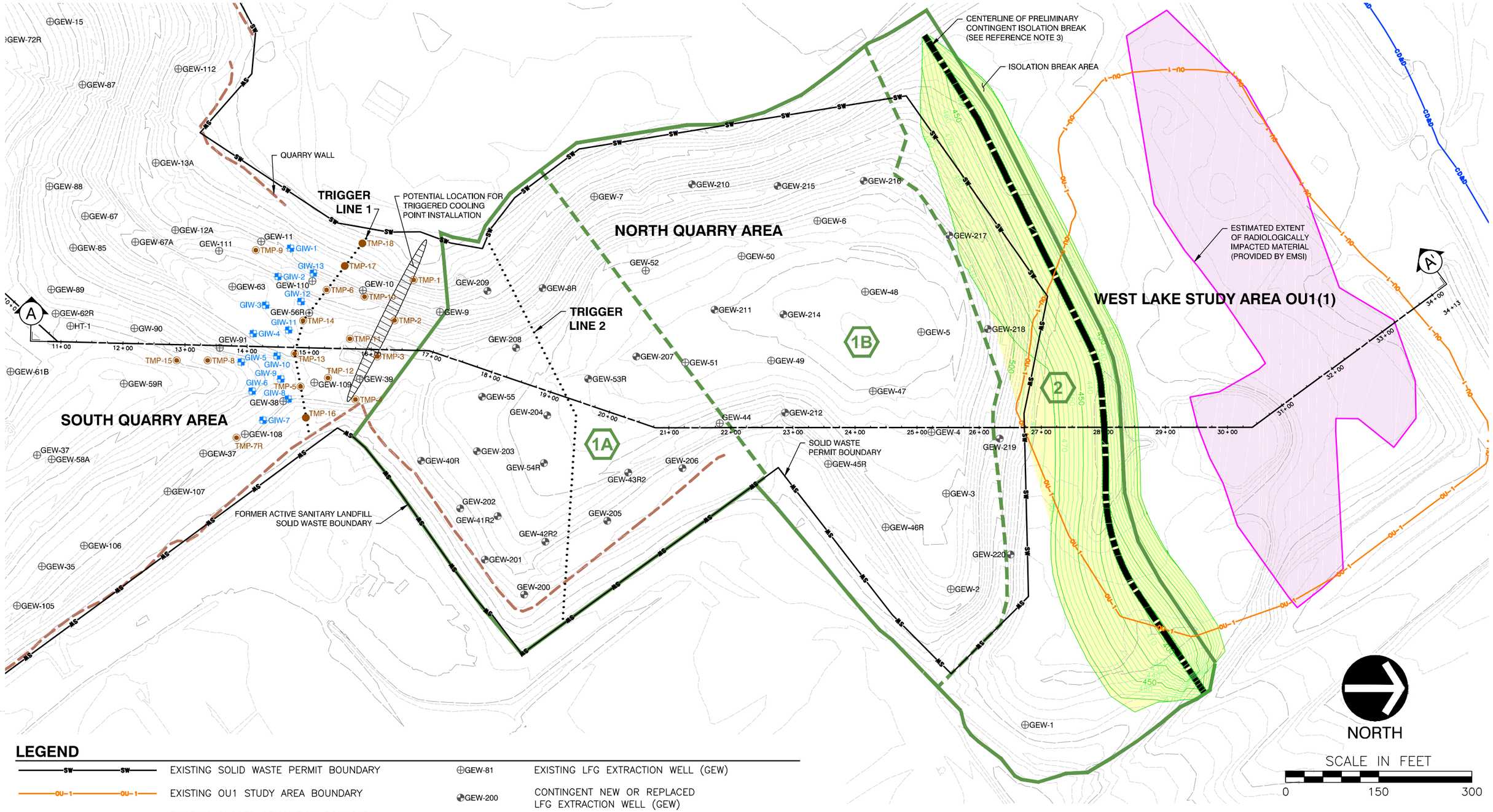
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NORTH QUARRY TRIGGER CRITERIA

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DATE:	JUN. 2013	DWG SCALE:	1"=150'	PROJECT NO:	131-178.0001

FIGURE NO.: 3

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LEGEND

SW — SW	EXISTING SOLID WASTE PERMIT BOUNDARY
OU-1 — OU-1	EXISTING OU1 STUDY AREA BOUNDARY
CD&D — CD&D	EXISTING CLOSED DEMOLITION BOUNDARY
	EXISTING QUARRY HIGHWALL
	PROPOSED CAP EXTENT
	PROPOSED CAP PHASE BOUNDARY
1B	PROPOSED CAP PHASE DESIGNATION
GEW-81	EXISTING LFG EXTRACTION WELL (GEW)
GEW-200	CONTINGENT NEW OR REPLACED LFG EXTRACTION WELL (GEW)
TMP-6	EXISTING TEMPERATURE MONITORING PROBE (TMP)
TMP-16	PROPOSED TEMPERATURE MONITORING PROBE (TMP)
GIW-10	EXISTING GAS INTERCEPTOR WELL (GIW)

REFERENCE

1. TOPOGRAPHIC INFORMATION BASED UPON BRIDGETON LANDFILL– DTM.DWG PROVIDED BY COOPER AERIAL SURVEYS CO., DATED FEB. 2013. SURVEY FIELD SUPPLEMENTED BY WEAVER BOOS CONSULTANTS.
2. DESIGN OF THE CONTINGENT NORTH QUARRY EVOH CAP AND ENHANCED GCCS, AS WELL AS ADDITIONAL INFORMATION ON PROPOSED ISOLATION BREAK IS PROVIDED WITH PART 2 OF THIS PLAN.

SUBMITTAL & REVISION RECORD		
NO	DATE	DESCRIPTION
1	08/13/2013	RESUBMITTAL

PLAN VIEW OF CONTINGENT ACTIONS

DRAWN BY:	MSP	CHECKED BY:	MRB	APPROVED BY:	IAC	FIGURE NO.:	4
DATE:	JUN. 2013	DWG SCALE:	1"=150'	PROJECT NO:	131-178.0001		

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APPENDIX A

PREVIOUS REPORTS ON POTENTIAL MITIGATIVE MEASURES

NORTH QUARRY HEAT BARRIER SYSTEM

BRIDGETON LANDFILL

PREPARED FOR
BRIDGETON LANDFILL, LLC.
12976 St. CHARLES ROCK ROAD
BRIDGETON, MO 60344
1/4/2013

Prepared by
P.J. Carey & Associates P.C.

EXECUTIVE SUMMARY

This report presents an evaluation of barrier systems that could be employed to prevent the migration of the subsurface heating activity in the South Quarry section of the Bridgeton Landfill (Landfill) from progressing beyond the entry of the North Quarry section of the Landfill. Due to the complexity in assessing and addressing the migration of the underground heat generating reaction, evaluations are ongoing and Bridgeton Landfill, LLC reserves its right to modify or supplement this report as appropriate based upon additional information and evaluation.

Evaluation and Selection of Barrier System

The evaluation considered a number of barrier types including:

- Physical separation using open excavations or structurally supported open space,
- Insertion of significant thicknesses of inert materials,
- Thin barriers of non-combustible materials, and
- Heat dissipation barriers.

The report provides a general description of each type of barrier, a discussion of the design elements required, and the performance goals. Examples of specific design elements are included in the general descriptions. The post installation performance requirement of the barriers is used to evaluate the ability of the barrier types to be successfully employed at the Landfill. In addition to the actual ability of the barrier type to prevent heat migration or combustion progress in theory; the ability to be installed in the required time frame, maintained and remain intact under the anticipated conditions as well as the demands on stormwater, leachate and gas management were considered for each barrier type.

The evaluation of the barrier types concluded that only heat dissipation type barriers were technically feasible and could be installed within a short enough time frame to be effective at achieving the goal with limited impacts. Barriers consisting of removal of significant amounts of waste materials and replacing them with inert fills were evaluated but were not considered due to the inability to construct in a reasonable time frame. Barriers requiring removal and replacement of significant amounts of waste also had significant issues with respect to air emissions, odors, vectors, and traffic that made them highly undesirable.

At this time the heat dissipation/barrier system has been selected as the preferred alternative for use at the Landfill on the basis of the evaluation of all barrier types.

Design of Heat Barrier

The heat barrier system was designed based on an analysis of the advance rate of the heat front, as reflected in settlement of the landfill, and the amount of energy associated with advancing the front. This information was used to develop a range of heat flow in the northern direction in the depth range indicated by the in-waste temperature monitoring to be the heat generating zone. Cooling pipe elements have been designed to maintain temperatures below 170 ºF on the north side of the barrier. Heat is extracted in this system by circulating water in the closed system cooling points at temperatures as low as

a few degrees above the wet bulb ambient air temperature using an evaporative cooler system. The design includes an initial insertion of approximately 42 cooling points across the narrow section of the quarry fill, supply and return headers for the cooling water and a cooler system comprised of a commercially available evaporative cooler.

Based on the current site data, the system has been designed to remove up to 75 Watts/ square meter (W/m^2) of energy across the entire cross section with the initial cooling point installation. The heat barrier can be expanded, if conditions require it, in terms of the number of cooling points used and the total heat energy extracted.

Time of construction of the heat barrier is estimated to be approximately 90 days following notice to proceed. Based on this time frame, an Action Line has been identified approximately 100 feet south of the proposed barrier location. In-waste temperature monitoring probes (TMPs) have been installed along the Action Line. Mobilization for construction of the barrier will occur if temperatures in the waste rise to 200 ºF or gas wellhead temperatures exceed 195 ºF at the Action Line. Based on the current state and movement of the heat front, it is apparent that adequate time is available to finalize the design, get contracts in place and establish the specific critical path item times that may require pre mobilization, purchase, and fabrication of system components.

The design elements are presented in 5 drawings. Final Construction drawings and specifications will be developed on the basis of this draft design.

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Figure 1 – General Site Plan

Figure 2 – Open Excavation at Quarry Neck

Figure 3 – Open Excavation in North Quarry

Figure 4 – Filled Excavaton in North Quarry

Figure 5 – Settlement Front Advance

Appendices

Appendix A - Calculations

1 Introduction

The purpose of this report was to evaluate, select and design a barrier system to prevent the underground heat generating reaction currently present in the South Quarry portion of the Bridgeton Landfill from progressing beyond the entry of the North Quarry portion of the landfill.

The report is based on analysis of measurements that have been obtained at the landfill through historically and recently performed surveys and analysis of waste temperature measurements. The report is arranged to identify the types of barrier systems that could be utilized, identify the design issues, develop an evaluation basis for each barrier type, select a barrier type, and present a design for the selected barrier that will be used to prepare construction specifications and a manual presenting barrier system operation and maintenance requirements.

The report utilizes site information that has been reported by others on behalf of the Landfill. It does not restate this information but focuses on the barrier system selection and design.

Because of the complexity in assessing and addressing the migration of the underground heat generating reaction, evaluations are ongoing and Bridgeton Landfill, LLC reserves its right to modify or supplement this report as appropriate based upon additional information and evaluation.

2 Barrier Types for Consideration

The type of barriers and general configurations that are considered for evaluation are shown below in Table 1. The barriers have been divided into general categories relating primarily to construction and design/performance. The table also includes ways in which the various systems could be combined with other systems within their own category or of other categories. The table is intended to include developed types of technologies that could be reasonably used if they were feasible. The table represents a preliminary identification of technologies, prior to any screening associated with feasibility evaluation.

Figure 1 depicts the Landfill surface grades as of March 2012 and the floor of the quarry. This provides a perspective on the size of potential barriers and depths of the waste column within the limits of the landfill.

TABLE 1

TYPES OF BARRIERS CONSIDERED – BRIDGETON LANDFILL

General Type	Configuration	Alignment	Geometry	Structure	Materials	Brace Options	Possible Combination of Types
Open Excavation-no structure	Excavation to Quarry Base	Restricted to non radioactive areas and areas without elevated temperatures	Slopes down to quarry bottom Surfaces with 3:1 slopes	NA	NA		
	Partial Excavation	Restricted to non radioactive areas and areas without elevated temperatures	Slopes down to some intermediate elevation with vertical to quarry floor Surfaces with 3:1 slopes	NA	NA		With zone below excavation vertical barrier – with or without heat extraction
Structurally supported open space	Parallel walls with internal bracing extending to quarry bottom	Restricted areas where total length is minimized	Vertical	Beam and Lagging	Steel beams Concrete lagging	Steel bracing	
				Structural Slurry Wall	Reinforced concrete placed in panels by tremie	Structural Slurry wall support panels normal to wall face	
				Tangential concrete caissons	Concrete with steel reinforcement	Steel Bracing	
	Cellular Empty Structures extending to quarry bottom	Restricted areas where total length is minimized	Vertical	Structural slurry wall	Concrete with steel reinforcement	Structural Slurry wall support panels normal to wall face	
Non Open Space Barriers-not structurally supported	Backfilled open sloped excavation extending to quarry floor	Same as open Excavations with no structures	Various slopes – from 3:1 to slopes as steep as 1.5:1 (maybe even 1:1 with safety precautions if shallow)	None	Soil or non-combustible waste materials	NA	Variations in combination open unfilled excavations and structurally supported non open space systems are possible-narrow barriers may require heat removal also
Non Open Space Barriers Structurally supported	Parallel wall internal bracing	Restricted areas where total length is minimized	Vertical	Beam and Lagging	Steel beams Concrete lagging Earthen backfill	Steel bracing	All may be combined with Heat Barrier systems and open excavation (to reduce vertical height of barrier
				Structural Slurry Wall	Concrete walls Earthen fill or cementious backfill	Structural Slurry wall support panels normal to wall face	
				Tangential concrete caissons	Concrete with steel beams Earthen fill or cementious backfill	Steel Bracing	

General Type	Configuration	Alignment	Geometry	Structure	Materials	Brace Options	Possible Combination of Types
	Parallel slurry walls no internal bracing	Restricted areas where total length is minimized	Vertical	Weak Structural Slurry walls	Cementious backfill with minimal steel	None – excavation under slurry	
Heat Removal	Active heat exchange in wells within waste using lower temperature liquid circulation	Not restricted but most effective with limited alignment length	In drill holes of various diameters with backfill In backfill associated with backfilled barrier option vertical or horizontal In drill holes in front of heated side of barriers	Dual pipe installations in drill holes – header for supply (closed system) with heat removed by air cooling and or chilling	Steel piping with conditioned water	NA	Non open space barriers
	Passive conductive elements	Not restricted but most effective with limited alignment length	Vertical in drill holes or in backfill with any orientation	Closed shapes	Highly conductive but non corroding metals (coated steels)	NA	As part of backfill in non open space barriers
Heat Barrier	Insulation Barrier	NA	Works only as part of non open space barrier	See non open space barriers	Non combustible expanding foams with mineral filler	NA	As part of backfill in non open space barriers
				In combination with all backfill and other heat type barriers			

3 Post Installation Barrier Performance Requirements

This section of the report discusses and presents the design considerations and performance requirements for the various types of barrier systems that could be installed. This forms the basis for evaluating the technical feasibility of the systems.

3.1 Open Excavation Type Systems - Slopes

This evaluated option refers to open excavation with slopes and not braced or open excavations that are then backfilled following construction. This pertains to cut excavations that are left open until such time as it is deemed unnecessary to maintain the open space.

3.1.1 Excavation Slope Stability

Slopes must be stable for the long term. It is likely the steepest slope meeting this criterion could be 2:1 or 2.5:1, depending on assumptions made regarding the development of seepage/pore pressures proximate to the excavation slopes. On the side that may be exposed to potential heating, a more shallow (3:1) maximum slope is appropriate to account for adverse seepage that would develop as a result of moisture content increases caused by condensation of water vapor as it approaches the locally cooler slope surface.

3.1.2 Slope Cover and Run-off Management

The final slope configuration resulting from the open excavation would require a cover to prevent waste exposure and oxygen intrusion. In addition, rainfall run-off must be directed and managed to prevent erosion.

For any portion of the open excavation barrier that is below the perimeter grades at the site where it is constructed, a pumping system and temporary holding basin at the bottom of the open area would be required. This basin must be lined to prevent intermingling of leachate, seepage, condensate etc. with stormwater.

Portions of the open excavation above the exterior limits of the landfill edge may be drained to a basin in a normal fashion.

The stormwater management system must be designed to accommodate a 100 year rainfall event. Given the short time of concentration, a measure of how long run-off takes to flow from the most remote location in the watershed to the discharge point, peak pumping rates to remove the incident rainwater below the perimeter drain for systems with limited storage would be high. With steeper slopes, the temporary cap is likely to be impervious. Steeper slopes with vegetated cover could be used on the non-heat side of the barrier, but would require 2.5:1 or flatter slopes or specialized systems to keep soils in place. The only reason for using vegetated slopes is to reduce run-off, since in the long term, the slopes are likely to be filled in to at least the gravity drainage level.

3.1.3 Seepage and Leachate Collection management

Seepage collection needs to be provided for the slopes under the temporary capping system. In the event that some leachate seepage were encountered at the base of the excavation a significant drain and pump station could be required at the bottom of the excavation area.

3.1.4 Gas Emission Management

Gas wells and under cap collectors are required to control emissions, especially on the heated side of the excavation. The need for these types of features has been identified at other sites experiencing similar conditions. Installation of gas collection components in this type of environment is very complex to install and operate. The potential for over-pull of ambient oxygen into the landfill is great as the system is tuned to manage heat, and the steam and pressure front associated with the subsurface heat generating reaction.

3.2 Open Space – Structurally Supported

This type of barrier creates an open zone in the waste that is near vertical on either face in the waste mass. Examples of this type of system would be braced excavations using beam and concrete lagging on both faces or parallel structural slurry walls with open space. Each face of the excavation is braced against each other using a system of whalers and beams.

3.2.1 Stability – Physical Forces

The bracing structures would have to be designed to withstand:

- Lateral earth pressures that will be exerted by the waste mass. These could be computed using standard formulae for active, passive and at-rest pressures based on methods for generally static conditions, presuming no volume destroying phenomena, e.g. reduction in waste volume through pyrolysis, advanced within a critical distance of the barrier. The critical distance is approximately defined as upward projection from the base of such an event at a 45 degree vertical angle toward the barrier. Therefore, if the maximum depth of a volume destroying event were 200 feet, the active, passive and at-rest design pressures would not apply if the event were within a 100 feet of barrier.
- Lateral strains and unbalanced earth pressures for potential volume destroying events within the critical distance discussed in the previous bullet item should be based on a displacement model and utilize large displacement finite element modeling to approximate stresses in the structural elements. Lateral displacements at the ground surface associated with subsidence at other sites experiencing similar conditions have been measured to be as much as 50 percent of the vertical subsidence in non-sloping areas. This requires that the support structure be ductile and maintain its integrity with significant deformation. Design for lateral movements on the order of 15 feet, or more, would have to be considered, based on settlement expectations of greater than 30 feet as being possible.
- Downdrag forces must be considered to fully develop on the surface of both sides (both the heated and unheated) of the barrier. The natural decomposition of the waste results in sufficient settlement to fully develop full downdrag forces.

3.2.2 Heat Resistance

This type of barrier has significant potential for oxygen intrusion through the face of the structure. This could greatly increase the potential for an actual combustion event near the barrier. It would be difficult to eliminate the possibility of oxygen intrusion through the face of the braced wall. As such, the structure should be designed to withstand the elevated temperatures associated with a fire condition. As an

alternative, flooding the open space if it is deemed likely that such an event is about to occur, could be considered in order to eliminate the need to consider temperatures above the boiling point in the design.

All materials used should be non-combustible. If cementious materials such as plastic concrete, normal reinforced concrete or precast elements are used, they must be designed to maintain integrity at the temperatures anticipated. Some temperature measurement should be included in the installation so decisions regarding flooding or heat exchange in front of the system could be installed and operated to reduce temperatures prior to the barrier structure being impacted.

3.2.3 Corrosion

The structural elements would be required to maintain their integrity under the design loads for the design life. Coatings, cathodic protection, use of special cements (sulfate resistant or fumé of silica based) would all need to be evaluated for inclusion in the design.

3.2.4 Explosive Environment Potential

It is likely that some combustible gas could enter this space creating a potential for explosion. For proper worker safety and environmental protection either the space would need to be well ventilated (which would create complications discussed in 3.2.5), flooded with water, or sealed using a fire resistant insulating material (making this a non-open space barrier discussed in 3.3).

3.2.5 Oxygen Intrusion

Oxygen intrusion through cracks of the facing elements in a beam and lagging system or structural slurry wall panel could allow preconditioned waste (dried, heated or partially pyrolyzed) to actually combust. No oxygen can be allowed to enter the waste on either side of the barrier system of this type. It is not likely that oxygen intrusion can be limited to an insignificant level. The failure to be able to do this is considered a fatal flaw for this type of barrier.

3.2.6 Leachate Seep Management

Leachate seepage through the face (assuming some cracks are present) must be collected and removed if the space is not designed to flood and be treated as leachate contaminated water.

3.3 Non –Open Space Barriers

This category of barrier includes systems that rely on backfill material placed into a space created by excavating, drilling or driving. The materials can be inert soils, structural elements or mixtures of soils, resistant foams or slurries. Cofferdams, filled segmented structural slurry wall bins, braced excavations filled with soils and foams, contiguous augered and backfilled piers would all be considered examples of this type of barrier.

3.3.1 Stability – Structural

The physical forces that non-open space barriers must withstand are similar to those identified in 3.2.1, with the exception that large open excavations that were backfilled would have sloping sides, eliminating the issue with lateral earth pressures and downdrag forces. However, lateral deformations could still be an issue if the open excavation was narrow enough. Excavations with width to depth ratios of 0.4 or less would require the following to be accounted for in the design:

- Lateral earth pressures exerted by the waste mass. These could be computed using standard formulae for active, passive and at-rest pressures based on methods for generally static conditions presuming no volume destroying phenomena advanced within a critical distance of the barrier. The critical distance is approximately defined upward projection from the base of such an event at a 45 degree vertical angle toward the barrier. For example, if the maximum depth of a volume destroying event were 200 feet, the active, passive and at rest design pressures would not apply if the event were within a 100 feet of barrier. For excavations with temporary structural support, these forces would be applicable for the short term applied to the temporary support without the backfill materials. Longer term calculations would include the backfill material properties.
- Lateral strains and unbalanced earth pressures for potential volume destroying events within the critical distance defined above. Lateral displacements at the ground surface associated with subsidence at other sites experiencing subsurface heating have been measured to be as much as 50 percent of the vertical subsidence in non-sloping areas. This requires that the support structure be ductile and maintain its integrity with significant deformation. Design for lateral movements on the order of 15 feet, or more, would have to be considered, based on settlement expectations of greater than 30 feet being possible. Design methodology would be similar to that described in 3.2.1
- Downdrag forces must be considered to fully develop on the surface of both sides (both the heated and unheated) of the barrier. The natural decomposition of the waste results in sufficient settlement to fully develop downdrag forces. The barrier, including the backfill materials must either resist the forces or allow significant deformation to minimize the forces developed. Coatings and other thin friction reducing layers should not be considered adequate for this application unless proven to remain functional for the expected range of slippage required (as much as 30 foot of vertical deformation) that could occur adjacent to the barrier. Reliance on force resisting structural elements or internal shearing of barrier fill materials would be acceptable.

3.3.2 Heat Transmission

The transmission of heat through the barrier from the heated to the unheated side must be such that the temperatures on the unheated side do not result in either volume reduction (pyrolysis or combustion) or conditioning (drying and heating) of the waste to the point that potential for combustion or triggering of non-combustion driven chemical reactions is elevated to the point that the barrier is not effective.

The critical temperature on the cooler side of barrier would range from of 175 °F to 210 °F depending on the moisture content that can be sustained in the waste. At these temperatures, the landfill gas withdrawal process removes a large amount of water vapor, resulting in the eventual dehydration of the waste mass, which is a significant step in preconditioning the waste for further temperature rise or pyrolysis.

Heat transfer calculations must be performed that are based on observed advance rates of the heat front at the site with some assumptions concerning the dimensions of the actual heat front. Site measurements using the TMPs and gas wellhead temperatures allow the boundary temperature and potential for delivery of heat energy to the barrier from the hot side to be estimated. The thermal properties of the waste and backfill materials may be estimated from the literature, with corrections being applied, as needed, to

account for pyrolyzed or dried waste. As will be discussed in 3.4, heat removal systems could be incorporated into backfill materials to reduce the transfer of heat across the barrier.

3.3.3 Corrosion

The barrier (including any structural elements that are being relied on for long term function, if any) would be required to maintain its integrity under the design loads and thermal properties for the design life, or be planned to be replaced as needed.

3.3.4 Other

Oxygen infiltration, explosive environments and leachate seep management, while issues for non-filled barriers, are largely eliminated by using fill in the barrier system.

3.4 Heat Barriers (Heat Removal Systems)

The goal of heat removal within a zone is to lower or maintain the temperature within a designated area of waste, to a level that will impede pyrolysis, smolder or other mechanism that could result in the continuation of the heat generating reaction beyond the barrier limits. In addition, creation of a local lower temperature zone will result in the condensing of water vapor in the vicinity of the heat barrier, reducing or eliminating waste dehydration. Systems of this type may be used alone or in conjunction with other filled barrier systems.

3.4.1 Physical Forces

The forces acting on portions of the heat removal system (cooling elements) installed in the waste are the same as those previously described for the other narrow type open and non-open space barriers. These forces are associated with lateral pressure, downdrag, and lateral deformation. As an alternate to long term performance under these forces, the cooling elements can be designed to be replaced as required.

3.4.2 Thermal Performance

The system must be designed to remove heat energy at a rate equal to the maximum rate that is likely to be delivered by the reaction without allowing the temperature on the unheated side of the barrier to exceed the target value. The design must address both total energy removal and the removal of heat at the cooling points, similar to design of an array of dewatering wells. Monitoring the temperature in the waste in the vicinity of the heat removal barrier would allow for additional cooling elements to be installed in areas where the rise rate of temperature indicated that more heat removal was needed. Elements could be active or passive or a combination. However, it's unlikely that passive elements alone can remove heat to a substantial depth while maintaining temperatures at or below target values. Liquid systems should be closed while air cooled systems could be once through.

The rates of transfer and temperature predictions must account for the thermal properties of the waste and backfill materials adjacent to the transfer device.

3.4.3 Corrosion

Pipes, pumps, coolers and other conveyance and cooling elements of the system must resist corrosion from both the coolant and the waste material.

4 Design Parameters

4.1 Waste Physical Parameters

4.1.1 Strength

The following general parameters may be used for waste strength:

Waste Condition	Effective Stress Friction Angle (φ') deg	Effective Stress Cohesion Intercept (c') psf
Severely Heat Impacted	28	0
Other Waste	34	300

A directional modifier could be added when evaluating potential failure surfaces that are near horizontal are deemed likely within the waste, reducing the φ' to 22 or 24° along horizontal surfaces.

4.1.2 Compressibility

Consolidation, rebound and other one dimensional type behaviors can be computed using typical compression and recompression indices. These same values can be used to model the waste in more complex non-1 dimensional conditions as modified cam clay material. Parameters that could be used are presented below.

4.1.3 Lateral Pressure

Lateral earth pressures use waste strength to compute at rest and active earth pressures for short term conditions of vertical systems.

Longer term earth pressures at-rest should be based on a k_o (ratio of horizontal to vertical effective stress for at-rest conditions) of 0.5. Passive resistance pressures and lateral pressures under subsided conditions will be approximated using finite element simulations

4.1.4 Downdrag Forces

The constant reduction in waste height on both the heat impacted and not heat impacted side of a near vertical barrier, pipes and other vertical elements create downdrag forces. Downdrag forces can be assumed to be fully developed in all cases given the magnitude of movement anticipated from even regular waste decomposition. Interface friction angles used for the calculation are shown below.

Material	δ° (interface friction angle – degrees)
Steel – Pipe, Sheeting, Beams	22 (accounts for corrosion)
Structural Slurry Wall	32 (accounts for roughness)
Lagging Elements	20
Coated Elements (polymer or epoxy)	18

The total downdrag force cannot exceed the full development in waste of downdrag for the elements as a result of group interaction. Piping or other buried vertical structural elements that are used in close proximity should be analyzed for group interaction.

The force could be assumed to be active all the way to bedrock for stiff elements.

As an example, the downdrag force developed per foot of wall alignment on one side of a slurry wall system (structural) is estimated as 17.5 x tan(δ) x h^2. For a depth of 200 ft this amounts to 430 kips (1 kip is 100,000 lbs) per running foot of wall alignment for each face of barrier. If both sides of the wall are included, this becomes 860 kips per foot. At 230 foot it becomes 580 kips per foot.

4.2 Waste Heat Flow

Estimation of heat flow toward a barrier is dependent on the distance from the heat generating event, the type of event (still to be determined), and the conductivity of the materials between the event and barrier. Alternatively, the estimation of heat flow can be estimated using the rate of advancement of the heat front and overall heat balance associated with warming of the waste, evaporation of moisture and energy consumed in volume reduction. Waste conductivity values can be estimated using published values for dry, damp and wet waste, char and soils.

Table 1 from Yashida and Rowe contains some of the values needed. Ragland, Aerts and Baker cite a wood char conductivity of 0.052 W/m K for dry char at room temp. Table 1 from Yashida and Rowe is included in Appendix A.

4.3 Gas Permeability

Gas permeability values from the literature can be used for modeling heat transfer from the vapor phase if needed. If cold gasses are injected in areas where the waste is saturated or significant condensation would accumulate, this moisture would freeze adjacent to the injection point. This would render further injection impossible unless fracturing occurred. Once freezing of the waste occurred, the heat exchange to the injection point would be limited by the conductivity of the frozen waste and the spacing of the injection points.

5 Initial Screening of Barrier Types

5.1 Open Excavations

5.1.1 Volume

The volume of material to be removed is computed to be between 2.5 million cubic yards in place for a barrier excavated at the narrowest point of the quarry and 650,000 cubic yards in place for a barrier excavated along the step up location where the quarry becomes shallower. The excavation limits and grading are shown in Figure 2 and Figure 3 for the excavation at the narrow point and along the step up, respectively.

5.1.2 Technical Feasibility

5.1.2.1 Excavation

Excavation of waste is considered technically feasible if the temperature of the waste is below 180 °F. For the purpose of this evaluation, excavation slopes of 3H:1V were assumed.

5.1.2.2 Seepage Controls

Seepage controls are required below the elevation where waste can be presumed saturated. This depth is no less than 30 feet above the base of the quarry (the current permitted level). This suggests that

significant seepage from the excavation faces should be anticipated below this depth. Seepage controls are likely to require rows of wells to depress the level of pore pressure within the waste. In solid waste the use of vacuum well points is not appropriate, given the limited vacuum that can be supported by leachate prior to foaming (about 12 feet of water column). Therefore deep wells spaced at relatively close spacing and seepage drains on the slope would be required. These are time consuming to install but technically feasible. In addition, temporary caps would be required to control odor, vectors and reduce the comingling of leachate and surface waters. Benches for maintenance of the system would have to be included in the design, increasing the excavation volume beyond the theoretical volumes provided in 5.1.1.

5.1.2.3 Stormwater management

The surface of much of the excavation would be below the drainage elevation. The area of the excavations is large, approximately 7 to 8 acres, depending on location and does not include a pond or storage facility for temporary stormwater management. Presuming the slopes are temporarily capped with plastic, this results in a peak run-off rate of 2+ million gallons per minute for a 25 year rainfall event. A very large pump and pond system would be needed to manage this run-off. Such a system would result in higher excavation volumes. The presence of leachate seepage emanating from the waste below an elevation of approximately 30 feet above the quarry floor will increase the risk of contamination of temporarily detained rainwater with landfill leachate.

5.1.3 Time of Construction

Waste excavated from the construction would be disposed of at an off-site facility. The rate of excavation is therefore controlled by the rate of transport off site. Presuming excavation prohibitions at the Landfill are removed and disposal capacity is available, a maximum excavation rate of 3,000 cubic yards per day, requiring 150 complete truck trips per 8 hours (19 per hour or approximately one every 3 minutes) could be achieved. This results in an excavation time of 833 days for a 2.5 million cubic yard excavation if one shift per day is assumed. Completion of the other works involved are likely to add at least 30 days for the completion of capping and connection of infrastructure and 30 days for the activities prior to excavation. This results in a completion time of approximately 900 days if all dewatering and other critical works are done simultaneously. This is reduced proportionally for the smaller excavation to approximately 250 days.

5.1.4 Discussion

5.1.4.1 Advantages

An advantage of an open excavation barrier is the ability to prevent heat transfer or combustion from heat generating reactions in the south area from advancing north.

5.1.4.2 Disadvantages

The following are disadvantages associated with an open excavation barrier:

- Significant air emissions, odors, and vector issues are likely unless enclosed excavation structures are utilized. However, the use of such structures would significantly increase time of completion. Enclosed structures also significantly increase the complexity of the operation and the number of potential health and safety issues for the workers,
- Significant increase in construction traffic on-site and off-site for an extended period,

- Exposure of unknown materials and potential health and safety risks to workers excavating,
- Complication of stormwater management and leachate management below drainage elevations,
- Significant time of completion (greater than 1 year and up to 3 years) requires triggering action prematurely. It also rules out barrier locations in narrower sections of the quarry fill,
- Excavation at neck area already is problematic given the limits of excavation would extend into the area already settling and with elevated temperatures,
- Does not address possibility that the waste removed and relocated contains materials that are driving the heat generating reaction, and could transfer the problem to the next site, and
- Creates a long term maintenance issue/challenge for maintaining the below exterior grade portions of the excavation.

5.1.5 Conclusion Concerning Feasibility

The long term challenges of leachate and stormwater management in the excavations that are well below the drainage elevation make this type of barrier system infeasible in the long term, even without consideration of time and complexity of construction.

5.2 Filled Excavations

5.2.1 Technical Feasibility

5.2.1.1 Excavation

Filled excavations are similar to the open excavation in technical feasibility with the exception that the use of steeper slopes presents some stability issues for deeper excavations. Steeper slopes in excavations are problematic once saturated waste is encountered. Temporarily stable slopes below the saturated zone will not be safe steeper than 2.5:1 without dewatering. Substantial dewatering would be necessary to lower the head in the waste within limits of potential failures.

Volumes of excavation materials would be less with steeper slopes resulting in excavation volumes of approximately 500,000 cubic yards for the second location, depicted in Figure 4, instead of 650,000 cubic yards for the open excavation. This presumes slopes of 2H:1V are used at all locations, which is likely an overly optimistic presumption. A filled excavation at the narrow point of the quarry was not considered for this option given that portions of the waste to be excavated are already higher than 180 ºF, which was identified as a limitation.

With the steeper slope and use of backfill, sequential backfilling would occur as the excavation progresses from west to east. This limits the amount of equipment that can be used. It would allow shorter exposure at depth reducing instability risk, but complicates the logistics of the excavation system.

5.2.1.2 Seepage Controls

Seepage controls would be similar to those discussed in the open excavation but would be abandoned as backfilling progressed over them. Temporary caps would also likely be employed to control odor and vectors, and to minimize the comingling of surface water and leachate. As the systems would be covered up, the design extraction points for all collection would need to advance with the advancing excavation. This ongoing installation of wells will result in increased complexity, but can be accomplished. The net result will be that steeper excavations can be used to reduce excavation volume if the excavation is

temporary and will be backfilled within a few months. However, the time frame needed to advance these excavations to the depths required is longer on a per cubic yard basis, compared to shallower sloped excavations. This is due to the increased dewatering and complexity of the cut and backfill operation.

5.2.1.3 Stormwater Management

As with the seepage controls, stormwater management for filled excavations is similar to that required for open excavation but is more complex. Sediment loads would be significant from the slopes of the earthen backfill unless stabilizing sprays are used to control erosion. In addition, the location of temporary sumps/sediment drops is complicated by the sequential backfilling operations. It is likely that limited sump sizes will require outside temporary basin construction and use of large pumps that are generator driven so as to be independent of power outages. While these activities are feasible, they represent a complex operating plan to avoid significant setbacks, such as flooding, large amounts of contaminated water or temporary instability of backfill.

Long term, the backfilled site would be able to drain by gravity.

5.2.2 Time of Construction

The time of construction will be approximately the same as for non-backfilled excavations, given the complexity of the operations and the added time to bring approximately 500,000 cubic yards of backfill to the Landfill and placing it. While some of these operations would be concurrent, the final backfill sequence would be done after excavation was complete and could represent 1/3 of the total fill amount. The filling rate would be controlled by the rate fill can be brought to the Landfill from offsite. This represents approximately 30 days in addition to the excavation completion time. Therefore the minimum time of the work is approximately 1 year if enclosed structures are not used.

5.2.3 Advantages and Disadvantages

5.2.3.1 Advantages

The following are advantages of filled excavations:

- Creates a physical and thermal barrier,
- Removes less waste from the site, and
- Eliminates the need for long term stormwater and seepage controls.

5.2.3.2 Disadvantages

The following are disadvantages of filled excavations:

- Significant air emissions and odors are likely unless enclosed excavation structures are utilized. However, the use of such structures would significantly increase time of completion. Enclosed structures also significantly increase the complexity of the operation and the number of potential health and safety issues for the workers.
- Significant increase in construction traffic on-site and off-site for an extended period Exposure of unknown materials and potential health and safety risks to workers excavating
- Complication of stormwater management and leachate management below drainage elevations

- Significant time of completion (approximately 1 year) which requires triggering action prematurely.
- Excavation at neck area already is problematic given the limits of excavation extend into the area already settling and with elevated temperatures.
- Does not address the possibility that the waste removed and relocated contains materials that are driving the heat generating reaction relocation could transfer the problem to the next site.
- Increases risk of instability by using steeper slopes and requires greater level of dewatering focus

5.2.4 Conclusion Concerning Feasibility

These types of barriers are technically feasible. However, the overall feasibility is limited due to time of construction and potentially significant issues relating to odor and air emission control issues.

5.3 Thin Vertical Barriers

5.3.1 Technical Feasibility

5.3.1.1 Physical Force Resistance

5.3.1.1.1 Downdrag Forces

Preliminary calculation of downdrag force is 10,000 lbs. per foot of barrier along the alignment or 40,000 lbs. per beam element (assuming a 4-foot center to center beam spacing). The downdrag force is relatively low compared to the compressive strength capacity of potential beams (i.e. H beams) when the forces are acting uniformly around the beam (in the absence of bending loads).

5.3.1.1.2 Lateral Force Imbalance

Thin barriers (those relying on bending capacity to resist lateral load imbalance) cannot meet the requirements for bending stresses that could develop should a volume consuming event occur along on one side of the barrier. If a total settlement of 40 feet were to occur on one side of the barrier the lateral force generated at the low side ground line would be generate bending moments in excess of 5.4×10^5 foot pounds per foot of wall along the profile. This very large bending moment, along with the compressive forces associated with downdrag, would create a beam/column behavior that would require very large and heavy beams to remain stable.

Similar calculations can be performed for concrete walls which must be installed in slurry wall type settings. This limits the strength of the concrete that can be used to a maximum of 3,000 psi. Using an approximate method and ignoring downdrag force influence, a 3 foot thick wall unit would require approximately 1/3 of the cross section of the wall to be reinforcing steel. It is likely that wall sections of at least 5 feet would be needed to incorporate the quantity of reinforcing steel required.

5.3.1.1.3 Ductility with Large Lateral Strains

Steel beam based and concrete based systems could be designed to be ductile; however the magnitude of tilting anticipated would result in requiring much more robust elements than presented above. In the end, the forces could be estimated but not predicted with accuracy.

5.3.1.1.4 Thermal isolation

All thin vertical barriers would be constructed of materials that have higher heat conduction properties than solid waste. As such, these barriers would transmit heat better than the waste, and would be ineffective in as a temperature barrier. All of these barriers would require substantial heat removal elements to keep temperatures within acceptable levels on the cool side of the barrier.

5.3.2 Thin Vertical Barriers Evaluated

Caisson drilling to install beams as part of a tangent pile system or slurry wall excavation to construct a structural concrete wall are known technologies that could be employed at the Landfill. A beam type wall, encased in concrete piers spaced on 4 foot centers, requires a large number of borings and advancement of the holes under slurry to the base of the quarry. This drilling is deeper than the standard caisson drill rigs are capable of, reducing the number of contractors available to a very few. Given the length of the wall, approximately 100 drilled piles would be needed at the narrowest point, with an average depth of 140 feet and a maximum depth of 250 feet.

Slurry wall excavation would have to be installed in panels but is feasible. Initial grouting or exposure of the upper 60 foot of waste to cement bentonite slurry may be needed to prevent slurry loss followed by re-excavation within 24 hours to the target depths

5.3.3 Conclusion as to Feasibility

The thin vertical barriers are not considered technically feasible to design. This is due to the significant uncertainty in the forces that could develop. The design of such elements to required depths relies on lateral bracing at prescribed interfaces supplied by either braces or tie back anchors. Neither of those bracing options are available at this installation. The wide range of possible force distributions and scenarios result in unacceptably high uncertainty of performance for the barriers of this type for the desired service life. In addition, they fail the thermal performance requirements.

Time of construction issues were not investigated given the technical infeasibility.

5.4 Wider Vertical Barriers

5.4.1 Technical Feasibility

5.4.1.1 Lateral Pressures

A wider vertical barrier resists the lateral loads by acting as a mass. The mass must remain coherent to the depth below which forces can be resolved by lateral pressures on the low side of the wall or non-uniform bearing pressure distributions at the bottom. Using the same example as in the thin barriers, a 40 foot elevation difference across the barrier requires the same overturning moment to be resisted. If the average width of the wall was 20 feet and the backfill was 115 pcf the overturning resistance moment is approximately 3 times the overturning moment. The shear load is approximately 0.25 times the wall weight at 40 feet. This suggests that a gravity wall barrier could sufficiently resist overturning and shear loads with nominal reinforcement.

Greater overturning and shear resistance could be provided by inclusion of reinforcement elements, either installed at the time of backfilling or post backfilling (drill and tension anchorages). If one considers a beam with adequate reinforcement representing the wider barrier, the compressive strength of the material

required would be on the order of 200 psi if 1 sq in of reinforcing steel per foot was used to resist bending and shear forces.

5.4.1.2 Downdrag

Downdrag forces are small compared to the bearing area of this type of system. This is due to the much increased cross sectional area of the wall compared to its external surface area. As a result, lateral pressures will control the strength of materials used for backfill.

5.4.2 Thermal Performance

The wider wall in this type of barrier would still allow significant heat transfer and would require the insertion of closed pipes for the removal of heat. These pipes would be suspended in the cementious backfill between the external slurry wall segments during its placement. They would not be subjected to downdrag and could be designed for a gradient based on the face of the barrier being the closest heat generation source. This would allow wider spacing of elements than discussed in the thermal barriers section without a wide barrier

5.4.3 Construction Method

The larger gravity type wall could be constructed between slurry walls by excavating the slurry and replacing it with low strength concrete, containing nominal reinforcement. Once the walls were set, the space between the walls (approximately 14 feet) would be excavated under slurry and filled by tremie method with the cementious backfill. The quantity of excavation is large and would be performed in panels using a clam bucket operation. The length of such a barrier, performed at the narrow neck, would be approximately 350 feet. The volume is estimated to be 38,680 cubic feet per foot of thickness, or 29,000 cubic yards for a 20 foot barrier at the narrowest location of the quarry fill.

Excavations using a clam bucket under slurry to the maximum depth anticipated (240 ft) can be made. The work is technically feasible.

5.4.4 Time of Construction

A double wall excavation is estimated to require two cranes approximately 5.5 months to complete. The excavation between the walls would require 139, 8 hr. crane shifts at 6 cubic yards per hour for a mass excavation and no time required for setting reinforcing cages etc. associated with the initial panel construction. Some additional days are required for clean-up and slurry disposal. A total construction time of approximately 9.5 months would be needed once the contractor mobilized if two crane shifts per day were achieved once the walls were completed. The completion times and production rates are based on conversations with slurry wall contractors.

5.4.5 Advantages and Disadvantages

5.4.5.1 Advantages

The following are advantages associated with wide wall barriers:

- The method is technically feasible at the narrow point of the site,
- Design methods can be robust and with small change in the cost,
- Provides a barrier that remains stable,
- Has less total excavation than large open excavations, and

- Results in limited stormwater/leachate run-off management issues following completion of construction.

5.4.5.2 Disadvantages

The following are disadvantages associated with wide wall barriers:

- The time of construction is approximately 10 months,
- Generates waste materials that needs to be moved off site (including a lot of spent slurry mixed with waste),
- Generates some air and odor emission problems, albeit less than open excavation options,
- Requires heat removal elements,
- Method is feasible only at the narrow neck. As the length becomes longer the time of construction is greatly extended,
- Requires significant effort during construction to limit run-off issues, and
- Requires temporary slurry ponds to be constructed over the north area (there is no other place for them).

5.4.6 Conclusion Concerning Feasibility

This type of barrier is technically feasible. However, it is limited in use to the narrowest segment of quarry and its time of construction is longer than acceptable for that location given the apparent northern rate of movement of the heat front.

5.5 Heat Removal Barriers

The heat removal barriers consisting of active heat removal elements (heat transfer pipes) were the only heat removal options evaluated in detail for purposes of this report. It was concluded from initial evaluations that cold gas inert gas injection and passive cooling elements are not feasible at the range of depths required for this project.

5.5.1 Physical Load Resistance

Pipe units are exposed to lateral strains in the direction of settlement events and to downdrag forces. The forces experienced depend on the pipe diameter and length. Based on the experience at other sites it is expected that all normal pipe systems will experience downdrag forces that exceed the ability of the pipes to remain round and passable within the anticipated duration of cooling, unless telescopic units are utilized. Such units are not commercially available and require custom fabrication. The current design presented in Section 7.2.1 provides an option for telescopic units. A decision on whether to use telescopic cooling point units will be made after some additional evaluation of the design.

5.5.2 Thermal Requirements

Preliminary calculations indicate that pipe spaced no closer than 4 foot, center to center, would be successful in keeping the temperatures between the pipes in the waste from exceeding 200 °F for the even if the rate of heat flow toward the barrier were greater than estimated at the present time. Further, the heat barrier can be scaled up to include more elements in a specific area to supply greater heat extraction in locations where monitoring demonstrates a temperatures need to be lowered.

Liquid circulated in this system would be water with anticorrosion additives (nontoxic) at proposed circulation temperatures above freezing.

5.5.3 Construction

If a barrier were to be constructed across the narrow point, as depicted in Figure 5, of the landfill, the total number of pipes would be approximately 40 with a maximum length of approximately 225 feet. Pipes would be installed to a predetermined height above the quarry floor as necessary, as indicated by the temperature readings. This reduces the possibility that pipes would run into the rock bottom and be damaged by downdrag. The total drilling footage needed for installation is approximately 6,600 ft if the initial installation is performed at 8 foot centers. Installation could be performed with drill rigs or by vibrasonic methods.

Schedule 40 steel pipe without coatings would likely be used or structural tubing for the external pipe, the internal pipes would be 1 ¼ inch diameter.

A chiller and air to air cooler would be installed and temperatures monitored in front of and behind the barrier to identify if added elements are needed or if higher circulation temperatures could be used, minimizing energy consumption. All these technologies are available.

5.5.4 Construction Time

Time of construction for this type of system, assuming 2 standard drill rigs were used is 22 working days for drilling (5 weeks), one day per hole for insertion performed concurrent with drilling, 4 weeks for added temperature monitoring and completion of piping work and some added time for startup. This results in approximately 3 months from start of work to completion provided major elements of the work are pre-arranged for purchase and schedule.

5.5.5 Advantages and Disadvantages

5.5.5.1 Advantages

The following are advantages associated with the heat removal barrier:

- Creates a thermal barrier that stops both heat and smolder driven processes,
- Creates little waste to be disposed off-site,
- Is adaptive to adjust to site conditions,
- Could be tested for efficacy on site in a smaller setting,
- Shorter installation time, and
- Has no temperature at which it cannot be installed.
- Odor and Air Emissions can be minimized by use of vacuum or stuffer boxes at drill head.

5.5.5.2 Disadvantages

The following are disadvantages associated with the heat removal barrier:

- Requires maintenance and replacement of parts and systems and
- Has energy consumption needs.

6 Evaluation of Screening Barriers

6.1 Feasibility

The feasibility of the various barrier systems was evaluated as discussed above. Based on the technical review, the barriers of the following types were found to be technically feasible:

- Non Open Space Barriers (open excavations filled with inert materials),
- Wide Structurally Supported Barrier (in-filled cellular structural slurry wall shapes), and
- Heat Barrier.

All other barrier systems evaluated were found to be technically infeasible.

Beyond technical feasibility, there are additional complexities that must be considered. Open excavations backfilled with inert materials were found to require considerable time of construction due to the need to excavate large amounts of waste, transport the waste off site and import large amounts of inert materials. This substantial time of construction (years) makes these types of barriers infeasible merely from a time of response, without regard to the very substantial issues associated with air emissions/odors, traffic, leachate handling, vectors issues, etc. The same is true for the wide structurally supported barrier, which is estimated to require approximately 10 months to a year to construct. It also required significant waste excavation, generates slurry wastes and requires some waste regrading in the area of the narrow point of the quarry. Given the potential rate of the heat front migration to the north, the construction time for the wide structurally supported barrier is too long to allow construction at the narrow point. The barrier is infeasible at other locations given the increasing length and depth of the barrier at more northerly locations.

The heat barrier can be installed in approximately 90 days, allowing it to be placed at a location at the narrow point of the quarry in advance of arrival of the heat front. It minimizes the excavation of waste and exposure to air emissions, odors and vectors. Therefore the heat barrier system is considered most feasible.

6.2 Selection of Barrier Systems for Use

Based on both technical and time related factors the heat barrier system has been selected as the preferred method to halt the progress of the heat front into the north quarry if needed. The design and construction of the barrier system is presented in Section 7.

7 Heat Barrier

7.1 Overall Approach

The use of heat removal at the narrow section of the landfill could be used to maintain a temperature within the waste mass, locally within the barrier area, that does not exceed 203 °F (95 C°). This limiting temperature will ensure that the waste materials do no dehydrate and react, causing settlement. Also, the presence of the retained moisture at these temperatures will reduce or eliminate the potential for pyrolysis or combustion at depth, for which dehydration and higher temperatures are a prerequisite. The location

for the heat barrier has been generally depicted on Drawing 1, which represents the narrowest location between the north and south quarry areas.

The heat removal system would be installed prior to the heat front reaching the proposed location. The location of heat front will be defined by the settlement front, gas well temperatures and TMPs. If constructed, the barrier would be operated until such time as the monitoring at the site indicated it was no longer necessary.

7.1.1 Current Advance Rate of Heat Front

The rate of movement of the heat front to the north, as indicated by abnormal site settlement and gas well temperatures was evaluated, as described below, to provide an estimate of the time frame available prior to the need to initiate installation of the heat barrier. It should be noted, as with all monitoring devices and other items installed vertically into the landfill mass, it is expected that the heat barrier elements will have finite operational lives. Therefore, earlier installation prior to need does not result in any advantage of performance.

It should also be noted that the Landfill intends to install a vapor interceptor barrier prior to (south of) the Action Line. It is believed that this barrier may prevent the movement of heat further north, delaying (permanently or temporarily) the installation of the proposed heat dissipation barrier. The installation of these interceptor wells has been successful in controlling heat front movement in other landfills experiencing a similar situation with a heat generating reaction.

7.1.1.1 Settlement Front

Settlement monitoring performed at the site from May 2012 thru November 2012 in the South Quarry area was analyzed for settlement rate. The data, GPS surveys performed by Aquaterra, were used to create digital terrain models (dtm) for each general date of survey. The surveys were performed at breaks in topography to record northing, easting and elevation. Therefore, the survey shots are not at the same locations each event. A statistical determination of settlement in the South Quarry was used to divide the settlement into two categories: settlement due to the reaction processes; and standard landfill settlement. This was performed by assigning the dtm elevation to grid points on 10 foot centers to each date of survey dtm and directly comparing the data over time at the same grid point. The grid point sets include approximately 15,000 to 16,000 data sets for settlement, with the number depending on the area surveyed. The analysis performed to date shows that a distribution of settlement rates is comprised of two normal type distributions (bi modal). Peaks in the settlement rate histograms were apparent at approximately 0.045 ft per day and 0.01 ft per day (see histograms). The bimodal distribution of settlement rates is most apparent and persists when data is viewed over multi month periods. For shorter periods, it appears that the variations in the dtms along with the variation in GPS data result in a masking of the outcomes. This is clear when looking at histograms for Analysis 1 and 2 versus Analysis 2 and 4 in the calculations presented in Appendix A. Note that in the calculation, settlement is presented as a negative value.

The analysis indicated that a settlement rate of 0.045 ft per day or approximately 1.35 feet per month would indicate the active settlement front zones. Given the bimodal distribution, it is reasonable to assume that some areas of high settlement rate are included down to a settlement rate of 0.035 ft per day. Filtering of the grid points at 0.035 ft per day of settlement was performed and the results plotted in CAD to determine where the zones experiencing this rate existed. It was found that the results appeared meaningful if the comparisons covered a period of three months. Shorter duration periods resulted in

undefined patterns as is expected based on the appearance of the single month settlement rate histograms. Using the 0.035 ft per day settlement rate (which is on the order of 4 to 5% per year vertical strain) to define the location of the settlement front with time, the northern limit of the front was determined for survey dates 7/2/12, 9/6/12, 10/2/12, 11/1/12, 12/11/12. The location of the northern extent of the accelerated settlement defined above is depicted in Figure 5.

The northern rate of movement towards the narrow point varies depending on location. Based upon the area between the lines of advance and along the northern facing edge (approximately 250 foot wide) the average rate of advance has varied as shown in the table below. The settlement monitoring method was recently modified to take readings at fixed locations on a grid, rather than use of survey points at locations that would appear to capture the topography. This should result in reducing the noise in this calculation. The most recent survey, 12/11/2012, was performed using this method. The settlement front for December 2012 is not significantly different than the location identified for previous month. This likely reflects the change in survey technique.

Period (all 2012)	Average Northern Advance Rate (ft/mo.)
July to September	21
September to October	39
October to November	18

7.1.1.2 Gas Well Temperatures and Northern Progress of Heat Front

Gas collection Wells GEW 11, GEW 12A, GEW 56R, GW 58, and GEW 59R, and GEW 63 are all in the general vicinity of the area of the heat front and the TMPs. Examination of the well head temperature records for these wells indicates that the time of occurrence of well head temperatures exceeding 195 to 200 °F and the location of the temperature front defined by settlement passing the area of the well is at approximately the same time. Wells in advance of the settlement front, such as GEW56R and GEW 63 do not exhibit temperature in excess of 170 °F. The exception to this appears to be on the east side of fill, where the November limit of the settlement front included GEW 58, which has yet to exceed a well head temperature of 185 °F (as of 11/15/12). The wellhead temperature graphs near the settlement front are presented in Figure 5.

Based on the examination of the gas well head temperatures, it appears the settlement front and well head temperatures in excess of 195 °F occur at approximately the same time along the northern advance of the heat front. The rate of advancement to the north based on gas well observations is similar to that of the settlement data. This advance rate can be used as an indicator of the physical rate of advance to the north of the heat front.

7.1.1.3 In-Waste Temperature Monitoring Points (TMP)

As of November 30, 2012, all 9 of the TMP's have been installed. A review of the data from the TMPs does not currently indicate any time trends except for some cooling at depth following the installation. With the exception of TMP-8 and TMP-9, which are the closest to the settlement front, the TMPs indicate that temperatures are less than 160 °F at all depths and temperatures are lower both as the ground surface and bottom of the waste are approached. Temperatures within 40 feet of the quarry bottom are typically less than 130 °F, with the exception being TMP-9 where a temperature of 184 °F is measured at depth.

Maximum temperatures measured as of early December are 197 °F in TMP-9 which is one of the nearest TMPs to the settlement front. The maximum temperature in TMP-8 was 183 °F.

A comparison of well head temperature to TMP readings was made at TMP-6 and GEW 56R. The well head temperature in GEW 56R was between 130 and 140 °F in November 2012 while the average TMP-6 and maximum TMP-6 values were 132 to 146 and 161 °F, respectively, during the period from 11/26/12 to 12/3/12, if only the upper 150 feet of waste is considered. The average temperatures are lower if the entire column to the bottom is considered. This comparison suggests that gas wells are good average temperature indicators, as was already expected. A plot of the TMP readings with elevation for the 12/11/12 reading date is presented in Figure 5.

As additional data rounds are collected from the TMPs, they can also be used to supplement estimates of heat front rate movement northward.

7.1.2 Trigger Events

7.1.2.1 General Discussion

Based on the observable rate of movement of settlement front and elevated temperatures toward the quarry narrow point, it would appear that the heat front is approximately 400 feet south of the proposed barrier location. At the maximum estimate of the advance rate, 25 ft per month, this would require 16 months for the heat front to reach the heat barrier location. At the slower rate indicated along the advance lines (5 feet per month) the computed time is 5 times that or approximately 6 years. The heat barrier system is estimated to require 60 days to install following arrival of equipment associated with installation of the cooling points (pipe, insertion rigs etc) on site. The time frame for notice to proceed may require adjustment depending on mobilization time for insertion equipment. Provided contracts are in place in advance for the work, a 90 to 100 day window of time for notice to proceed should be adequate. Delivery times on key components, such as the cooler are approximately 7 weeks, while lead time on Hollow Structural Shape (HSS) shapes for the cooling points (CP) is 8 weeks including purchase, machining and coating. Given that cooling points are installed early in the work and the lead time is longer than the mobilization time for the insertion equipment, the CP material appears to be the critical item for determining the beginning of action. To be conservative, a time of 120 days should be allowed between onset of action and the time for the system to be operational. Based on the current maximum rate of advance, and based on the historic motion of the settlement front, this would accommodate an advancing rate of 25 feet per month if the action limit is 100 feet away from the location of the boundary.

The calculated advance rate variance is affected by the methodology of the prediction and steps should be taken to allow the arrival rate of the front to be monitored with less uncertainty. In addition, the shape of the quarry is likely to result in greater heat conduction to the surrounding rock mass, slowing the advance as the quarry walls and depth move inward and upward. At present, it would appear that use of the maximum rate of advance, based on the October –November survey periods (three month rate ending on the last date) provides a conservative prediction of the time it will take for the heat front to reach the proposed heat barrier location. The location of a line through TMP-1 to TMP-4 is approximately 300 feet from the current settlement front. Temperature levels in TMP-9 indicate that the 200 °F reading will soon occur at this location, 250 feet away from the TMP-1 to TMP-4 alignment. At the maximum measured rate of advance it is estimated that 10 month or more would elapse prior to arrival of temperatures of

200 °F in the waste at the line passing through TMP-1 through TMP-4, or the fall of 2013, if no slowing of the front occurs. This would allow for 6 months of construction time, at the current 18 foot per month advance rate, if the line through TMP-1 through TMP-4 were adopted as the Action Line.

It should be noted that Bridgeton Landfill intends to install a relief well system, as stated in 7.1.1, in the area of the heat front and south of the Action Line that may significantly reduce the rate of advance based on experience at other sites.

As the heat front advances toward the Action Line, better estimates of the rate of movement can be made. On the basis of this added information, the schedule for obtaining quotes, signing contracts and construction can be modified as needed, based on the data making it reasonable to assume that material purchase and construction times can be achieved.

7.1.2.2 Trigger Measurements

A review of available literature has indicated that for low temperature pyrolysis or other pre-conditioning for smolder to occur, the waste materials would have to be dried. No evidence of any low temperature alteration of this type has been observed at this site, or other sites with waste at temperatures less than 200 °F. In addition, no phenomena reported in the available literature indicate significant alteration of material other than dry samples heated in the presence of oxygen. Therefore a this temperature measured in TMP or a gas well head reading in excess of 195 °F at or north of the Action Line, once verified as representative, be considered the trigger for beginning of installation of the heat barrier at the location shown in the attached drawings. The rate that the heat front is migrating north will be measured and reported monthly.

All forms of monitoring, settlement, gas well head, and in-waste temperature monitoring will be used for an overall evaluation of the rate of advance. Given the variability of monitoring results, no one individual measurement should be deemed appropriate in the absence of corroborating data of the others.

7.1.3 Sequential Installation - Monitoring

Monitoring of temperatures will continue once the operation of the heat barrier (full or partial) begins, including monitoring of the temperatures south and north of the barrier. The performance of the system will be adjusted to maintain waste temperatures below 200 °F within the barrier area and below 170 °F north of the installed system. The monitoring system within the barrier and any additional monitoring points will be installed as a part of the barrier construction. Should the monitoring data show the temperatures within the waste are exceeding the target levels the system will be adjusted by increasing the rate of heat transfer, e.g. increasing coolant circulation rates, lowering coolant temperatures, etc. Should the modification of operational parameters be insufficient to achieve the desired target levels, additional heat exchange elements would be installed in the waste where needed. A total of 20 additional TMPs are proposed to be installed as part of the barrier system to aid in monitoring the progression of heat removal form the area. These are shown on Sheet 3 of the drawings.

In-waste temperature monitoring will occur daily. The data will be compiled and reported monthly. Details as to how decisions would be made to change operations and add additional elements will be documented in the operations and maintenance manual for the heat barrier system.

7.2 Heat Dissipation / Barrier Design

7.2.1 Design Methodology

The heat dissipation / barrier system is designed to remove heat energy in the waste at a rate sufficient to achieve a temperature of not greater than 170 °F on the north side of the barrier. The actual method of heat removal is via cooling points (CPs) consisting of pipes inserted into the waste through which liquid is circulated. The temperature difference between the waste mass and the lower temperature circulating liquid creates a removal of heat energy. The amount of energy removed by a CP is a function of the temperature difference, the heat conductivity of the materials (in this case waste and the steel tubing) and the diameter of the surface maintaining the lower temperature and the temperature gradient. The extraction of energy per CP and the rate of energy delivered by the landfill mass will be equal when the temperature front does not progress past the heat barrier.

The amount of energy being delivered to the heat front was estimated based on the rate of advance of the front with time, using rate of movement of the settlement front northward as described in 7.1.1.1. Using the information from the TMP readings, it was noted that the hotter portions of the waste mass appeared to be approximately 40 feet thick as the heat front approaches, with the remainder of the waste column apparently being heated from this zone. The energy required to advance the front a distance of 18 feet in 30 days (using the October/November period data) for a unit width was calculated for a condition where residual moisture is driven from the waste and for a condition of dry waste. The calculations, provided in Appendix A, show that the energy required to advance the front a minimum of approximately 11W/m^2, if the waste is dry and 145 W/m^2 if the residual moisture content is approximately 3%. Higher energy flow would be associated with higher moisture contents in the waste. However, it should be noted that the heat of evaporation of the moisture in the waste is transferred to the waste on the cool side of heat front when hot vapor moves into the waste and condenses. Once the waste temperature is raised the majority of liquid in the waste in the areas of rising temperature is evaporated into landfill gas at temperatures below the boiling point due to significant rise in the partial pressure of water vapor in landfill gas with increasing temperature. This accounts for the observations of gas well and TMP installation drilling finding nearly dry waste in areas beyond the heated zones in the waste.

Based on the above, it appears that a good portion of the energy associated with vaporization is recycled at locations near the heat front and that the energy flow to the front is likely higher than 11 W/m^2 but much less than 145 W/m^2. For the purpose of design of the system a 30 W/m^2 was adopted for the initial installation configuration with evaporative cooling only. A maximum value of 145 W/m^2 was adopted for a maximum for the design if a second row of units is installed and for the cooler and header system of liquid supply. It should be noted that additional heat transfer using the same configurations would be possible if chilling of the liquid below the wet bulb temperature was performed. This feature could be added to the operation if more heat transfer is needed once the operation begins.

Based on the calculations, vapor transmission appears to be a significant means of energy transfer in the areas with rising temperatures, exceeding conduction as a major mode of heating at the damp/dry waste interfaces. It also results in the general dehydration of the waste mass. This suggests that steps should be taken to limit the development of positive pressure differences between the hot and cold side of the advancing front. As previously mentioned, Bridgeton will be installing a “relief well” system in the early

part of 2013 in the vicinity of the heat front to accomplish this goal. This information will be submitted separate from this report.

7.2.1.1 Description on Elements and Design Features

The individual elements of the heat barrier system designed to remove the heat from the waste mass are referred to in this report as cooling points. The points will consist of a closed end pipe inserted into the landfill mass. Water with some corrosion inhibitor will be forced to the bottom of the pipe using an inner supply pipe. The water will then flow up the annular space between the smaller supply pipe and absorb energy from the warmer landfill mass outside the pipe. Flow rates in the pipes have been chosen to ensure the circulation rate is sufficient to allow the water to reach the bottom without substantial warming and the total rise in temperature limited to maintain good heat exchange capability in the entire column. A detail of the cooling points is depicted on Sheet 4 of the drawings.

At the top of the cooling points a well head will provide the ability to monitor temperature and pressure. Connection to the supply and return headers will have valving that allows the flow rates to be modulated to maintain desired operating temperatures as well as to isolate cooling points that need maintenance.

Currently, it is proposed that the external pipes will be made of coated carbon steel. The coating is intended to reduce the rate of corrosion. In addition, two options are under consideration, one of solid exterior pipe and a second of an exterior pipe, comprised of alternating larger and smaller pipes to allow significant settlement of the pipe to occur without crimping or other problems caused by downdrag. Details for both are provided on Drawing 4. A decision on what system to use has yet to be made, but both of these methods are workable and others are under consideration. Changes to the cooling point details may change based on further consideration. Any changes would be submitted to the Missouri Department of Natural Resources (MDNR) prior use in the barrier system. Internal supply pipes are currently proposed to be PEX, PVC or steel and are designed to deliver at least 10 gpm (gallons per minute) circulation flow in each cooling point with limited head loss. Higher flows can be achieved if needed using the proposed 1.25 in diameter internal pipe.

7.2.1.2 Overall Heat Removal Capacity

The overall heat removal capacity of the system is approximately 1.5 million BTU per hour. This would be achievable on warm days in St. Louis using an evaporative cooler. A circulation rate of approximately 250 gpm would be used to achieve this removal rate. Higher heat removal rates would be achieved, if required by installing either a chiller unit or an additional cooler unit in addition to adding cooling points, either on the hot or cold side of the heat barrier. This system can be expanded as required either locally or along the entire line based on the site behavior. A catalog cut for a typical cooler system is provided in Appendix A.

7.3 System Layout

The layout of the system is shown on Drawing 1 and Drawing 3 in plan view. A profile along the Heat Barrier is shown in Drawing 2 along with the individual cooling points. The cooling points for the initial installation will be spaced at 8 foot center to center along the proposed alignment. Supply and return headers will run parallel to the cooling point alignment and convey fluids to the west where pumps, controls and the cooler unit will be located, as shown on Drawing 1. The offset distances from the quarry floor and walls, limiting the cooling point depths as described in 7.2, are shown in Drawing 2.

7.4 Installation Description

Experience during the sonic drilling for construction of the TMPs has shown that vibrasonic methods are effective in advancing a mandrel with a point through the waste. Issues of size and total hydraulic fluid cooling capacity were experienced with a sonic rig. A larger vibratory hammer set up similar to a large pile driving system is being considered as a means to overcome these limitations. That could allow use of a mandrel with a sacrificial point and a large enough inner diameter to accommodate the proposed cooling points. Once the mandrel reaches the design depth, the cooling pipe is inserted and the annulus filled with a weak grout mixture of fine sand, bentonite and a small amount of cement to allow set to occur. The mandrel is withdrawn as backfill is added. This is quite similar only on a larger scale, to the sonic drilling performed at the site to date. Should this intended method prove to be ineffective, cooling points could be installed using specially constructed bucket auger rigs or rotary or modified mud rotary drilling methods.

7.5 Operations

Operation of the heat removal system would be continuous until such time as the temperatures in the vicinity of the barrier are less than 150 F^{o}. The system could be operated intermittently or portions of the system may be operated. The specifics of the duration and the use of intermittent operations versus continuous at much lower flow rates would be developed once temperatures begin to subside in the barrier area. Initially, the system will be operated to lower the temperature of the waste along the barrier alignment as low as possible given the limits of the ambient air cooling mechanisms proposed and flow rates lower than 250 gpm total. Lowering the temperature to as low as possible while the ambient air temperatures are low will allow a some buffer in the event the heat flow toward the boundary increases. There are no adverse impacts from the lowering of the temperature to below the normal landfill temperature in this limited area. Positive impacts would be the generation of added moisture content of the waste due to localized condensation. This moisture will increase the heat conduction and heat capacity of the waste locally, which would positively impact the performance of the heat barrier.

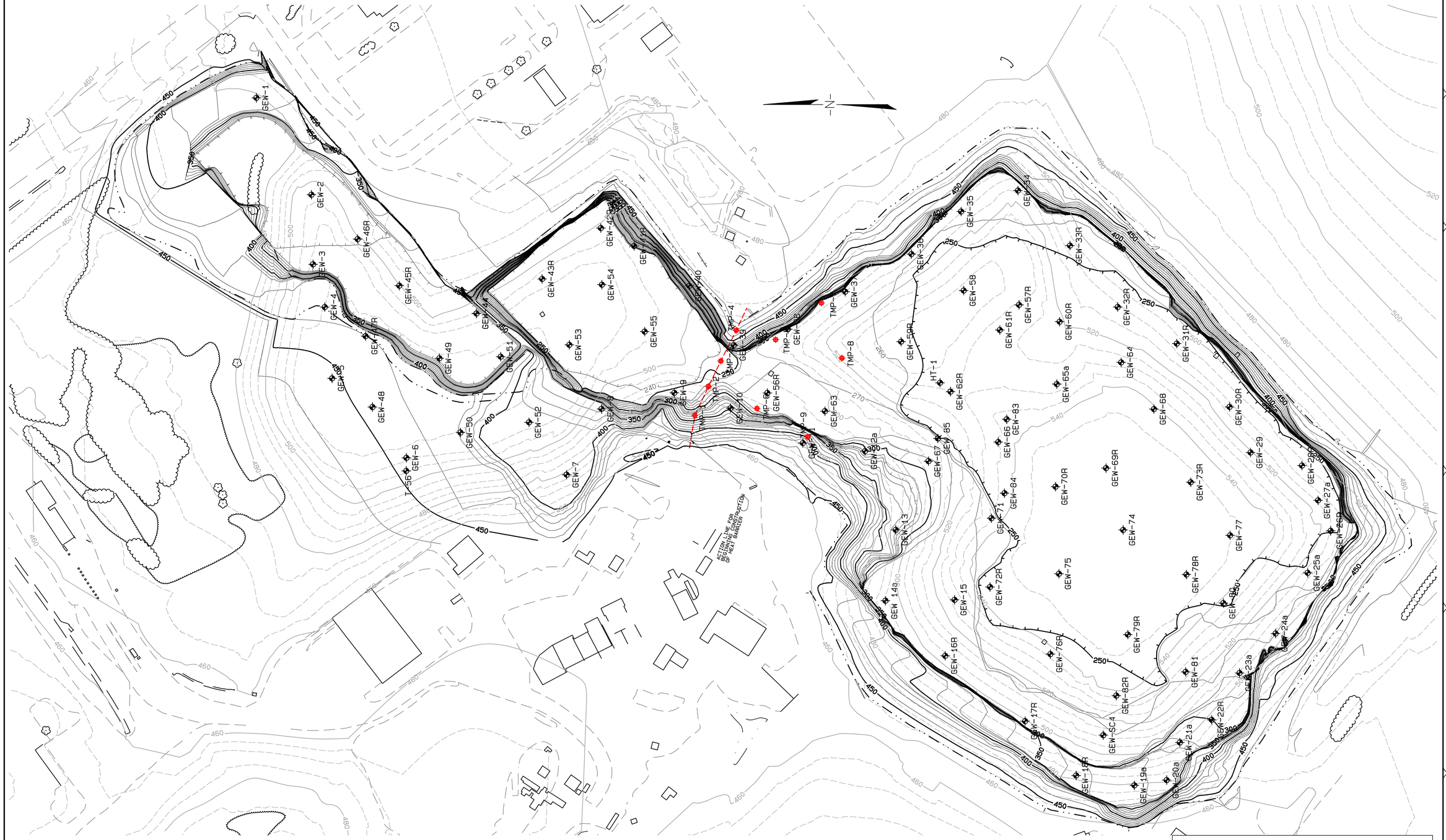
7.6 Additional Monitoring

TMPs to be used for monitoring and adjusting operations are depicted in Drawing 3. A total of 20 additional TMPs are proposed. The detail for the TMPs is provided in Drawing 5. The proposed design is the same used to for the 9 existing TMPs. In addition, the settlement monitoring and ongoing gas well monitoring will be continued. Also records of flow rates and temperatures for the cooling system will be kept to allow the quantification of heat removal to be made.

The major elements of monitoring and record keeping and data submittal will be submitted together with the final construction plans and specifications. This will ensure the monitoring and reporting aspects of the work are incorporated into the design and equipment.

7.7 Operations Manual

An operations manual will be developed and submitted that outlines the specific items associated with safety, operations, monitoring, record keeping, reporting and maintenance of the system. This manual will be completed in draft form at the initiation of operations. Given the uniqueness of the operations, the manual would be finalized by the end of the first quarter of operations and submitted to the MDNR 30 days following the first quarter of operations.



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BRIDGETON, MO

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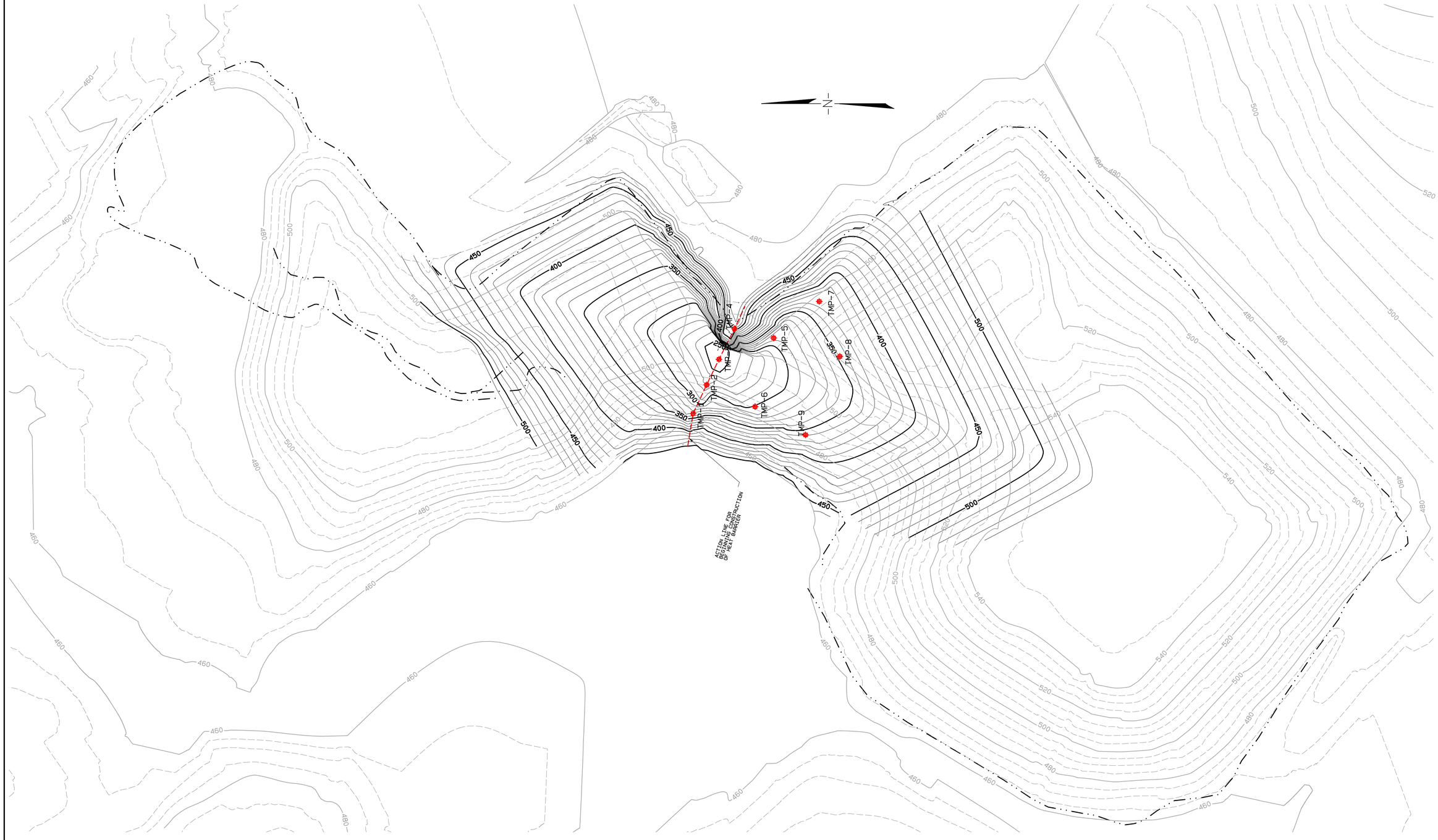
P. J. CAREY & ASSOCIATES, P.C.
5979 VALLINE WAY, SUGAR HILL, GA. 30518

PROJ. NO.: 179.001
DATE: 1/3/2013
DESIGNED BY: PJC
DRAWN BY: PJC/KLOH
CHECKED BY: PJC
APPROVED BY: PJC

FIGURE 1
OVERALL SITE PLAN

HEAT DISSIPATON / BARRIER PLAN
BRIDGETON LANDFILL

DRAWING
FIG-1



GRAPHIC SCALE 1"=100'

0 100 200 300

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Report Generated: Wednesday, October 31, 2012 11:23:44 AM

Where the second surface is above the first the volume is reported as fill.
Where the second surface is below the first the volume is reported as excavation.

Shrinkage/swell factors: Excavation 1.0000 Fill 1.0000

First Surface Layer Name	Number of Points	Second Surface Layer Name	Number of Points
3DTOPO_12	44,828	EV_1-OPEX3:1	804

Excavation Volume (Cu. Yd.)	Fill Volume (Cu. Yd.)
2,505,663.2	226.9

Net Difference: 2,505,436.3 Cu. Yd. Waste

LEGEND

- QUARRY WALL
- 325 EXISTING 3/2012 TOPO (10-FOOT)
- EXISTING 3/2012 TOPO (2-FOOT)
- 316 EXCAVATION BOTTOM (25-FOOT)
- EXCAVATION BOTTOM (5-FOOT)
- TMP-3 EXISTING TEMPERATURE MONITORING POINT

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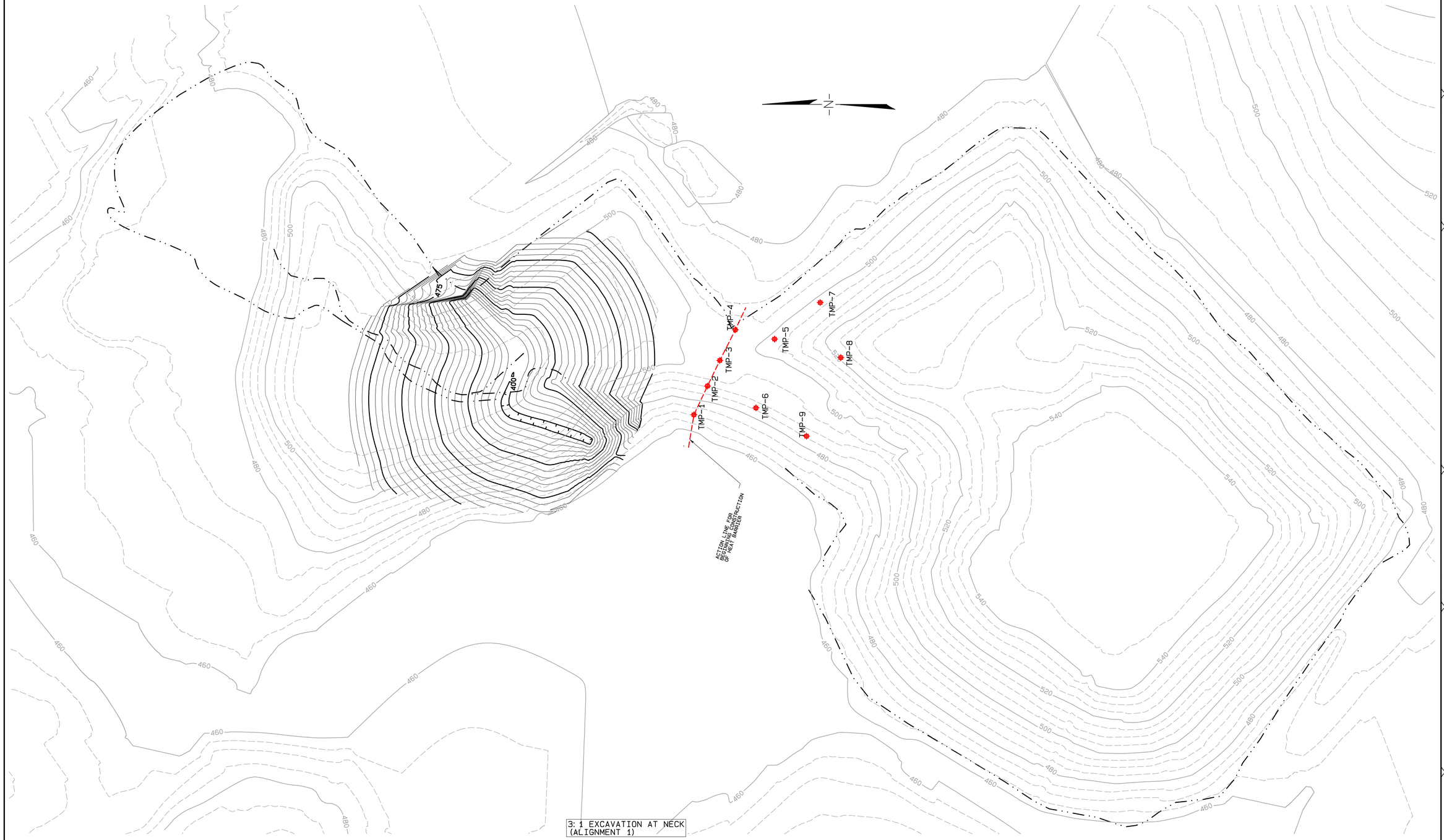
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FIGURE 2
OPEN EXCAVATION AT QUARRY NECK

HEAT DISSIPATON / BARRIER PLAN
BRIDGETON LANDFILL

DRAWING
FIG-2



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Where the second surface is above the first the volume is reported as fill.
Where the second surface is below the first the volume is reported as excavation.

Shrinkage/swell factors: Excavation 1.0000 Fill 1.0000

First Surface Layer Name	Number of Points	Second Surface Layer Name	Number of Points
3DTOPO_12	44,828	EV_2_OPEX3:1	473

Excavation Volume (Cu. Yd.)	Fill Volume (Cu. Yd.)
641,397.2	1,381.0

Net Difference: 640,016.1 Cu. Yd. Waste

LEGEND

- QUARRY WALL
- 325 EXISTING 3/2012 TOPO (10-FOOT)
- EXISTING 3/2012 TOPO (2-FOOT)
- 316 EXCAVATION BOTTOM (25-FOOT)
- EXCAVATION BOTTOM (5-FOOT)
- TMP-3 EXISTING TEMPERATURE MONITORING POINT

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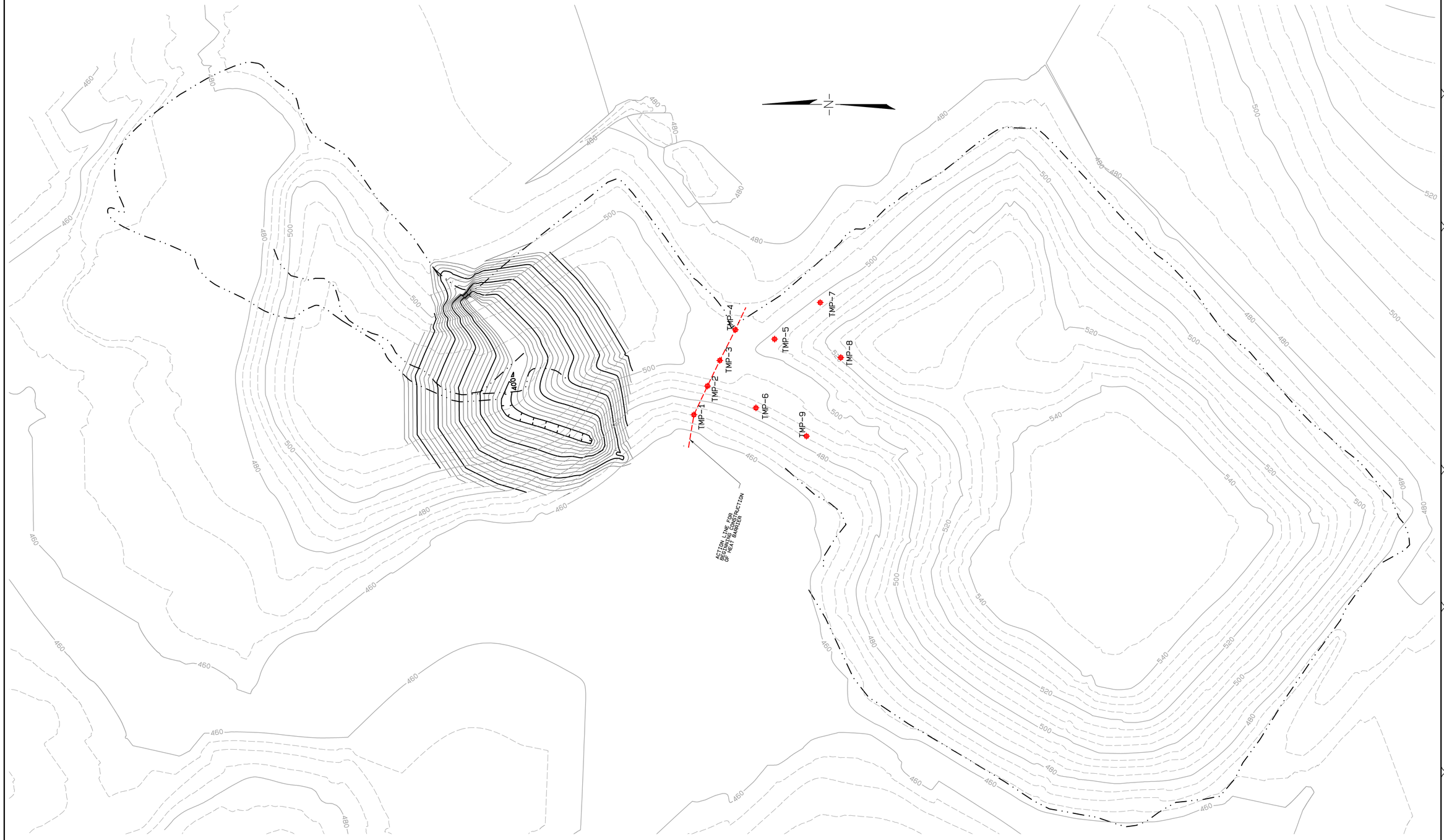
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DATE: 1/3/2013
DESIGNED BY: PJC
DRAWN BY: PJC/KLH
CHECKED BY: PJC
APPROVED BY: PJC

FIGURE 3
OPEN EXCAVATION IN NORTH QUARRY

HEAT DISSIPATON / BARRIER PLAN
BRIDGETON LANDFILL

DRAWING
FIG-3



GRAPHIC SCALE 1"=100'

0 100 200 300

EXCAVATION AT 2:1 NOT EXTENDING TO BOTTOM OF DEEP SECTION OF QUARRY BUT USING A BARRIER ALONG THE DEEP SECTION THAT IS EITHER HEAT ROBBING OR WIDE FILLED BARRIER (OR BOTH) EXCAVATION TO BE BACKFILLED TO DRAIN WITH EARTH (ALIGNMENT 2)

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Where the second surface is above the first the volume is reported as fill.
Where the second surface is below the first the volume is reported as excavation.

Shrinkage/swell factors: Excavation 1.0000 Fill 1.0000

First Surface Layer Name	Number of Points	Second Surface Layer Name	Number of Points
3DTOPO_12	44,828	EV_2OPEX: 2:1	444

Excavation Volume (Cu. Yd.)	Fill Volume (Cu. Yd.)
459,147.1	71.5

Net Difference: 459,075.5 Cu. Yd. Waste

LEGEND

- QUARRY WALL
- 325 EXISTING 3/2012 TOPO (10-FOOT)
- EXISTING 3/2012 TOPO (2-FOOT)
- 316 EXCAVATION BOTTOM (25-FOOT)
- EXCAVATION BOTTOM (5-FOOT)
- TMP-3 EXISTING TEMPERATURE MONITORING POINT

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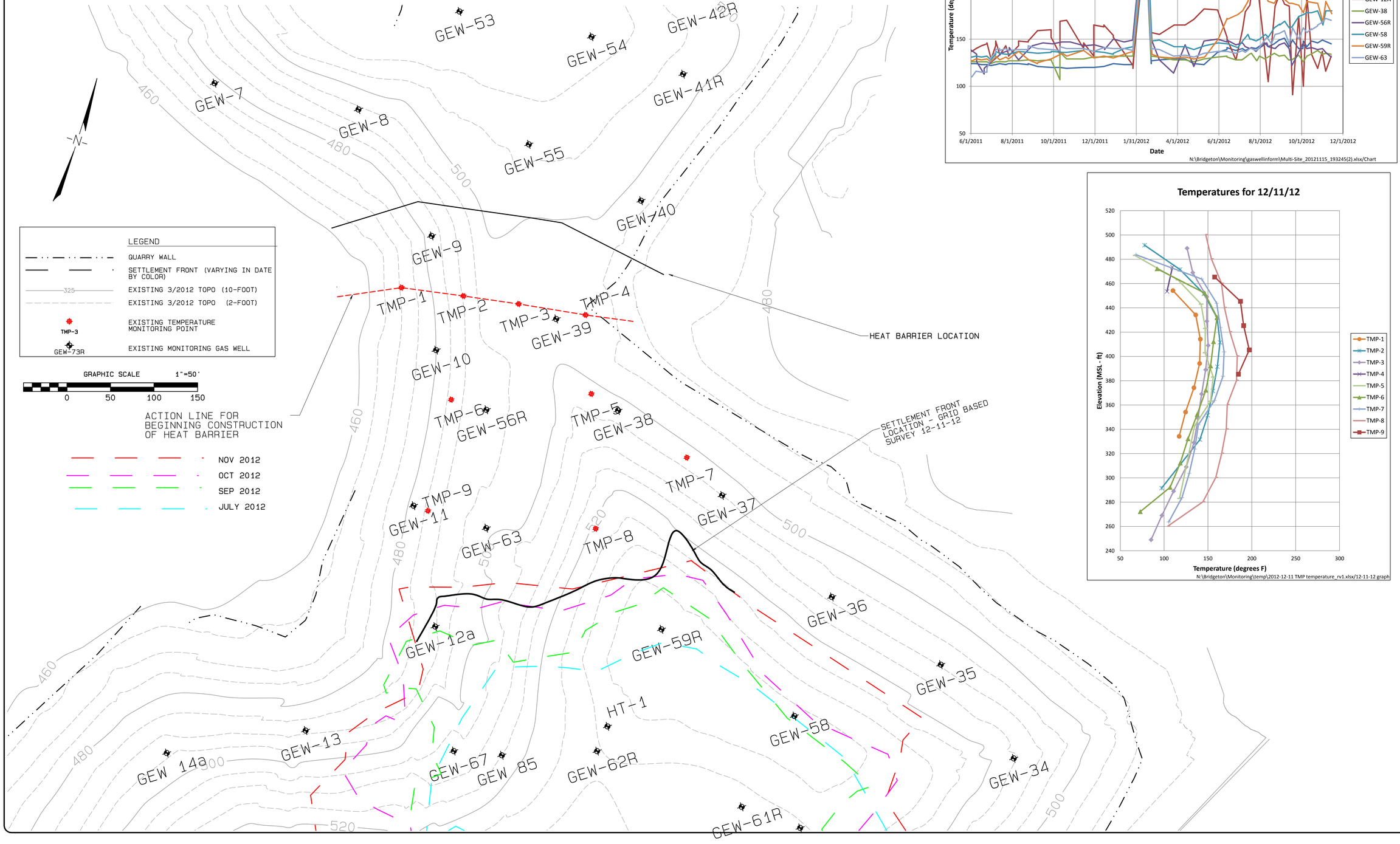
P. J. CAREY & ASSOCIATES, P.C.
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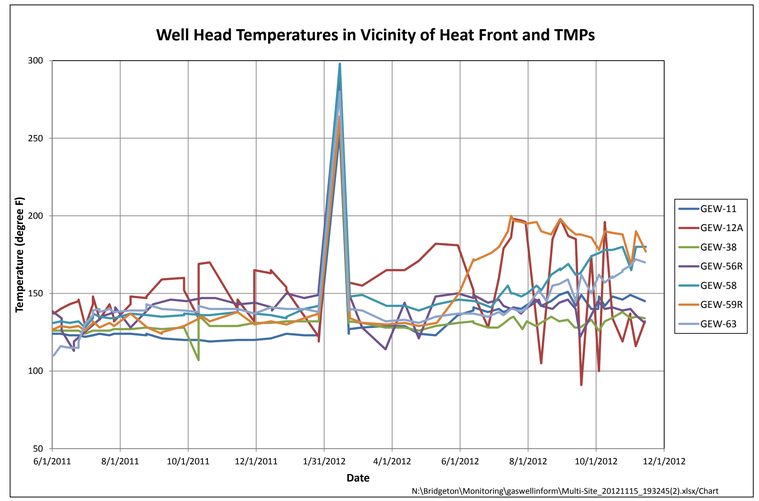
PROJ. NO.: 179.001
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CHECKED BY: PJC
APPROVED BY: PJC

FIGURE 4
FILLED EXCAVATION IN NORTH QUARRY

HEAT DISSIPATON / BARRIER PLAN
BRIDGETON LANDFILL

DRAWING
FIG-4





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PROJ. NO.: 179.001
DATE: 1/3/2013
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CHECKED BY: PJC
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FIGURE 5
SETTLEMENT FRONT ADVANCEMENT WITH TIME

HEAT DISSIPATON / BARRIER PLAN
BRIDGETON LANDFILL

DRAWING
FIG-5

APPENDIX A

Subject/Calcution: **Determination of Settlement Rates**

P.J.Carey & Associates, P.C.

Client: Bridgeton Landfill, LLC Project: Bridgeton
Project No. : 179.001
Performed by: Peter Carey Checked by: KH

$ORIGIN = 1$

Object: To analyze settlement rates for different time intervals in order to identify standard landfill settlement versus settlement due to subsurface heat generating reaction.

Below are four different time intervals denoted as 1 through 4. The settlement is compiled on an excel sheet for gridded points in the south quarry area (38 acres) and analyzed below. The gridded points were created by PJCA at regular 10 foot spacing and then assigned the change of elevation (settlement) for each respective time interval.

INTERVAL 1 : May 14 2012 to July 2 2012

Read excel compiled data for settlement:

$$\Delta el := \text{READEXCEL}("..\drawings\settsurveypts\settlementanalysis.xlsx","Sheet1!T5:T16592")$$

$j := 1 .. \text{rows}(\Delta el)$ counts to the number of data points

$\Delta T_1 := 49\ day$ Time during interval

Filter data for points without data for this interval:

$$Settle_j := \text{if}\left(\Delta el_j = "\#N/A", NaN, \Delta el_j\right) \qquad filterSettle := \text{filterNaN}(Settle)$$

$i := 1 .. \text{rows}(filterSettle)$

Calculate the rate of settlement for the data set:

$$Rate_i := \frac{filterSettle_i \cdot day}{\Delta T_1}$$

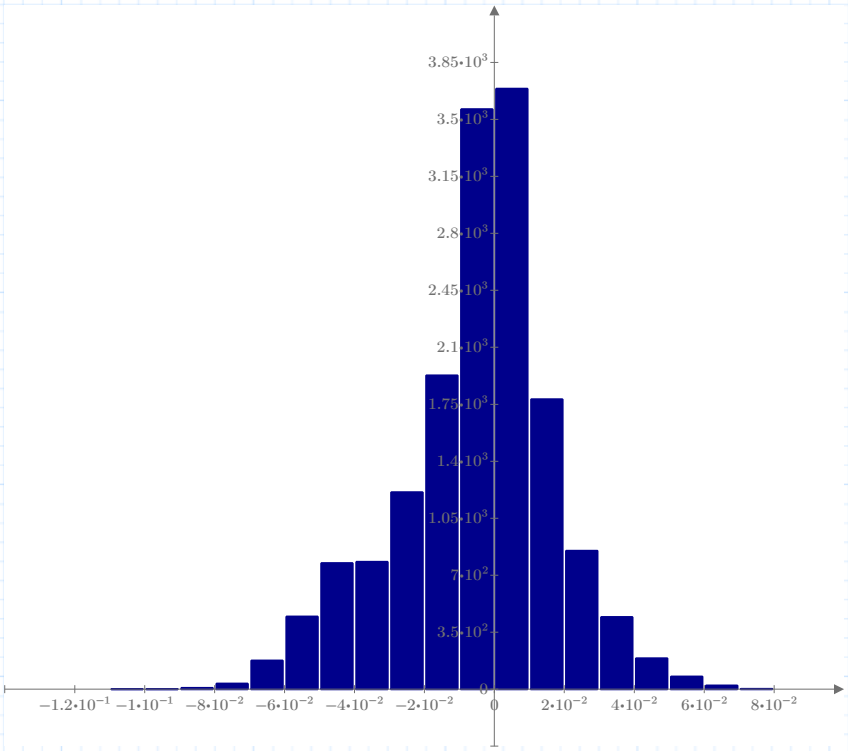
To analyze the data, define the histogram bin size and intervals:

$Interval_1 := -.11$ $m := 1 .. 19$

$Interval_{m+1} := -.11 + .01 \cdot m$

$Analysis_1 := \text{histogram}(Interval, Rate)$

Interval 1 Histogram



This histogram shows a possible shape which suggests secondary settlement due to heat generating reaction rate of approximatley -0.040 ft per day.
Note that this is just a raw settlement rate analysis and not a vertical strain rate.

INTERVAL 2 : July 2 2012 to August 7, 2012

Read excel compiled data for settlement:

$\Delta el := \text{READEXCEL}(\text{"..\drawings\settsurveypts\settlementanalysis.xlsx"}, \text{"Sheet1!U5:U16592"})$

$j := 1 .. \text{rows}(\Delta el)$ counts to the number of data points

$\Delta T_2 := 36\ day$ Time during interval

Filter data for points without data for this interval:

$Settle_j := \text{if}(\Delta el_j = \text{"\#N/A"}, NaN, \Delta el_j)$ $filterSettle := \text{filterNaN}(Settle)$

$i := 1 .. \text{rows}(filterSettle)$

Calculate the rate of settlement for the data set:

$$Rate_i := \frac{filterSettle_i \cdot day}{\Delta T_2}$$

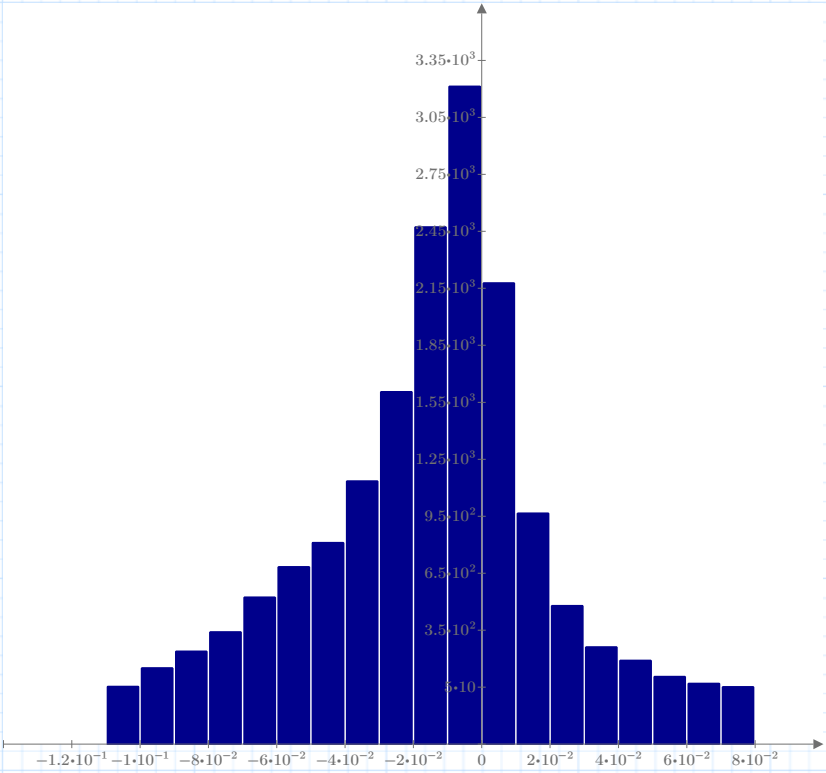
To analyze the data, define the histogram bin size and intervals:

$Interval_1 := -.11 \qquad m := 1..19$

$Interval_{m+1} := -.11 + .01 \cdot m$

$Analysis_2 := \text{histogram}(Interval, Rate)$

Interval 2 Histogram



There is no difinitive bimodal shape to this histogram, therefore no real conclusion can be drawn about the secondary settlement rate due to subsurface heat generating reaction. The lack of bimodal shape can be due to the accuracy of the survey during this period versus the magnitude of settlements measured over a month period. Using greater time periods may be better.

INTERVAL 3 : May 14, 2012 to August 7, 2012

Read excel compiled data for settlement:

$El_1 := \text{READEXCEL}(\text{"..\drawings\settsurveypts\settlementanalysis.xlsx"}, \text{"Sheet1!C5:C16592"})$

$El_3 := \text{READEXCEL}(\text{"..\drawings\settsurveypts\settlementanalysis.xlsx"}, \text{"Sheet1!I5:I16592"})$

$\Delta el := El_3 - El_1$ calculate change in elevation

$j := 1..\text{rows}(\Delta el)$ counts to the number of data points

$\Delta T_3 := (49 + 36)\ day$ Time during interval

Filter data for points without data for this interval:

$$Settle_j := \text{if}\left(\Delta el_j < -999 \vee \Delta el_j > 999, NaN, \Delta el_j\right) \quad filterSettle := \text{filterNaN}\left(Settle\right)$$

$$i := 1 .. \text{rows}\left(filterSettle\right)$$

Calculate the rate of settlement for the data set:

$$Rate_i := \frac{filterSettle_i \cdot day}{\Delta T_3}$$

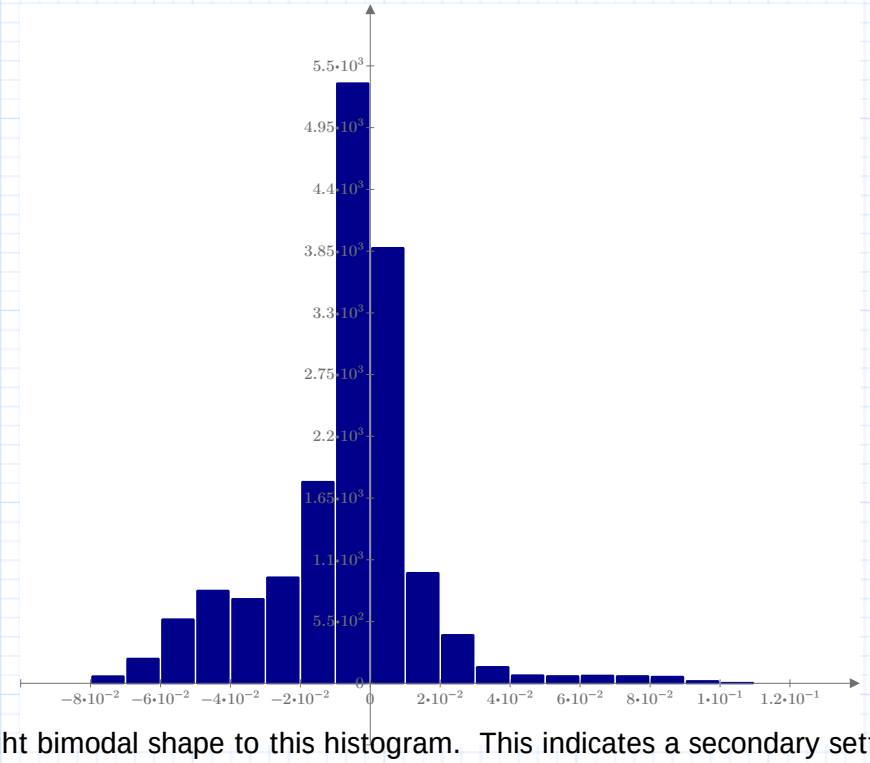
To analyze the data, define the histogram bin size and intervals:

$$Interval_1 := -.08 \qquad m := 1 .. 19$$

$$Interval_{m+1} := Interval_1 + .01 \cdot m$$

$$Analysis_3 := \text{histogram}\left(Interval, Rate\right)$$

Interval 3 Histogram



There is a slight bimodal shape to this histogram. This indicates a secondary settlement rate between -0.05 and -0.04 ft/day due to subsurface heat generating reaction.

INTERVAL 3 : May 14, 2012 to September 6, 2012

Read excel compiled data for settlement:

$$El_1 := \text{READEXCEL}\left("..\backslash drawings\backslash settsurveypts\backslash settlementanalysis.xlsx", "Sheet1!C5:C16592"\right)$$

$$El_4 := \text{READEXCEL}\left("..\backslash drawings\backslash settsurveypts\backslash settlementanalysis.xlsx", "Sheet1!L5:L16592"\right)$$

$\Delta el := El_4 - El_1$ calculate change in elevation

$j := 1 .. \text{rows}\left(\Delta el\right)$ counts to the number of data points

$\Delta T_4 := \left(49 + 36 + 30\right) day$ Time during interval

Filter data for points without data for this interval:

$$Settle_j := \text{if}\left(\Delta el_j < -999 \vee \Delta el_j > 999, NaN, \Delta el_j\right) \quad filterSettle := \text{filterNaN}\left(Settle\right)$$

$$i := 1 .. \text{rows}\left(filterSettle\right)$$

Calculate the rate of settlement for the data set:

$$Rate_i := \frac{filterSettle_i \cdot day}{\Delta T_4}$$

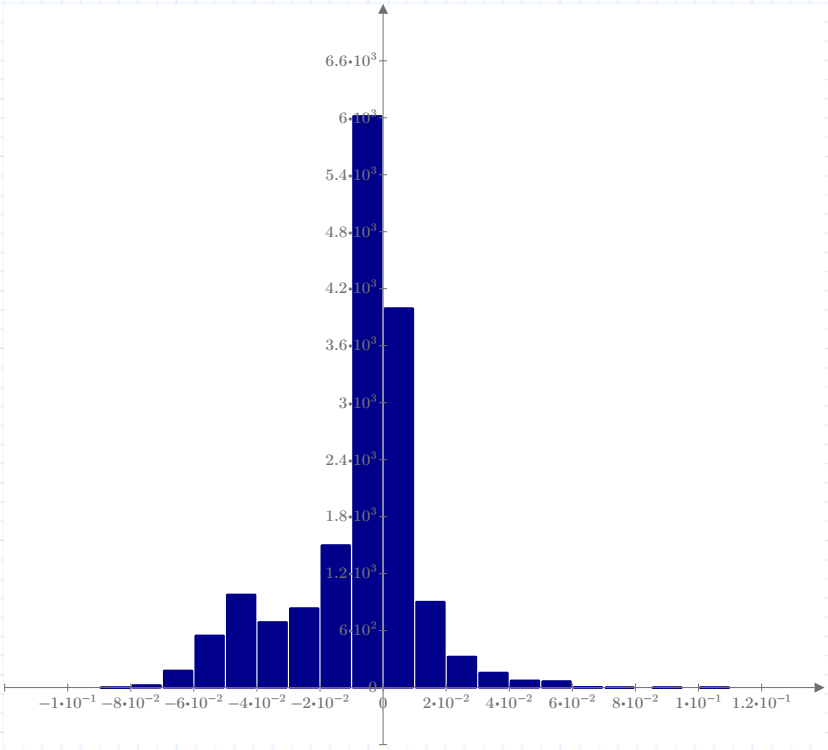
To analyze the data, define the histogram bin size and intervals:

$$Interval_1 := -.09 \qquad m := 1 .. 17$$

$$Interval_{m+1} := Interval_1 + .01 \cdot m$$

$$Analysis_4 := \text{histogram}\left(Interval, Rate\right)$$

Interval 4 Histogram



As with Interval 3, there is a slight bimodal shape to this histogram. This indicates a secondary settlement rate between -0.05 and -0.04 ft/day due to subsurface heat generating reaction.

Subject/Calcution: **Heat Barrier Calcs - Thermo**

P.J.Carey & Associates, P.C.

Client: Bridgeton Project: Bridgeton
Project No. 179.001
Performed by: PJC Checked by: KH

Purpose:
To compute approximate heat flow in the waste mass per unit area assuming a range of temperature gradients and heat conductivity values. Calculation assumes steady state one dimensional conditions. The intent is to compute the possible demands on a cooling system. For this calculation, gradients are assumed to be reflective of a heat gradient consistent with measurements in the field as opposed to a combusition event. In the event gradients are found to be much higher, added rows of piping could be installed.

Definition of variables:

$A := 1\ m^2$ A = Unit Area

$k_e := \begin{bmatrix} 0.35 \\ 0.45 \\ 0.65 \\ 0.96 \end{bmatrix} \frac{J}{m \cdot s \cdot K}$ ke = the heat condution coefficient from Yoshida and Rowe

$i := 1..6$ i = number of temperature intervals

$\Delta T_i := [50\ \ 30\ \ 50\ \ 60\ \ 80\ \ 120]\ \Delta°F$ ΔT = temperature difference (assumed)

$j := 1..6$ j = number of distance intervals

$\Delta X_j := [3\ \ 6\ \ 9\ \ 12\ \ 15\ \ 30]\ ft$ ΔX = distance interval (assumed)

$$Gradient_{i,j} := \frac{\Delta T_i}{\Delta X_j}$$

$$Gradient_{1,1} = [30.378\ \ 9.113\ \ 10.126\ \ 9.113\ \ 9.721\ \ 7.291]\ \frac{K}{m}$$

Heat flow (q) per square meter based on gradient maximum and minimums:

$$q_{min} := A \cdot k_e \cdot 6\ \frac{K}{m} = \begin{bmatrix} 2.1 \\ 2.7 \\ 3.9 \\ 5.76 \end{bmatrix} W \qquad q_{max} := A \cdot k_e \cdot 30\ \frac{K}{m} = \begin{bmatrix} 10.5 \\ 13.5 \\ 19.5 \\ 28.8 \end{bmatrix} W$$

Removal devices :
Compute the ability of a pipe array, spaced relatively uniformly, to remove heat.
Assume no special antifreeze or solution, so the minimum temperature within the pipe is 35 degrees F.

Definition of additional variables:

T = Temperature, initial and final
r1 = pipe radius
r2 = pipe spacing divided by 2 (furthest particle from pipe distance)
q = heatflow, conductivity

Scenario 1:

$T_1 := 80\ °F$ $T_2 := 160\ °F$ (Initial Guess)

$r_1 := \frac{4\ in}{2} = 0.167\ ft$ $r_2 := 4\ ft$

$$q(T_2) := A \cdot 2 \cdot \pi \cdot k_{e_4} \frac{(T_1 - T_2)}{\ln\left(\frac{r_2}{r_1}\right)}$$

Guess Values

$T_2 = 160\ °F$

Constraints

$q(T_2) = -30\ W \cdot 2\ r_2$

$T_2 > T_1$

Solver

$\text{find}(T_2) = 149.376\ °F$

SOLUTION WORKS IF CONDUCTIVITY OF BACKFILL IS > or =1 W/mK . - about that of wet waste

suggests that water to air radiator in the summer is adequate

Scenario 2:

$T_1 := 100\ °F$

$r_1 := \frac{3.5\ in}{2} = 0.146\ ft$ $r_2 := 6\ ft$

$$q(T_2) := A \cdot 2 \cdot \pi \cdot k_{e_4} \frac{(T_1 - T_2)}{\ln\left(\frac{r_2}{r_1}\right)}$$

Guess Values

$T_2 = 160\ °F$

Constraints

$q(T_2) = -12\ W \cdot 2\ r_2$

$T_2 > T_1$

Solver

$\text{find}(T_2) = 148.685\ °F$

$q(T_2) = -54.092\ \frac{kg \cdot m^3}{s^3}$

the calculation above suggests that a scenerio assuming the projected heat does not include the heat of vapor transmission would be able to be captured with a spacing of 12 feet on center and 3.5" od transfer pipe

Scenario 3:

$T_1 := 80\ °F$

$r_1 := \frac{4\ in}{2} = 0.167\ ft$ $\quad r_2 := 2\ ft$

$$q(T_2) := A \cdot 2 \cdot \pi \cdot k_{e_4} \frac{(T_1 - T_2)}{\ln\left(\frac{r_2}{r_1}\right)}$$

Guess Values

$T_2 = 160\ °F$

Constraints

$q(T_2) = -150\ W \cdot 2\ r_2$

$T_2 > T_1$

Solver

$\text{find}(T_2) = 215.612\ °F$

note the W assumes maximum based on current heat front movement rates and assumes a rate of rise of temperature and waste drying and suggests that a 4 foot spacing with a cooler could manage 150 Watts per sq meter flux rate if a 4 inch od exchanger is used

Heat Flux vs. Heat Front Movement

Check the heat flux against the rate of movement of the heat front.
Assumptions:
Assume approximately a 40 foot thick layer that is being dried from 3% moisture to near zero moisture. This would be consistent with observations of nearly dry waste in the borings near the heat front.
The total evaporated liquid per meter width per month can be estimated by assuming a total density of 65 pcf and an advance rate of about 15 to 20 feet per month. The heated water vapor moving in advance of the front, once liberated from the waste in the front, warms the waste in the advancing area. Therefore it is not necessary to include this value in the energy balance. The energy does need to be continued to be delivered to the advancing front to evaporate the water at the front edge, assuming it is not taken away via gas collection.

Based on the calculations below, the energy required is very dependant on the moisture content in the waste at the front zone.

Definition of additional variables:

$L := 18\ ft$	Length (average heat front advancement during the month)
$H := 40\ ft$	Height (layer thickness)
$W := 1\ m$	Width (per unit meter)
$\Delta T := 10\ \Delta°C = 10\ K$	Approximate (observed) increase in temperature during the month
$\Delta t := 30\ day$	Time (month of observation)
$\gamma_{waste} := 65\ \frac{lb}{ft^3}$	Total density of waste in warmed zone

$LHV_{h2o} := 2260 \ \frac{J}{gm}$ Latent heat of vaporization for water (assumed to be close to that of the landfill liquid)

$C_{e_drywaste} := 500 \cdot \frac{J}{kg \cdot K}$ Heat capacity of dry waste per degree (K or degrees C)

$mc_{liquid} := 3\%$ Moisture content of the waste in warmed zone as a percent of dry waste

$V := L \cdot H \cdot W = 66.89 \ m^3$ Volume of assuming per unit meter width

$W_{liquid} := \gamma_{waste} \cdot \left(1 - \frac{1}{1 + mc_{liquid}}\right) = 1.893 \ \frac{lb}{ft^3}$ Calculate weight (mass) of liquid

$E_{vap} := W_{liquid} \cdot LHV_{h2o} \cdot V = \left(4.584 \cdot 10^9\right) J$ Energy required to vaporize the volume of landfill liquid

$E_{temp} := V \cdot C_{e_drywaste} \cdot \gamma_{waste} = \left(3.482 \cdot 10^7\right) \frac{J}{K}$ Energy required to increase the waste temperature one degree (K or oC)

Calculate the range of flux for the heat advancement to travel 18 ft over the 30 days.

Assuming vaporization (upper bound):

$flux_{vap} := \frac{E_{vap}}{W \cdot H \cdot \Delta t} = 145.071 \ \frac{W}{m^2}$ this value requires a gradient that is higher than any measured on site

Assuming no residual moisture present and 10 degree temperature increase (lower bound):

$flux_{nrmoist} := \frac{E_{temp}}{W \cdot H \cdot \Delta t} \cdot \Delta T = 11.019 \ \frac{W}{m^2}$ this is more consistent with the gradient of temp at site and suggests that heat transmission laterally by conduction is more in the dry areas - in the wetter zones its mostly heat transfer with steam, where the energy is reused and works to dry out the waste

The flux translates into heat removed (exchanged) per device (cooling point).

This value translates into the heat removed per device as the spacing c-c times the depth . Note that this is much higher than assumed by only using the gradient as the measure of energy flux. This is consistent with slower rate of rise of well temps and temps prior to reaching close to the boiling point that has been observed at the site.

$x_{space} := 8 \ ft$ C-C spacing of heat removal devices

$A_{barrier} := 52613 \ ft^2$ Cross-sectional area along profile of heat barrier

$L_{barrier} := 360 \ ft$ Length of barrier line

$n_{pipe} := 42$ Number of pipes

$L_{pipe} := \frac{A_{barrier}}{L_{barrier}} = 146.147 \ ft$ Averager pipe length, determined by area divided by length of barrier line

Calculate rate of heat exchange assuming no residual moisture present and 10 degree temperature increase (lower bound):

$ExchangeRate_{nrmoist} := flux_{nrmoist} \cdot \frac{1}{2} \cdot A_{barrier} = (2.693 \cdot 10^4)\ W$

Assume 1/2 of the pipe experiences the full flux (which was measured from the hotest zones)

$ExchangeRate_{nrmoist} = (9.189 \cdot 10^4)\ \frac{Btu}{hr}$

Check this lower bound of heat exchange and check a circulation rate to verify that the average temperature of the liquid doesn't rise too much (i.e. less than 20 degree F). Assume the heat capacity of water.

$Q := 50\ gpm$ Assumed flow/circulation rate

$C_\rho := 1.88 \cdot 10^3 \cdot \frac{J}{kg \cdot K}$ Heat capacity of water

$\Delta T := \frac{ExchangeRate_{nrmoist}}{C_\rho \cdot Q \cdot 1\ \frac{gm}{cm^3}} = 4.541\ \Delta°C$ $\Delta T = 8.174\ \Delta°F$

Flow/circulation is OK because less than 20 degree F

Calculate rate of heat exchange assuming vaporization (upper bound):

$ExchangeRate_{vap} := flux_{vap} \cdot \frac{1}{2} \cdot A_{barrier} = (3.545 \cdot 10^5)\ W$

Assume 1/2 of the pipe experiences the full flux (which was measured from the hotest zones)

$ExchangeRate_{vap} = (1.21 \cdot 10^6)\ \frac{Btu}{hr}$

Check the upper bound of heat exchange and check a circulation rate to verify that the average temperature of the liquid doesn't rise too much (i.e. less than 20 degree F). Assume the heat capacity of water.

$Q := 270\ gpm$ Assumed flow/circulation rate

$C_\rho := 1.88 \cdot 10^3 \cdot \frac{J}{kg \cdot K}$ Heat capacity of water

$\Delta T := \frac{ExchangeRate_{vap}}{C_\rho \cdot Q \cdot 1\ \frac{gm}{cm^3}} = 11.071\ \Delta°C$ $\Delta T = 19.928\ \Delta°F$

Flow/circulation is OK because less than 20 degree F

This suggests that a 1.5 M BTU exchange device would likely be sufficient for up to 150 watts/sq m flux.

If a higher energy flux rate were assumed, consistent with significant moisture evaporation energy included a greater number of cooling points would be required and a larger exchange rate would occur. Point spacings could be decreased to 4 foot c-c by installation of a second row of points parallel to the existing barrier. The total exchange rate could then be increased by coupling these additional points with a larger cooling device.

Based on the above calculations, the initial design should be 8 ft c-c spacings and a second row offset at 8 ft away at the same spacing or closer depending on site observations. Reduce the possibility of vapor phase heat transfer by installing gas extraction to the south of the advance front prior to it getting within 100 ft of the barrier location, to limit vapor transmission to the barrier area. The ability to add a chiller to the liquid circulation would allow for increased heat extraction without addition of more points .

Table 1 Properties used in simulation of Tokyo landfill case

Parameters	sign	units	value
Landfill layer(unsaturated)			
Water content	w	[%]	28.9
Apparent density	ρ_e	[kg/m^3]	1157
Specific heat	C_e	[J/(kg)]	1939
Effective thermal conductivity	k_e	[J/(ms)]	0.35
Landfill layer(saturated)			
Water content	w	[%]	42.3
Apparent density	ρ_e	[kg/m^3]	1424
Specific heat	C_e	[J/(kg)]	2363
Effective thermal conductivity	k_e	[J/(ms)]	0.96
Natural soil layer			
Water content	w	[%]	9.1
Apparent density	ρ_e	[kg/m^3]	1800
Specific heat	C_e	[J/(kg)]	1109
Effective thermal conductivity	k_e	[J/(ms)]	0.86
Aerobic decomposition			
Depth of aerobic zone	H_{ae}	[m]	1.0
Rate of methane production	Ro	[mol-O_2/(m^{3}s)]	10^{-5}
heat generation	ΔH_o	[kJ/(mol-O_2)]	460×10^3
Rate of heat generation	Q_{ae}	[J/(m^{3}s)]	4.67
Anaerobic decomposition			
Rate of methane production	R_m	[mol-CH_4/(m^{3}s)]	5×10^{-6}
heat generation	ΔH_m	[J/(mol-CH_4)]	43.5×10^3
Rate of heat generation	Q_{an}	[J/(m^{3}s)]	0.218
Total gas generation	V_m	[mol-CH_4/m^3]	1298
Duration of decomposition	$t_{an}=V_m/R_m$	[year]	8.2
The depth of landfill	H	[m]	33.5
The depth of natural soil layer	H_{soil}	[m]	30
Air annual average temperature	θ_a	[° C]	15
Natural soil temperature	θ_o	[° C]	15
Initial temperature of waste cell	θ_o	[° C]	15
Infiltrated water flux	v_z	[mm/d]	2.0
Excessive drainage flux of leachate	v_e	[mm/d]	0.05-0.08
Heat transfer coefficient	h	[J/(m^{2}s)]	10

P.J.Carey & Associates, P.C.

CLIENT Bridgeton
PROJECT Bridgeton
JOB No 179.001
DATE 12/20/12

CALCULATION BY PJC
CHECKED BY KH
APPROVED BY PJC

OBJECT To estimate the friction flow losses in the various pipes.
1. Central supply pipe of the cooling point
2. Annulus pipe of the cooling point
3. Supply header

CENTRAL SUPPLY PIPE

Using Hazen Williams formula

$C_1 := 150$ Hazen Williams flow coeffictient (for english units), where 1 corresponds to a clean system and 2 a degraded one with age and scale formation

$L_{central} := 225ft$ Length of central supply pipe

$Q := 10gpm$ estimated flow

$D_i := 1.38in$ inner diameter for 1 1/4 sch 40 pipe

Calculate Friction Flow Loss

$$h_f := \left[\frac{.002083 \cdot \frac{L_{central}}{ft}}{\left(\frac{D_i}{in}\right)^{4.8655}} \cdot \left(\frac{100 \cdot \frac{Q}{gpm}}{C_1} \right)^{1.85} \right] ft$$

$h_f = 3.27\,ft$ Minor friction flow loss

THE ANNULUS PIPE

Using Darcy's equation

The annulus flow is between a 3.5" OD structural shape with a 3" ID and a 1.66" OD 1 1/4 pipe inside

$D_1 := 3.0in$

$D_2 := 1.66in$

$L_{central} = 225\,ft$ Same length as Central Pipe

$Q = 10\,gpm$ Same flow as Central Pipe

$WettedPerimeter := (D_1 + D_2) \cdot \pi = 1.22\,ft$

$$A_{flow} := \left[\left(\frac{D_1}{2}\right)^2 - \left(\frac{D_2}{2}\right)^2\right]\cdot\pi = 0.034\,ft^2$$ Flow area

$$hydraulicdiameter := \frac{4A_{flow}}{WettedPerimeter} = 0.112\,ft$$ Effective hydraulic diameter

$$v := \frac{Q}{A_{flow}} = 0.654\,\frac{ft}{s}$$ Velocity

$$\nu := .000001004\,\frac{m^2}{sec}$$ kinematic viscosity of water

$$R_e := \frac{v\cdot hydraulicdiameter}{\nu} = 6.76\times 10^3$$ Reynolds number

$$f := \frac{64}{R_e} = 9.468\times 10^{-3}$$ laminar friction factor

Calculate Friction Flow Loss

$$h_f := f\cdot\frac{L_{central}}{hydraulicdiameter}\cdot\frac{v^2}{2g} = 0.127\,ft$$ Minor friction flow loss

Losses in the supply header

Using Hazen Williams formula the supply header has two sections with different diameters.

Friction head loss in the first section of the supply header (6" pipe):

$C_1 := 150$ Hazen Williams flow coeffictient (for english units), where 1 corresponds to a clean system and 2 a degraded one with age and scale formation

$L_{supply1} := 320ft$ Length of supply header pipe that is 6" (cooler to station 2+00)

$Q := 350gpm$ estimated flow

$D_i := 6in$ inner diameter for 1 1/4 sch 40 pipe

Calculate Friction Flow Loss

$$h_{f1} := \left[\frac{.002083\cdot\frac{L_{supply1}}{ft}}{\left(\frac{D_i}{in}\right)^{4.8655}}\cdot\left(\frac{100\cdot\frac{Q}{gpm}}{C_1}\right)^{1.85}\right]ft = 2.621\,ft$$

Friction head loss in the second section of the supply header (4" pipe):

$C_1 := 150$ Hazen Williams flow coeffictient (for english units), where 1 corresponds to a clean system and 2 a degraded one with age and scale formation

$L_{supply2} := 160ft$ Length of supply header pipe that is 4" (station 2+00 to 3+50)

$Q := 200gpm$ estimated flow

$D_i := 4in$ inner diameter for 1 1/4 sch 40 pipe

Calculate Friction Flow Loss

$$h_{f2} := \left[\frac{.002083 \cdot \frac{L_{supply2}}{ft}}{\left(\frac{D_i}{in}\right)^{4.8655}} \cdot \left(\frac{100 \cdot \frac{Q}{gpm}}{C_1} \right)^{1.85} \right] ft = 3.347\ ft$$

$h_f := h_{f1} + h_{f2} = 5.968\ ft$ Minor friction flow loss

Industrial

Cooling Systems









- Reduce or Eliminate Water Use
- Winter Heat Recovery
- Free Cooling Economizers

motivair™

COOLING SOLUTIONS

www.motivaircorp.com





Motivair closed-loop fluid cooling systems dramatically cut utility and maintenance costs when applied to water-cooled industrial equipment including molding machines, air compressors, furnaces, and hydraulic systems. They are also ideal for “Free-Cooling” economizers on chillers, when used to pre-cool the return chilled water during winter operation.

MFC CLOSED LOOP (DRY) FLUID COOLING SYSTEMS

MOTIVAIR MFC FLUID COOLERS, CLEAN & EFFICIENT COOLING FOR YOUR PROCESS.

Designed for simple installation, these pre-engineered systems continuously cool and circulate a solution of water and ethylene glycol without any evaporation loss, freeze-ups, water treatment or routine maintenance. Internal scaling and corrosion are virtually eliminated because air is automatically removed and the same fluid is re-circulated continuously. In contrast to cooling towers or city water systems, water or sewer charges are eliminated.

Motivair MFC systems are shipped in two sections, an air-cooled heat exchanger and a pumping station. Both are completely factory assembled and tested before shipment. The heat exchanger features a galvanized housing for indoor or outdoor use. Copper tubes and aluminum fins provide superior heat transfer. Fans are compartmentalized for efficient fan cycling. Solid-state fan sequencer is standard on multiple fan units. All heat exchangers are tested to 400 PSIG and multiple fan units are shipped with a pre-wired control panel.

The pumping station may be installed anywhere between the heat source and the heat exchanger. Included are single or duplex close-coupled pumps, TEFC motors, NEMA 4 panel, temperature and pressure gauges, pressure differential switch (duplex systems) isolation and check valves, expansion tank, purger, vent and fill valve. The control panel includes starters, indicating lights, auto changeover (duplex systems) lead/lag selector switch and pump failure visual and audible alarms. All pump stations are sized per application ensuring adequate flow and pressure for each individual system.

AVAILABLE OPTIONS INCLUDE:

- Shell and tube trim cooler
- Copper fins
- Coil coating for corrosive environments
- Stainless steel construction

MFC SPECIFICATIONS

FLUID COOLER MODEL	FLOW RATE (GPM)	HEAT REJECTION CAPACITY* (BTU/HR)	NO. OF FANS	TOTAL AIRFLOW (SCFM)	OVERALL DMENSIONS(IN.) L	W	H	INT VOL. (GAL.)	EMPTY WEIGHT (LBS.)
MFC0200	22	200,000	2	21,000	90	43	50	6	580
MFC0250	28	250,000	2	20,600	90	43	50	9	630
MFC0300	34	300,000	2	19,800	90	43	50	9	650
MFC0350	39	350,000	2	18,500	76	43	50	12	730
MFC0400	45	400,000	3	30,900	130	43	50	17	900
MFC0450	51	450,000	3	29,700	130	43	50	17	930
MFC0500	56	500,000	3	28,600	130	43	50	22	1010
MFC0550	62	550,000	4	41,200	231/121**	88	50	18	1580
MFC0600	68	600,000	4	39,600	231/121**	88	50	18	1620
MFC0700	79	700,000	4	37,000	231/121**	88	50	24	1760
MFC0800	90	800,000	6	61,000	341/176**	88	50	27	1810
MFC0900	101	900,000	6	60,600	341/176**	88	50	27	2390
MFC0950	107	950,000	6	59,400	341/176**	88	50	27	2440
MFC1000	113	1,000,000	6	57,200	341/176**	88	50	36	2550
MFC1100	124	1,100,000	6	55,500	341/176**	88	50	36	2610
MFC1200	135	1,200,000	8	79,200	231	88	50	36	3140
MFC1300	146	1,300,000	8	76,300	231	88	50	48	3200
MFC1400	158	1,400,000	8	74,000	231	88	50	48	3510
MFC1500	169	1,500,000	10	99,000	286	88	50	45	3990
MFC1600	180	1,600,000	10	98,200	286	88	50	60	4000
MFC1700	191	1,700,000	10	95,300	286	88	50	60	4150
MFC1800	203	1,800,000	10	92,500	286	88	50	60	4380
MFC1900	214	1,900,000	12	117,900	341	88	50	72	4710
MFC2000	225	2,000,000	12	114,400	341	88	50	72	4890
MFC2100	236	2,100,000	12	111,000	341	88	50	72	5230

**Performance based on 40% glycol entering the cooler @ 125° F, leaving the cooler @ 105° F, & 95° F ambient.*
***These coolers are available in eiher a 1-fan or 2-fan-wide configuration.*
Contact Motivair for Economizer (Free-Cooling) applications!

MEC CLOSED LOOP EVAPORATIVE COOLING TOWERS

DESIGN FEATURES

The Motivair MEC closed loop evaporative towers combine the advantages or our MFC closed loop dry fluid coolers with the lower water temperatures available from an open draft evaporative cooling tower. Rugged construction, and optional hot dipped galvanizing after fabrication make these towers suitable for the most demanding industrial applications.



The spray pump continuously drenches the tubular heat exchanger surface with a spray of re-circulated water, while the fan forces ambient air across the coil. The evaporation of the spray water removes heat from the closed loop fluid at temperatures below the ambient “dry bulb” temperature. The evaporative cooling effect is based on the prevailing “wet bulb” temperature, which is a measurement of moisture in the air. (A lower wet bulb temperature increases evaporation from the cooler, and directly increases capacity.)

COMPONENTS

The MEC Series Closed Loop Evaporative Towers consist of four main components: (1) the cooling coil; (2) the spray system; (3) the fan system; and (4) the discharge mist eliminators.

- **THE COOLING COIL** separates the closed loop fluid from the spray water thereby eliminating the possibility of contaminated cooling water. This also allows the use of glycol as the closed loop fluid for winter operation.
- **THE SPRAY SYSTEM** includes a sump, spray pump, riser, distribution pipes, and spray nozzles designed to circulate spray water from the basin and continuously drench the cooling coil surface.
- **THE FAN SYSTEM** moves the correct amount of air over the wet cooling coil surface to maximize the heat transfer. This air carries away the heat from the closed loop fluid in the form of increased temperature and evaporated spray water (latent heat of vaporization).
- **THE DISCHARGE MIST** eliminators keep spray water droplets inside the cooler, to reduce water consumption, drift losses and vapor “plumes.”

In most areas of North America the maximum ambient “wet bulb” temperature is below 78°F, and it rarely exceeds 80°F. In general, this makes Evaporative Closed Loop Systems ideally suited for use when the maximum required cooling water temperature is around 85°F.

Water consumption is approximately 2 GPM per million Btu/h for evaporation losses, plus occasional blow downs to clean the sump.

MEC SPECIFICATIONS

FLUID COOLER MODEL	FLOW RATE (GPM)†	HEAT REJECTION CAPACITY* (BTU/HR)	TOTAL AIRFLOW (SCFM)	FAN MOTOR HP	SPRAY PUMP HP	PAN HEATER KW	OVERALL DMENSIONS(IN.) A	B	C	OPER. WEIGHT (LBS.)
MEC0300	27	300,000	6,400	3	0.5	3	70	67	114	2,790
MEC0400	`36	400,000	9,300	5	0.75	3	70	78	107	3,630
MEC0500	45	500,000	9,200	5	0.75	3	70	78	114	3,895
MEC0700	63	700,000	14,700	7.5	1	4.5	130	73	100	4,520
MEC0900	81	900,000	14,400	7.5	1	4.5	130	73	114	5,455
MEC1100	99	1,100,000	20,500	15	1.5	6	130	84	107	6,580
MEC1300	117	1,300,000	20,500	15	1.5	6	130	84	114	6,990
MEC1600	144	1,600,000	29,400	15	1	4.5	135	103	107	8,670
MEC1800	162	1,800,000	29,400	15	1	4.5	135	103	114	8,910
MEC2000	180	2,000,000	40,500	20	1.5	6	135	126	100	11,020
MEC2200	198	2,200,000	40,200	20	1.5	6	135	126	107	11,270
MEC2400	216	2,400,000	40,100	20	1.5	6	135	126	114	11,600
MEC2800	252	2,800,000	61,200	30	3	9	195	126	100	14,880
MEC3400	306	3,400,000	61,000	30	3	9	195	126	107	15,870
MEC3800	342	3,800,000	60,000	30	3	9	195	126	114	17,410

**Performance based on 40% glycol entering the cooler @ 115° F, leaving the cooler @ 90° F, & 78° F ambient.*
***See Closed Loop Water Cooling Systems brochure for pump station details.*

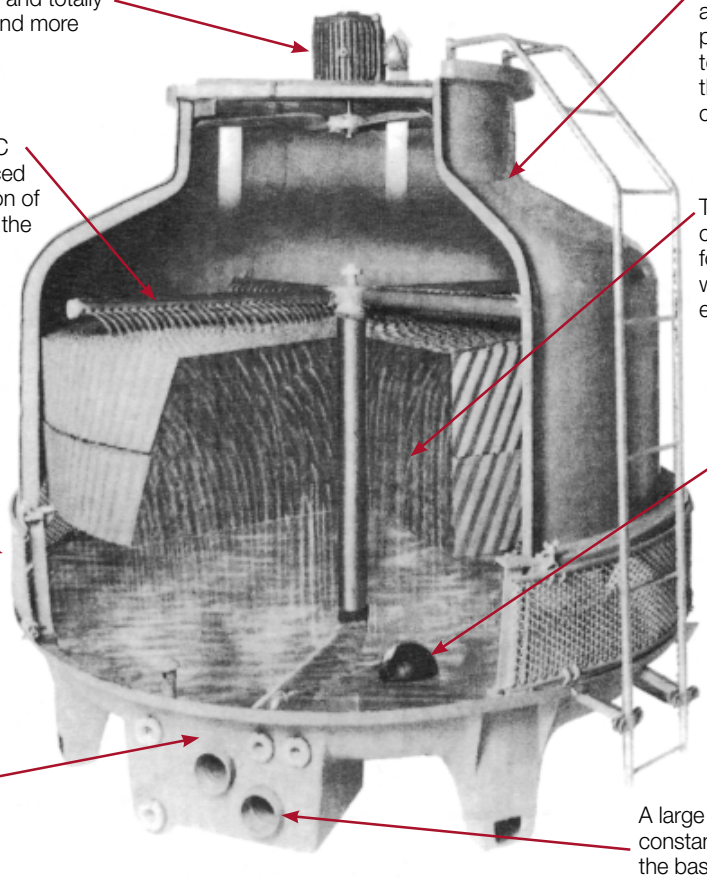
MOT OPEN DRAFT EVAPORATIVE COOLING TOWERS

The fan motor is weather-proofed and totally enclosed allowing for less noise and more efficient long-term performance.

The sprinkler pipes are sturdy PVC material pierced with closely-spaced holes allowing thorough distribution of water in a rotating spray covering the entire surface of the fillter.

The round design permits maximum air intake regardless of wind direction.

Efficiency is enhanced by a low internal pressure drop.



Housing panels and water basin are built of fiberglass reinforced plastic ensuring rust-free long term performance even under the most severe environmental conditions.

The efficiently designed PVC filler creates a surface area that allows for maximum dispersion of water which creates a superior cooling effect.

A large-capacity, durable water basin constructed from rust-proof fiberglass rein-forced platic gurantees low maintenance and long-term operation.

A large diameter outlet pipe draws a constant supply of cooled water from the basin to serve the facility.

RELIABLE, COST EFFECTIVE EVAPORATIVE COOLING

DESIGN FEATURES:

Lightweight and compact, the Motivair open draft cooling towers provide evaporative cooling at the lowest cost, combined with quick and easy installation. On-site assembly is simplified by the modular design of all components. Smaller models are shipped pre-assembled while larger units can be either customer assembled on site, or factory assembled on site for a reasonable fee. Prevailing wind directions will not affect cooling tower performance due to the unique circular design of the basin and casing.

CASING: Easy access simplifies cleaning. Individual fiberglass panels are fastened together with stainless steel bolts for periodic wash down and general clean up. The Motivair MOT cooling tower is designed for durability and long life, even under the most severe environmental weather conditions.

FAN BLADES: Aerodynamically designed propeller type fans are used to conserve power and assure quiet operation. Models MOT-3 through 50 feature a factory balanced ABS plastic blade. Models MOT-60 and above feature an all aluminum alloy, adjustable blade fan.

FAN MOTOR: Models M0T-3 through 200 feature direct drive motors. Models, MOT-225 and larger feature a unique belt drive, designed to reduce noise levels to a minimum.

WATER DISTRIBUTION SYSTEM: Models MOT-3 through 60 feature an ABS plastic sprinkler with stainless steel shaft. Models MOT-70 and above feature an aluminum alloy sprinkler head. Both types of sprinkler head cause very low-pressure loss, and require minimum maintenance.

INLET LOUVERS: Non-rusting PVC plastic mesh provides easy access to the sump, while preventing foreign objects from entering.

LADDER: A ladder is provided for maintenance and inspection accessibility to fan and sprinkler systems on models MOT-40 and above.

FILL MATERIAL: Honeycomb heat embossed PVC is formed to permit high heat transfer efficiency. The Motivair fill is suitable for operation with inlet water temperatures up to 115°F. If higher temperatures are required, please contact factory.

MOT SPECIFICATIONS

Water IN Water OUT Wet Bulb	90°F 80°F 65°F	90°F 80°F 70°F	95°F 85°F 70°F	92°F 82°F 72°F	95°F 85°F 75°F	97°F 87°F 75°F	95°F 85°F 77°F	95°F 85°F 78°F	96°F 86°F 80°F	98°F 88°F 82°F	90°F 83°F 75°F	94°F 85°F 75°F	M O T
	9	6	9	7	8	9	6	6	5	6	8	9	3
	15	10	15	11	12	15	10	10	9	10	13	14	5
	24	18	24	19	20	24	18	16	14	15	22	23	8
	30	21	30	23	26	30	21	20	18	20	28	29	10
	46	33	47	35	40	47	33	30	28	30	41	43	15
	61	44	62	48	52	62	44	40	37	40	56	58	20
	77	56	78	60	66	78	56	50	47	50	70	72	25
	91	68	93	72	80	93	68	61	57	61	84	87	30
	122	90	124	97	107	124	91	83	77	82	112	116	40
	152	114	156	121	134	156	115	105	98	104	140	145	50
	183	137	187	146	160	187	137	125	116	124	169	174	60
G	214	160	218	170	187	218	160	145	135	144	197	203	70
P	244	183	250	195	214	250	183	168	156	167	225	232	80
M	306	228	311	243	268	311	229	208	193	207	281	290	100
	381	287	390	305	335	390	288	262	245	261	352	362	125
	456	346	468	368	403	468	348	318	297	318	422	435	150
	533	401	546	428	470	546	403	369	344	367	493	508	175
	608	461	624	490	539	624	464	426	398	425	563	580	200
	691	509	702	543	600	702	508	460	427	457	633	652	225
	765	570	780	608	670	780	571	520	484	518	704	725	250
	920	681	936	727	801	936	682	620	575	616	845	871	300
	1065	808	1092	859	942	1092	812	744	695	742	986	1016	350
	1220	920	1249	979	1075	1249	924	845	788	842	1127	1161	400
	1502	1182	1560	1250	1363	1560	1200	1113	1053	1119	1408	1453	500
	1825	1386	1873	1473	1616	1873	1394	1278	1194	1275	1690	1742	600
	2108	1648	2185	1745	1904	2185	1670	1546	1459	1551	1971	2035	700
	2433	1848	2498	1965	2155	2498	1860	1703	1592	1700	2255	2323	800
	2994	2379	3121	2514	2735	3121	2421	2253	2139	2270	2815	2908	1000
	3740	2977	3902	3146	3421	3902	3032	2824	2683	2846	3519	3635	1250
	4491	3568	4683	3771	4102	4683	3632	3380	3209	3404	4223	4361	1500

MPF PLATE & FRAME CLOSED LOOP COOLING SYSTEMS

These systems utilize a plate & frame heat exchanger to cool closed loop, re-circulated water, using a raw water supply, (open draft cooling tower, river or pond water) without contaminating the closed loop. This is particularly useful for air compressors or other water-cooled machinery, which have high water side maintenance costs; where avoidance of down time is critical; or when the available cooling water quality is unacceptable.

The high efficiency of the stainless steel plate design enables Motivair systems to cool the closed loop fluid to within 5°F of the raw cooling water. This efficiency also permits an extremely compact design, and occupies minimal floor space. Clip-in Nitrile rubber gaskets allow simple dismantling and re-assembly for cleaning.

Available as a complete package, or a split system, the Motivair system includes a plate and frame exchanger, process pump, NEMA 4 control & alarm panel, piping, isolation valves and temperature & pressure gauges. Piping and electrical connections are the only on-site requirements, before the system is fully operational. Optional strainer packages are available when the cooling water has an unacceptable level of suspended solids. Occasional maintenance is easily performed by back-flushing the exchanger, or by loosening the “follower” plate and removing the stainless steel plates. They are easily cleaned with a pressure hose, then re-assembled with the Nitrile rubber, clip-in gaskets and re-tightened, before resuming operation (see operation and maintenance manual).



REQUIRED DATA FOR SYSTEM DESIGN:

- Application description
- Fluid to be cooled & flow rate
- Fluid temperature entering exchanger
- Required leaving fluid temperature
- Available cooling water flow and temperature
- Allowable pressure drops
- Process fluid pump available pressure (PSI)

OPTIONAL REDUNDANT COMPONENTS

For critical applications, a complete standby exchanger is recommended, with isolation valves, so one may be cleaned while the other is in service. Motivair offers a pressure differential option, which continuously monitors the cooling water pressure differential across the exchanger(s). At a pre-determined, adjustable differential, visible and audible alarms are activated, signaling the operator to clean the exchanger or switch to the standby. Optional strainer assemblies can also be fitted with a similar indicator, to warn the operator to clean the strainer. Also available is an automatic standby pump, with associated piping, valves & controls. In the event of a pump failure, the standby pump starts automatically, while the visible & audible alarms are activated.

PUMP/TANK STATIONS

Every open and closed loop cooling tower requires a pumping package in order to circulate the cooled water or glycol to and from the designated process. Motivair designs and builds a full range of pump stations and pump/tank station packages that can be customized to suit any application (See Pump Station brochure for further details).



Available options include:

- Simplex, duplex or triplex pumps
- Stainless steel water circuit
- Automatic pump change over
- Visible & audible alarms
- Flow meters
- Baffled tanks
- Automatic water make-up
- Pressure & temperature gauges
- Isolation & check valves
- NEMA 4 control box
- VFD pump speed control
- High pressure pump option
- Redundant pump packages

APPLICATION, INTEGRATION & SOLUTIONS FOR ALL YOUR COOLING NEEDS:



MPC
1/2-50 ton packaged air-cooled or water-cooled chillers for Industrial cooling, Medical cooling or custom HVAC applications. Includes integrated microprocessor, pump station, and storage reservoir.



MLC
70-240 ton air-cooled, water-cooled & split system chillers for central plant operation, industrial processes or HVAC applications. Integrated “Free-Cooling” option

motivair™

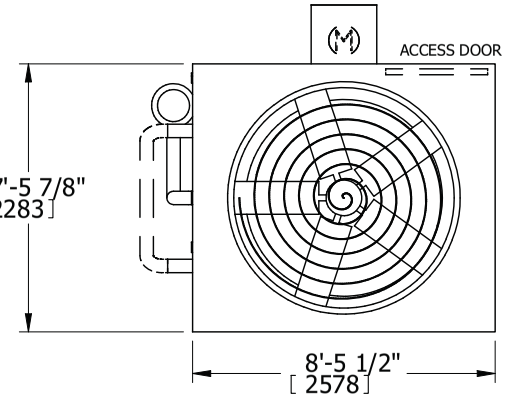
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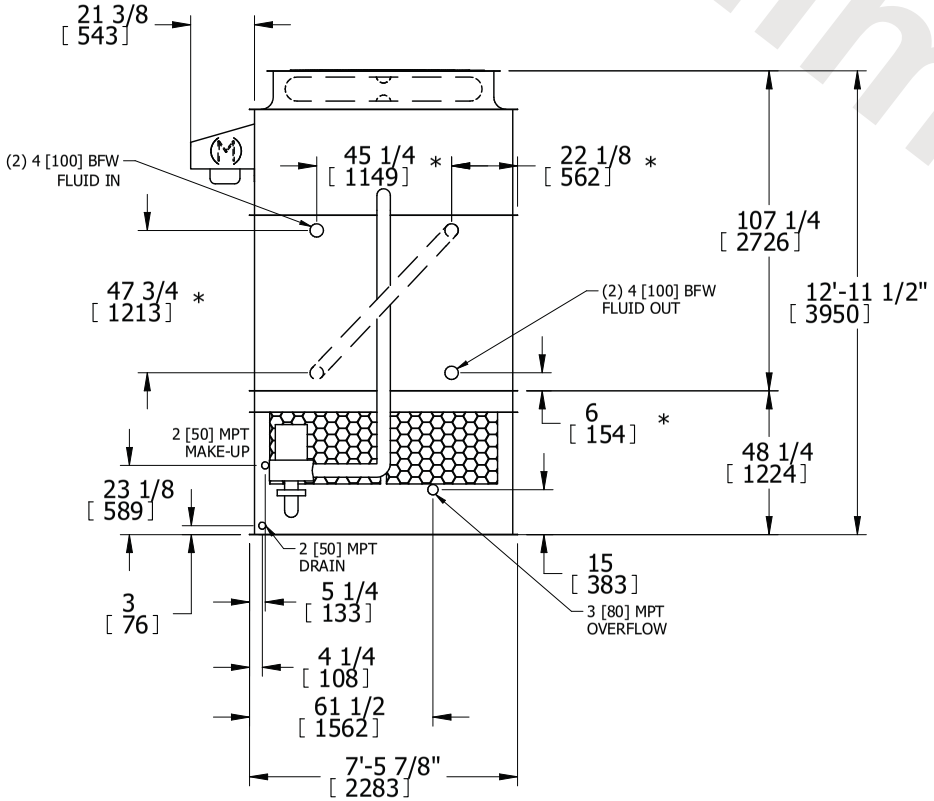
UNIT	MODEL #	SCALE	DWG. #	REV.	DATE	SERIAL #
CLOSED CIRCUIT COOLER	MEC-1800					

NOTES:
1. (M)- FAN MOTOR LOCATION
2. HEAVIEST SECTION IS UPPER SECTION
3. MPT DENOTES MALE PIPE THREAD
   FPT DENOTES FEMALE PIPE THREAD
   BFW DENOTES BEVELED FOR WELDING
4. +UNIT WEIGHT DOES NOT INCLUDE ACCESSORIES (SEE ACCESSORY DRAWINGS)
5. MAKE-UP WATER PRESSURE
   20 psi MIN [137 kPa], 50 psi MAX [344 kPa]
6. *-APPROXIMATE DIMENSIONS DO NOT USE FOR PRE-FABRICATION OF CONNECTING PIPING
7. SERIES FLOW PIPING AND AUX. CROSSOVER DRAIN BY OTHERS.

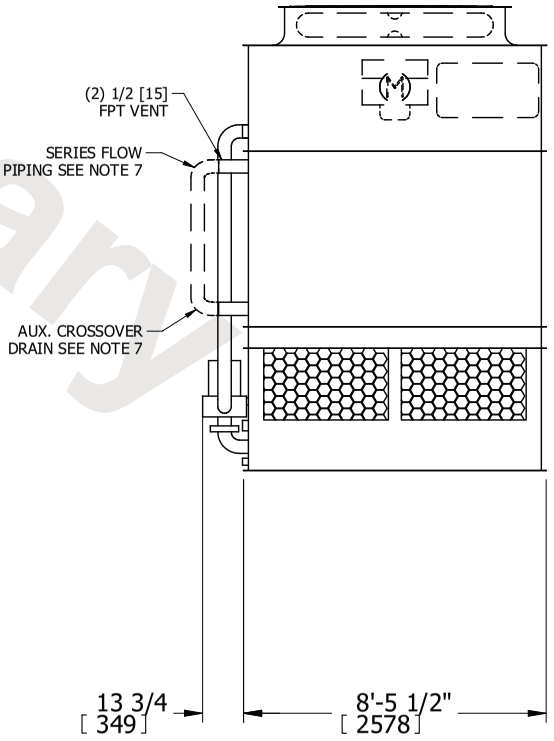
FACE 2
PLAN VIEW



FACE 1



FACE 2



FACE 1

Preliminary

SHIPPING WEIGHT	11100 lbs+ [5035] kg+	OPERATING WEIGHT	15980 lbs+ [7248] kg+	HEAVIEST SECTION WEIGHT	9800 lbs+ [4445] kg+	NO. OF SHIPPING SECTIONS	2

HEAT DISSIPATON / BARRIER PLAN

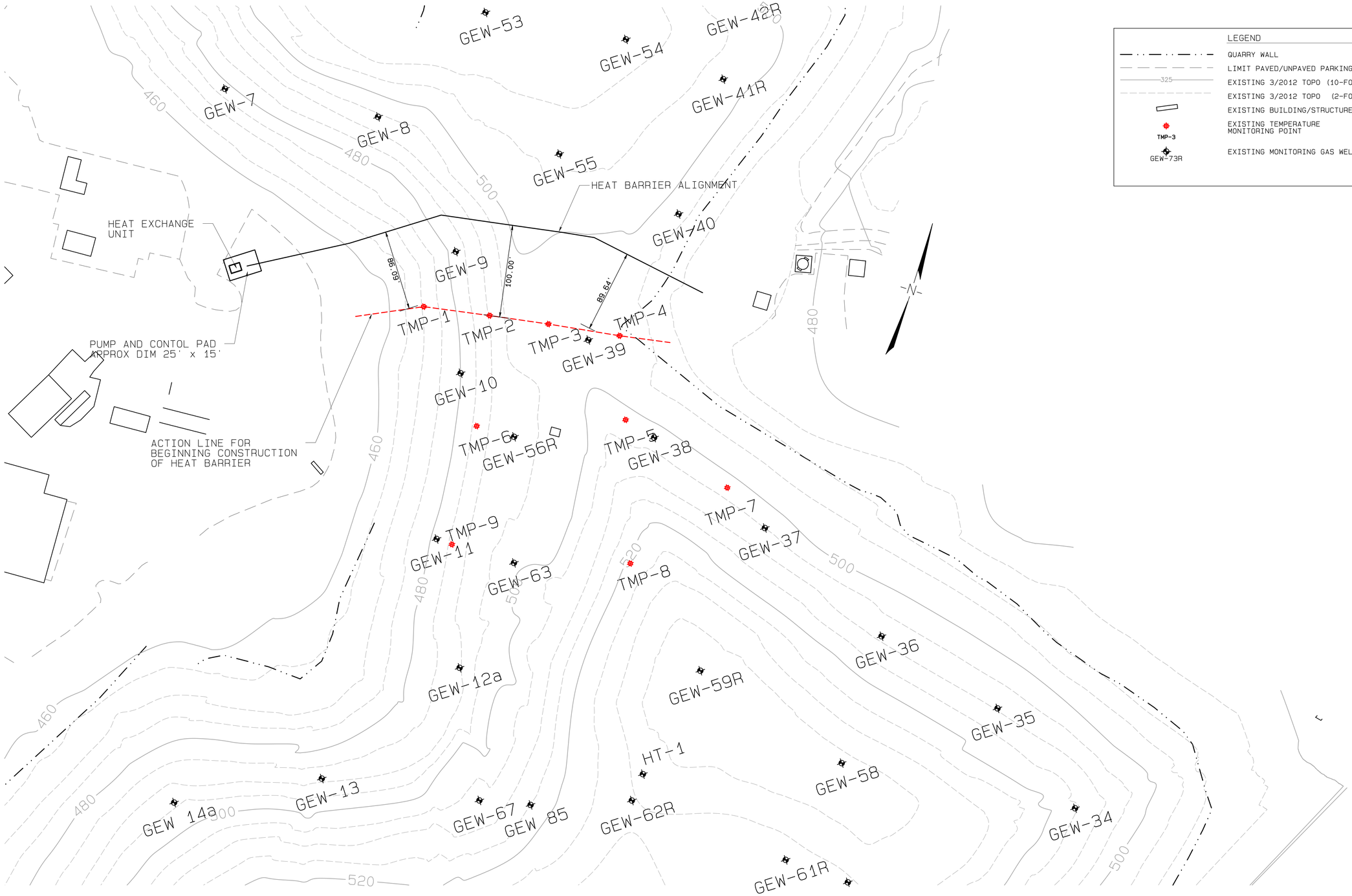
FOR

BRIDGETON LANDFILL

DATE OF ISSUE:12/29/2012

BRIDGETON LANDFILL, LLC
12976 ST. CHARLES ROCK RD.
BRIDGETON, MO 60344

P. J. CAREY & ASSOCIATES, P.C.
5878 Valine Way
Sugar Hill, GA 30518
Tel: 678 482-5193
www.pjcarey.com



BRIDGETON LANDFILL, LLC
12976 ST. CHARLES ROCK RD.
BRIDGETON, MO

DATE
REVISION
1 2 3 4 5

P. J. CAREY & ASSOCIATES, P.C.
5078 VALINE WAY, SUGAR HILL, GA. 30518

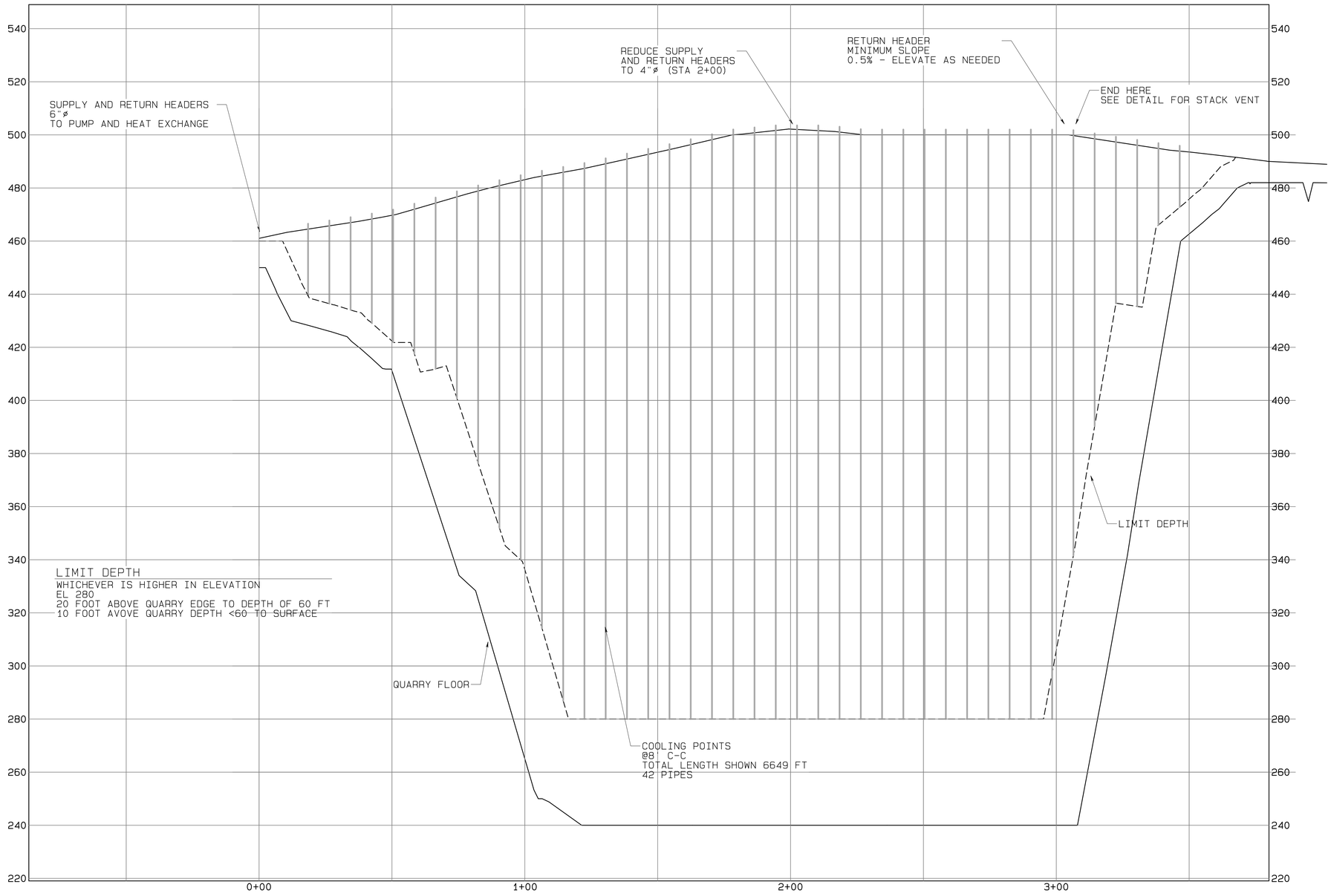
PROJ. NO.: 179.001
DATE: 12/28/2012
DESIGNED BY: PJC
DRAWN BY: PJC/KLOH
CHECKED BY: PJC
APPROVED BY: PJC

SITE PLAN

HEAT DISSIPATON / BARRIER PLAN
BRIDGETON LANDFILL

DRAWING
1

SHEET 1
OF 5



PROFILE ALONG HEAT BARRIER ALIGNMENT

BRIDGETON LANDFILL, LLC
12976 ST. CHARLES ROCK RD.
BRIDGETON, MO

DATE
REVISION
1
2
3
4
5

P. J. CAREY & ASSOCIATES, P.C.
5978 VALINE WAY, SUGAR HILL, GA. 30518

PROJ. NO.: 179.001
DATE: 12/29/2012
DESIGNED BY: PJC
DRAWN BY: PJC/KLCH
CHECKED BY: PJC
APPROVED BY: PJC

PROFILE ALONG BARRIER
WITH COOLING POINTS

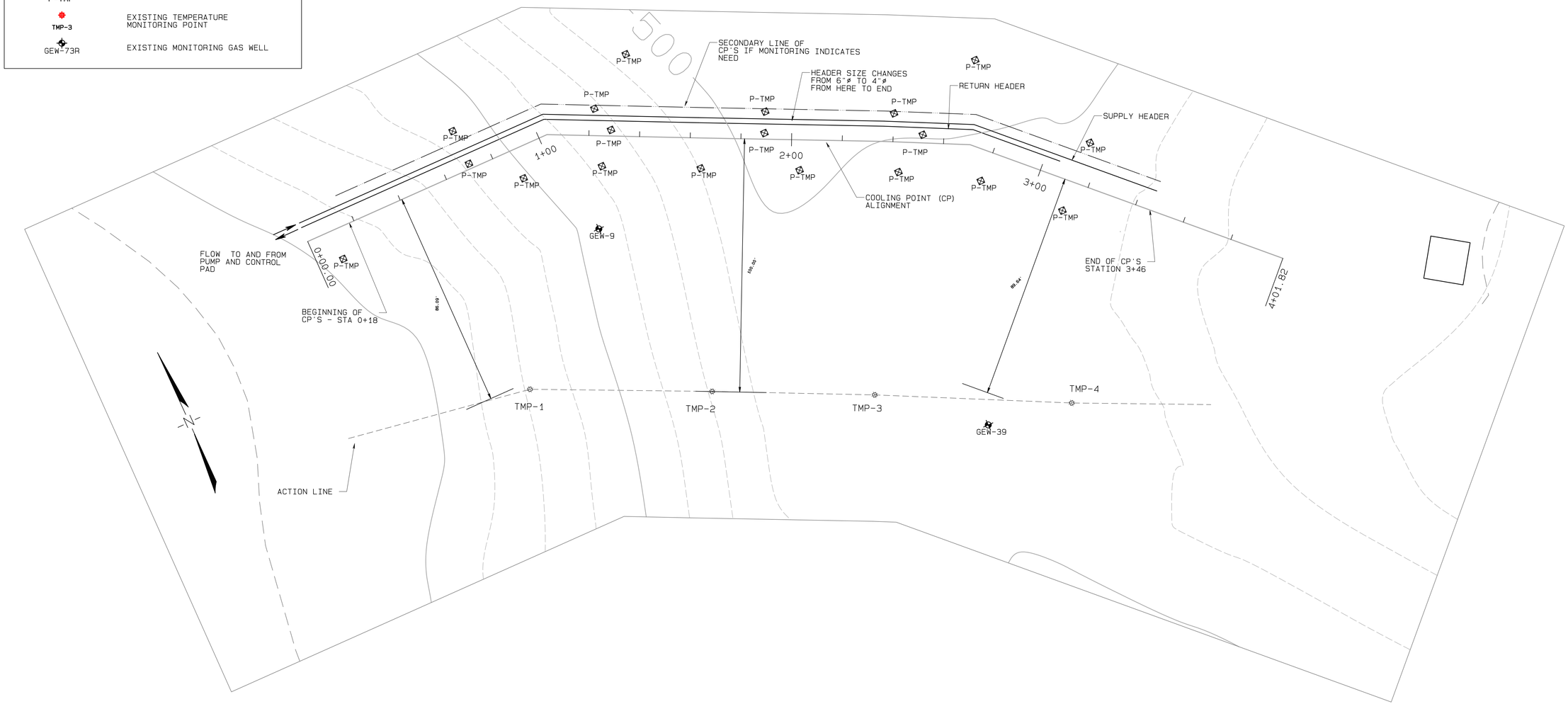
HEAT DISSIPATON / BARRIER PLAN
BRIDGETON LANDFILL

DRAWING
2

SHEET 2
OF 5

LEGEND

- LIMIT PAVED/UNPAVED PARKING
- 325 — EXISTING 3/2012 TOPO (10-FOOT)
- EXISTING 3/2012 TOPO (2-FOOT)
- P-TMP — PROPOSED TEMPERATURE MONITORING POINT
- TMP-3 — EXISTING TEMPERATURE MONITORING POINT
- GEW-73R — EXISTING MONITORING GAS WELL



PLAN VIEW IN HEAT DISSIPATION / BARRIER AREA

GRAPHIC SCALE 1"=20'

0 20 40 60

BRIDGETON LANDFILL, LLC
12976 ST. CHARLES ROCK RD.
BRIDGETON, MO

DATE

REVISION

1 2 3 4 5

P. J. CAREY & ASSOCIATES, P.C.
5078 VALLINE WAY, SUGAR HILL, GA. 30518

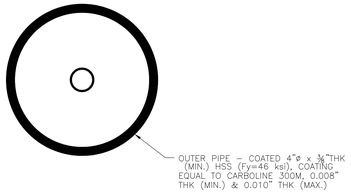
PROJ. NO.: 179.001
DATE: 12/29/2012
DESIGNED BY: PJC
DRAWN BY: PJC/KLOH
CHECKED BY: PJC
APPROVED BY: PJC

BARRIER AREA PLAN VIEW

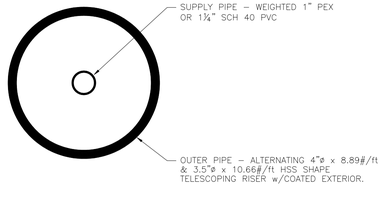
HEAT DISSIPATON / BARRIER PLAN
BRIDGETON LANDFILL

DRAWING 3

SHEET 3 OF 5



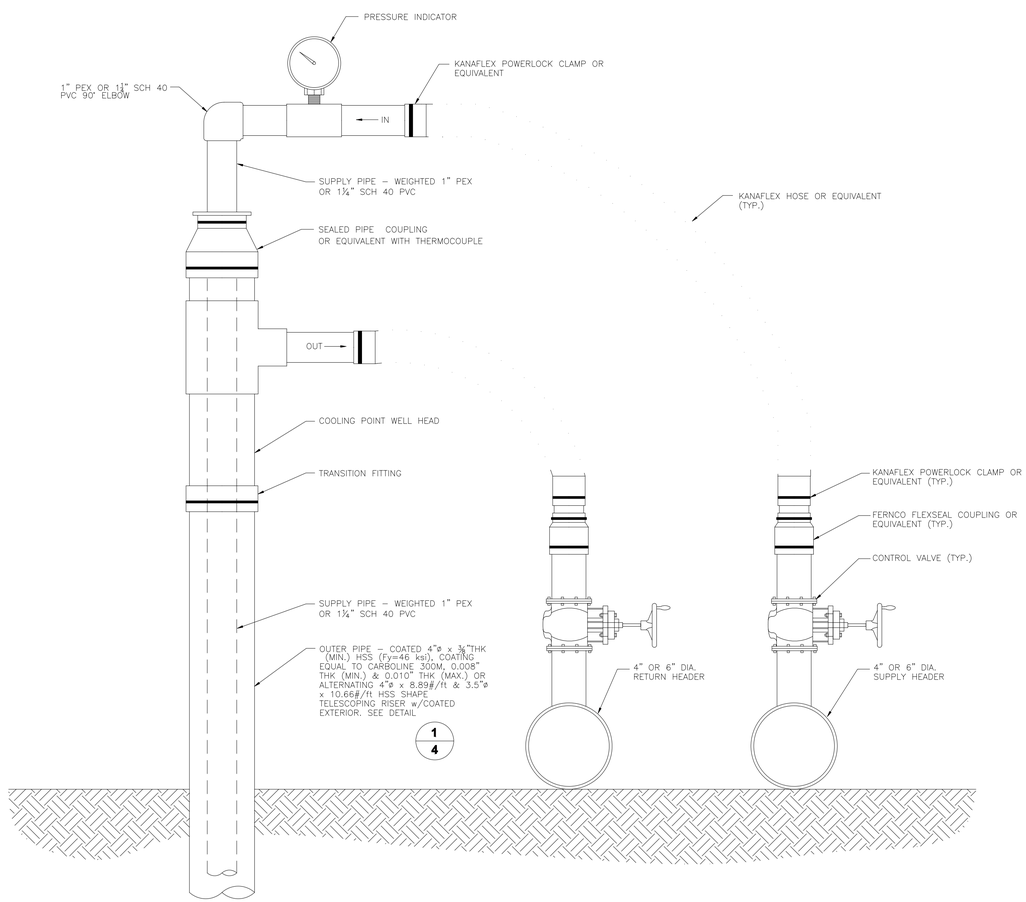
OPTION 1 - SOLID COATED OR UNCOATED PIPE



OPTION 2 - TELESCOPING RISER

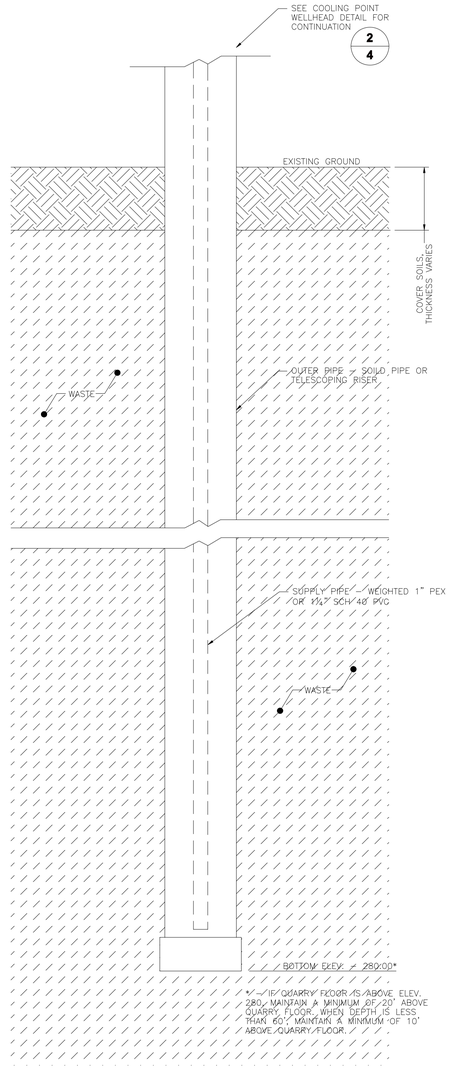
HEAT EXCHANGE TUBES (COOLING POINTS (CP))

DETAIL 1/4
SCALE: NOT TO SCALE



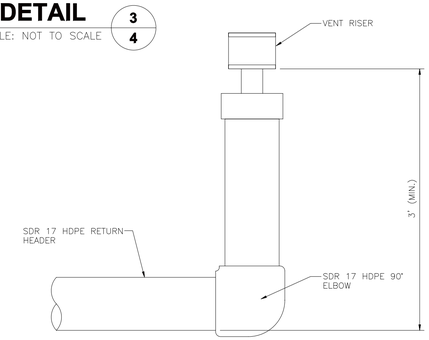
COOLING POINT WELLHEAD

DETAIL 2/4
SCALE: NOT TO SCALE



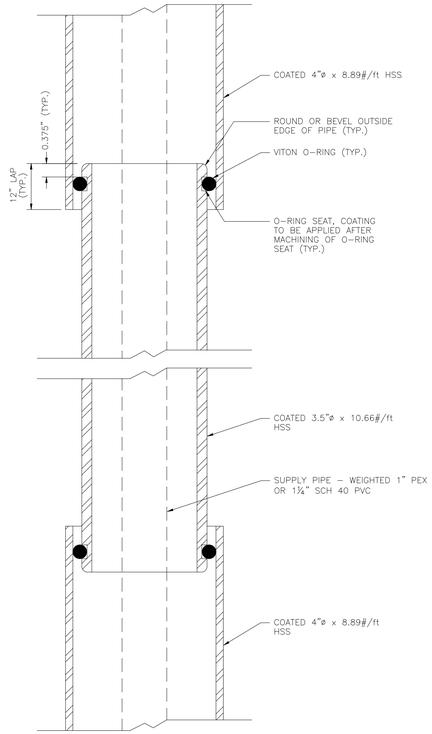
TYPICAL COOLING POINT DOWNHOLE (SOLID PIPE OR TELESCOPING RISER)

DETAIL 3/4
SCALE: NOT TO SCALE



TYPICAL RETURN HEADER VENT

DETAIL 5/4
SCALE: NOT TO SCALE



TYPICAL TELESCOPING RISER

DETAIL 4/4
SCALE: NOT TO SCALE

PIPE SEGMENT NOTES

1. THE LOWEST PIPE SEGMENT IS THE SMALLER DIAMETER
2. BELOW A DEPTH OF 180' THE MAXIMUM EXPOSED LENGHT IS 25' PER SEGMENT. FROM 140' TO 180' THE MAXIMUM EXPOSED LENGTH IS 30'. FOR DEPTHS < 140' MAXIMUM EXPOSED LENGTH IS 40'
3. MINIMUM STICK UP AT GROUND SURFACE IS 2'.

BRIDGETON LANDFILL, LLC.
12976 ST. CHARLES ROCK RD.
BRIDGETON, MO

DATE
REVISION
1 2 3 4 5

P. J. CAREY & ASSOCIATES, P.C.
5978 VALINE WAY, SUGAR HILL, GA 30518

PROJ. NO: 179.001
DATE: 12/18/2012
DESIGNED BY: PJC
DRAWN BY: BWS & DET
CHECKED BY: PJC
APPROVED BY: PJC

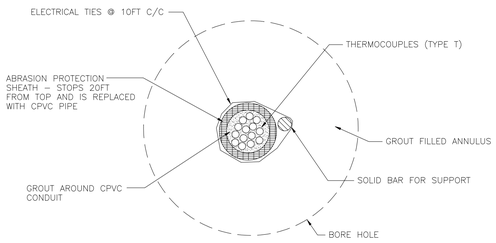
DETAILS

HEAT DISSIPATION/BARRIER PLAN
BRIDGETON LANDFILL

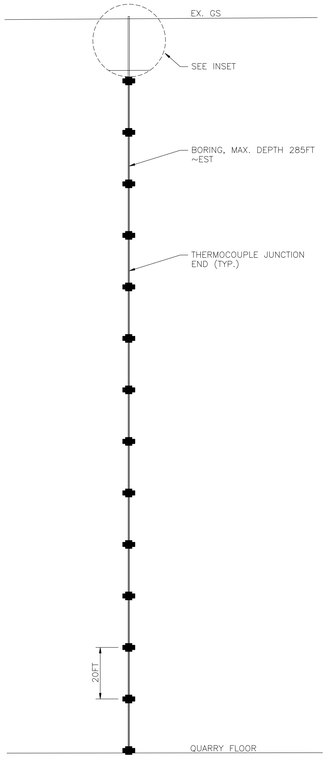
DRAWING 4

SHEET 4 OF 5

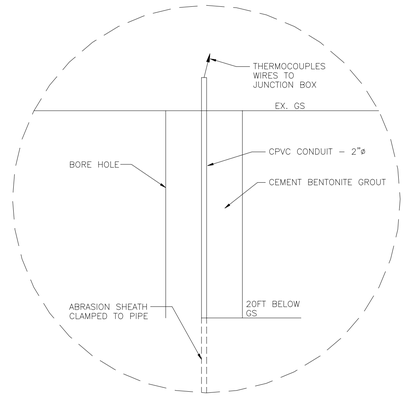
Project Desc: Path: N:\Bridgeton\drawings\PJCA\bridgeton Heatrrier.pro Plot Date/Time: Mon Dec 17,2012 / 131701



PLAN VIEW



SECTION



INSET

TEMPERATURE MONITORING POINT (TMP)

DETAIL 1/5

SCALE: NOT TO SCALE

BRIDGETON LANDFILL, LLC.
12976 ST. CHARLES ROCK RD.
BRIDGETON, MO

REVISION	DATE
1	
2	
3	
4	
5	

P. J. CAREY & ASSOCIATES, P.C.
5978 VALINE WAY, SUGAR HILL, GA 30518

PROJ. NO.	179.001
DATE:	12/18/2012
DESIGNED BY:	PJC
DRAWN BY:	BAS & BET
CHECKED BY:	PJC
APPROVED BY:	PJC

DETAILS

HEAT DISSIPATION/BARRIER PLAN
BRIDGETON LANDFILL

DRAWING 6

SHEET OF 6

Project Desc: Path: N:\Bridgeton\drawings\PJC\Bridgeton Hbarrier.pro Plot Date/Time: Mon Dec 17 2012 - 13:17:01

January 10, 2013
File No. 23211003.00

MEMORANDUM

TO: Chris Nagel, Missouri Department of Natural Resources

FROM: Craig Almanza, Bridgeton Landfill, LLC

Dan Brennan, SCS Engineers

SUBJECT: Bridgeton Landfill - Gas Interceptor Well Design

1 INTRODUCTION

In an effort to minimize or stop movement of subsurface heat from the south quarry to the north quarry, additional special purpose, interceptor gas wells are being proposed. These wells are planned to be located approximately 50 feet north of the first line of temperature monitoring probes (TMPs 7R, 8, and 9) installed at the facility. A description of the design approach and contingencies are described below.

2 DESIGN APPROACH

The location of the interceptor wells are 50 feet north of a theoretical line that would run from TMP-7R through TMP-8 and then to TMP-9.

The Gas Interceptor Wells (GIWs) have been planned so the first well is located approximately 75 feet from the west edge of the quarry (south quarry). The remaining wells begin 50 feet from the first well and are spaced 50 feet from one another along the line described above (50 feet north of the theoretical TMP line). The GIWs are labeled on the Site Map – GIW-1 through GIW-7. The wells are grouped into two separate collection lines – four wells in one group and three wells in the other group. Each well group has a common header manifold that is then connected to the existing 16-inch header which runs east and west at the narrow part of the landfill at the North and South Quarry boundaries. Each well group has a main header valve, the potential for a bypass to a cooling device if needed, and each well has a control valve. Additionally, each well has a 6” Tee which has been designed to accommodate the use of a phase separation tank, if required.

The well spacing design will provide heavy vacuum overlap from well to well. This will create a low pressure area “wall” (vacuum curtain) that will allow heated and pressurized gas a controlled means of escape where it can be safely destructed in the current GCCS.

3 WELL DESIGN

The wells are designed to be drilled a maximum depth of 150 feet below ground surface. However, due to the bottom surface grades, GIW-1 can only achieve a depth of approximately 57 feet below ground surface. A well schedule has been provided on the detail sheet drawing.

The wells will be constructed of carbon steel and be 6-inch in diameter. The wells will have 25 feet of solid pipe and the rest will be perforated pipe, as shown on the well detail (Detail 3 on Sheet 3). Each well will have a flanged cast iron knife valve (McMaster-Carr Model #6312T35 or equivalent) for control of heated gas and potential liquids that may be collected. This knife provides maximum flexibility in adjusting to actual conditions that may be encountered. The top of each well will be a steel flange that can either accept a custom steel wellhead or a Landtec wellhead. Each well head will be approximately 4-5 feet above ground when completely constructed.

4 WELL DESIGN CONTINGENCIES

Due to the nature of the heat generating reaction at the Bridgeton Landfill, it is possible that the collected gas may be heated above normal operating temperatures or may be heated gas along with liquids. Both of these situations have been identified and worked into the design of the system.

If the collected gas is a heated gas with the extra liquids, each GIW had been design with a tee and blind flange that can be utilized to direct the collected gas to a phase separation device and then be re-inserted into the header piping. If the collected gas is only a heated gas (without the extra liquids) then a bypass line has been designed into each well group header that can direct the gas into a cooling device before continuing to the blower/flare station.

5 HEADER SYSTEM

The header system of the proposed GIW collection system will be tied into the existing 16-inch diameter header located approximately at the North/South Quarry boundary. The existing header is located approximately 4 feet below ground surface and slopes both to the east and the west from the high point approximately at the midpoint of the header. The headers from the new well groups will be sloped downhill to the existing header, running above ground until it gets close to the tie-in with the existing header, where it will go below ground to make the connection to the existing header.

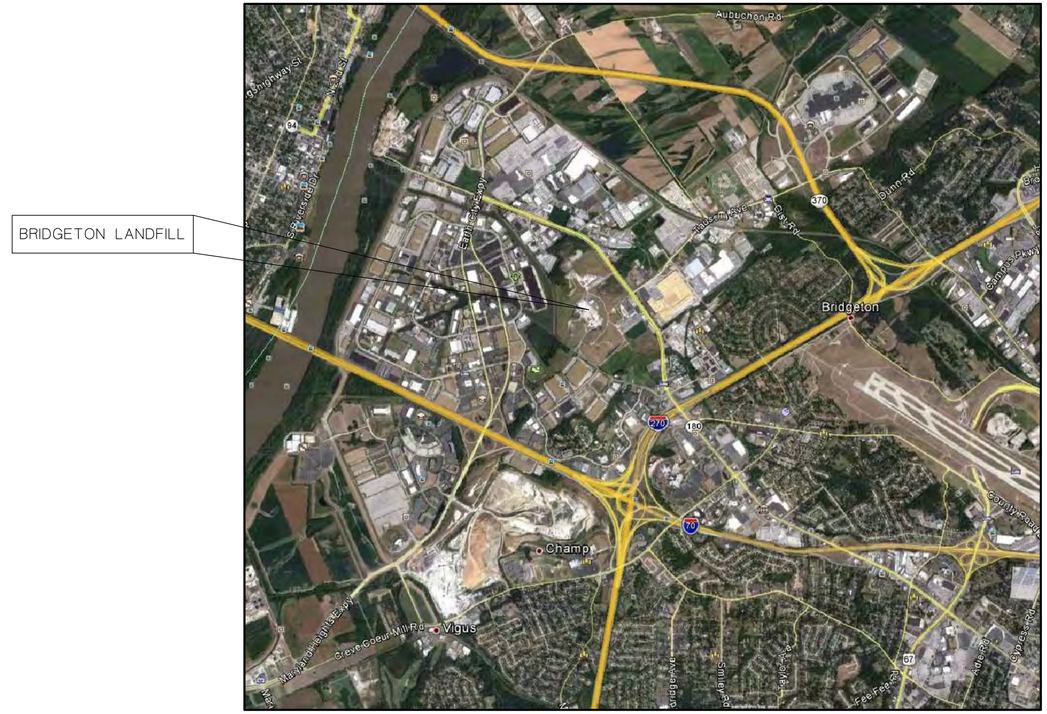
The main header and from each well group as well as the common collector pipe for each well group is a 10-inch diameter pipe. The lateral to each GIW is a 4-inch diameter pipe. Steel piping

for the header and the common collection manifolds will be used on the well side of the contingency cooling device flange. HDPE pipe will be used from this flange north to the 16" header tie-in. The 4" lateral lines will also be constructed of steel (See detail drawing).

2013 GAS INTERCEPTOR WELL DESIGN
BRIDGETON LANDFILL
BRIDGETON, ST. LOUIS COUNTY, MISSOURI

DRAWING INDEX

DRAWING NO.		DRAWING TITLE
1	–	COVER SHEET
2	–	WELL LAYOUT SHEET
3	–	CARBON STEEL INTERCEPTOR WELL DETAILS



LOCATION MAP

0.5 mi. 0 0.5 mi. 1 mi.
SCALE FEET

PREPARED FOR:

BRIDGETON LANDFILL, LLC
13570 ST. CHARLES ROCK ROAD
BRIDGETON, MO 63044

PREPARED BY:

SCS ENGINEERS
2060 READING ROAD
SUITE #200
CINCINNATI, OHIO 45202–1497
PHONE (513) 421–5353
FAX (513) 421–2847

JANUARY 10, 2013

REV.	DATE	DESCRIPTION	CK. BY

SHEET TITLE: COVER SHEET
PROJECT TITLE: BRIDGETON LANDFILL 2013 GAS INTERCEPTOR WELL DESIGN

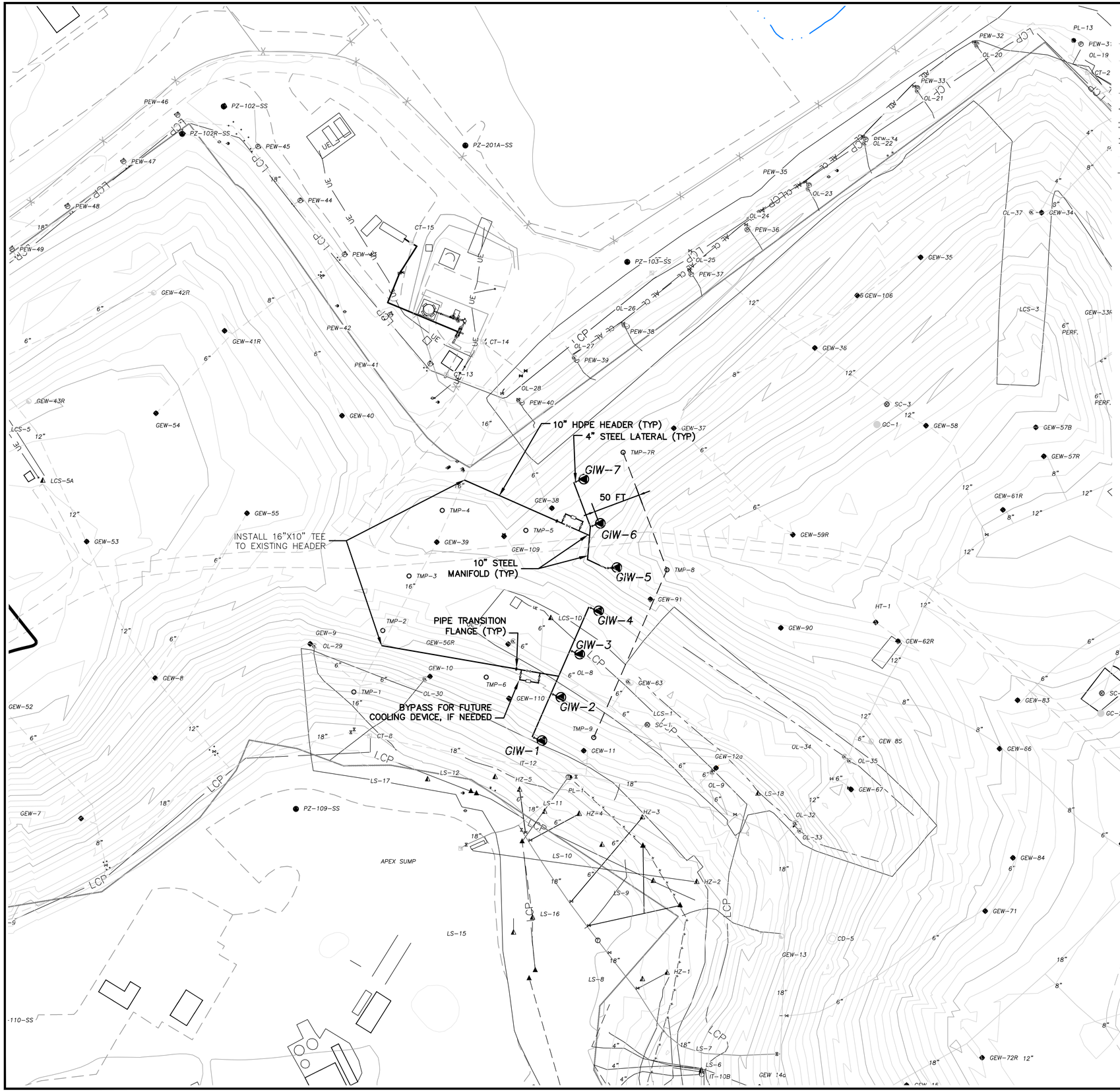
CLIENT:
BRIDGETON LANDFILL, LLC
BRIDGETON LANDFILL
13570 ST. CHARLES ROCK ROAD
BRIDGETON, MO 63044

SCS ENGINEERS
STEARNS, CONRAD AND SCHMIDT
CONSULTING ENGINEERS, INC.
2060 READING ROAD, SUITE #200, CINCINNATI, OHIO 45202
PH. (513) 421–5353 FAX NO. (513) 421–2847

PROJ. NO: 23211003.00
DSN. BY: FDB
DWN. BY: FDB
CHK. BY: JJW
O/A R/W DR: DAE

CADD FILE: COVER SHEET
DATE: 1/10/2013
SCALE: NONE
DRAWING NO. 1 of 3

C:\WORK\23211003 BRIDGETON LF ENG ASSISTANCE\DELIVERABLES–REPORTS\INTERCEPTOR WELLS\COVER SHEET.DWG



LEGEND

- EXISTING 10' CONTOURS
- EXISTING 2' CONTOURS
- BUILDING
- FENCE
- WATER
- PAVED ROAD
- UNPAVED ROAD
- PERMITTED WASTE LIMITS
- LFG COLLECTION PIPE
- GEW-34 — LFG COLLECTION WELL
- GEW-2 — LFG DUAL-EXTRACTION WELL
- VALVE
- SC-1 — SURFACE COLLECTOR
- OL-1 — OVER LINER TIE-IN POINT
- WB-1 — WELL BORE BOOT
- CLEANOUT
- STORM WATER OUTFALL
- PL
- ELECTRIC LINE
- CT-4 — CONDENSATE SUMP
- 2012 HEADER PIPE
- GEW-100 — 2012 PROPOSED WELLS
- LEACHATE COLLECTION PIPE
- LEACHATE DISCHARGE
- LCS-1D — LEACHATE COLLECTION SUMP
- GMP-12 — LFG MONITORING PROBE
- PGW-39 — PERIMETER LFG COLLECTION WELL
- PERIMETER CONNECTION PIPE
- 100-SD — LFG INTERCEPTION TRENCH WELL
- GROUNDWATER WELL
- LFG INTERCEPTION TRENCH
- PROPERTY LINE
- POWERPOLE

NOTES:

1. EXISTING GRADE CONTOURS SHOWN ARE FROM AERIAL SURVEY COMPLETED BY THE SANBORN MAPPING COMPANY ON FEBRUARY 19, 2009. CONTOURS WITHIN THE WASTE BOUNDARY ON THE SOUTH END ARE TAKEN FROM A GROUND SURVEY COMPLETED BY SHERBUT-CARSON-CLAXTON, LLC IN MAY 2011.
2. LOCATION OF LANDFILL GAS COLLECTION AND CONTROL SYSTEM COMPONENTS IS BASED ON AS-BUILT INFORMATION, WHERE AVAILABLE, AND APPROXIMATED OTHERWISE.
3. CONSTRUCTED COMPONENT TYPES, DIMENSIONS, AND LOCATIONS ARE BASED ON AS-BUILT INFORMATION, WHERE AVAILABLE, OTHERWISE THEY ARE APPROXIMATE.
4. BASE MAP PROVIDED BY AQUATERRA ENVIRONMENTAL SOLUTIONS, INC.

100' 0 100' 200'
SCALE FEET

REV.	DATE	DESCRIPTION	CK. BY

SHEET TITLE: WELL LAYOUT PLAN

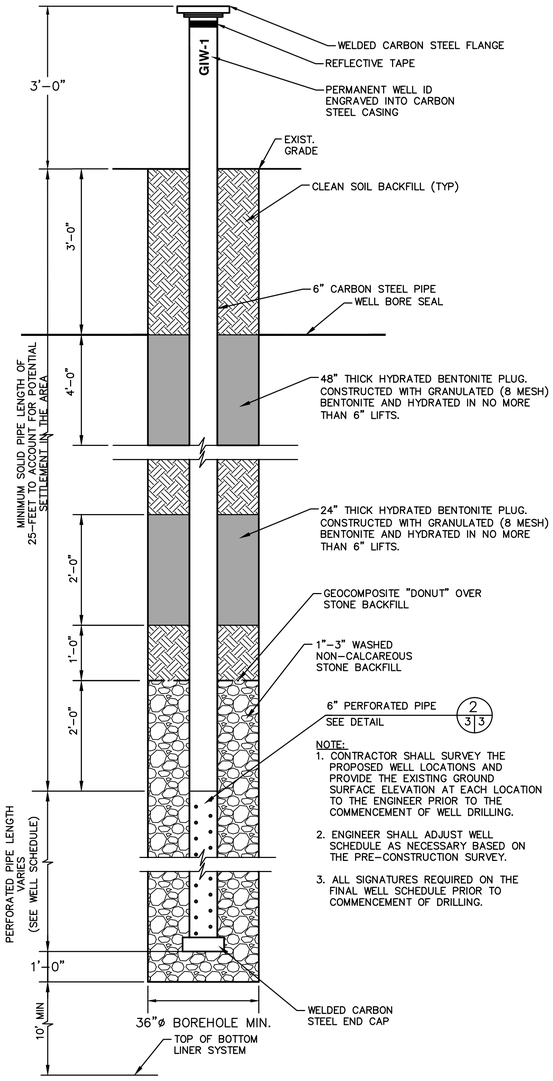
PROJECT TITLE: BRIDGETON LANDFILL 2013 GAS INTERCEPTOR WELL DESIGN

CLIENT:
BRIDGETON LANDFILL, LLC
BRIDGETON LANDFILL
13570 ST. CHARLES ROCK ROAD
BRIDGETON, MO 63044

SCS ENGINEERS
STEARNS, CONRAD AND SCHMIDT
CONSULTING ENGINEERS, INC.
2060 READING ROAD, SUITE #200, CINCINNATI, OHIO 45202
PH. (513) 421-5353 FAX NO. (513) 421-2647

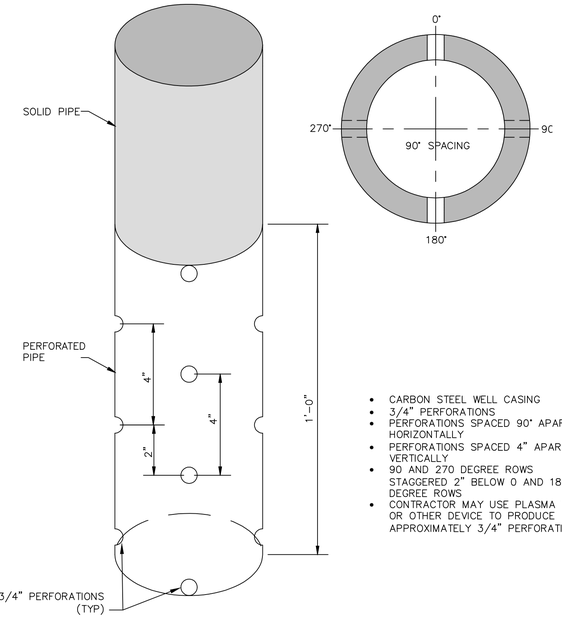
PROJ. NO. 23211003.00
DSN. BY: FDB
DWN. BY: FDB
CHK. BY: JJW
D/A RVW BY: DAE

CADD FILE: SITE MAP
DATE: 1/10/2013
SCALE: AS SHOWN
DRAWING NO. 2 of 3



NOTE:
1. CARBON STEEL WELL SECTIONS CAN BE CONNECTED USING OUTSIDE THREADED COUPLERS, OR WELDED STEEL FLANGES.

GAS INTERCEPTOR WELL DETAIL 1/2|3
NOT TO SCALE



- CARBON STEEL WELL CASING
- 3/4" PERFORATIONS
- PERFORATIONS SPACED 90° APART HORIZONTALLY
- PERFORATIONS SPACED 4" APART VERTICALLY
- 90 AND 270 DEGREE ROWS STAGGERED 2" BELOW 0 AND 180 DEGREE ROWS
- CONTRACTOR MAY USE PLASMA TORCH OR OTHER DEVICE TO PRODUCE APPROXIMATELY 3/4" PERFORATIONS

PERFORATION DETAIL 2/3|3
NOT TO SCALE

WELL SCHEDULE

LANDFILL GAS COLLECTION SYSTEM
WELL FIELD SCHEDULE

Well No.	Location Coordinates N-S	Location Coordinates E-W	Surface Elevation (ft MSL)	Waste Bottom Elevation (ft MSL)	Landfill Depth (ft)	Borehole Depth (ft)	Well Pipe Depth (ft)	Slotted Pipe Depth (ft)	Solid Pipe Depth (ft)	Above Grade Riser (ft)	Thickness of Gravel Pack (ft)
GIW-1	1,067,752	516,216	477.4	420.4	57	57	56	31	25	5	34
GIW-2	1,067,732	516,261	490.6	280.0	211	150	149	124	25	5	127
GIW-3	1,067,712	516,307	495.9	275.9	220	150	149	124	25	5	127
GIW-4	1,067,692	516,353	501.1	270.2	231	150	149	124	25	5	127
GIW-5	1,067,672	516,399	511.8	270.0	242	150	149	124	25	5	127
GIW-6	1,067,690	516,446	510.0	270.0	240	150	149	124	25	5	127
GIW-7	1,067,707	516,493	501.9	329.1	173	150	149	124	25	5	127
Total						957	950	775	175	35	796

NOTES:

1. THIS DRAFT WELL SCHEDULE IS NOT INTENDED FOR CONSTRUCTION UNTIL ACTUAL SURVEY DATA IS OBTAINED AND THE WELL SCHEDULE IS REVISED BY THE ENGINEER.
2. SURVEYOR SHALL LOCATE WELLS AND VERIFY SURFACE ELEVATIONS BEFORE CONSTRUCTION. A PRE-CONSTRUCTION SURVEY (NORTHING/EASTING/ELEVATION DATA) SHALL BE PROVIDED TO THE ENGINEER A MINIMUM OF 2 WEEKS PRIOR TO CONSTRUCTION. ENGINEER SHALL VERIFY THE WELL SCHEDULE BASED ON THE PRE-CONSTRUCTION SURVEY.
3. FOLLOWING REVIEW OF SURVEY DATA, CONTRACTOR SHALL GET AUTHORIZATION FROM OWNER AND ENGINEER PRIOR TO DRILLING.
4. WELL DEPTHS BASED ON TOPOGRAPHIC SURVEYED BY SHERBERT-CARSON-CLAXTON, DATED MAY 2011, AND BASE GRADES OBTAINED FROM MIDWEST ENVIRONMENTAL CONSULTANTS APRIL 1998 LANDFILL GAS RECOVERY SYSTEM DESIGN.

DESIGN FIRM QA/QC REVIEWER ACKNOWLEDGEMENT: _____ DATE _____

DESIGN FIRM PROJECT MANAGER ACKNOWLEDGEMENT: _____ DATE _____

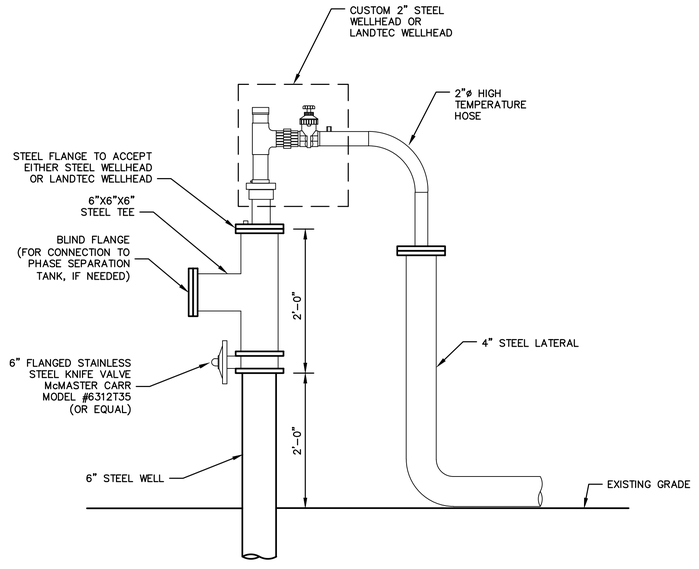
ENVIRONMENTAL MANAGER: _____ DATE _____

CQA INSPECTOR: _____ DATE _____

SURVEYOR ACKNOWLEDGEMENT: _____ DATE _____

DRILLER ACKNOWLEDGEMENT: _____ DATE _____

UNDER NO CIRCUMSTANCES SHALL DRILLING ACTIVITIES BEGIN WITHOUT PROVIDING THE ABOVE SIGNATURES. ANY CHANGES TO WELL LOCATIONS OR DEPTHS SHALL REQUIRE THESE SIGNATURES TO BE OBTAINED AGAIN.



WELLHEAD DETAIL 3/3|3
NOT TO SCALE

REV.	DATE	DESCRIPTION	CK. BY
1	7/27/12	RESPONSE TO MDNR COMMENTS	

SHEET TITLE: CARBON STEEL INTERCEPTOR WELL DETAILS

PROJECT TITLE: BRIDGETON LANDFILL 2013 GAS INTERCEPTOR WELL DESIGN

CLIENT:
BRIDGETON LANDFILL, LLC.
BRIDGETON LANDFILL
13570 ST. CHARLES ROCK ROAD
BRIDGETON, MO 63044

SCS ENGINEERS
STEARNS, CONRAD AND SCHMIDT
CONSULTING ENGINEERS, INC.
2060 READING ROAD, SUITE #200, CINCINNATI, OHIO 45202
PH. (513) 421-5353 FAX NO. (513) 421-2847

PROJ. NO. 23211003.00
DSN. BY: FDB
DWN. BY: FDB
CHK. BY: JJW
QA/A RVW BY: DAE

CADD FILE: SHEET 3

DATE: 1/10/2013

SCALE: NONE

DRAWING NO. 3 of 3

C:\WORK\23211003 BRIDGETON LF ENG ASSISTANCE\DELIVERABLES-REPORTS\INTERCEPTOR WELLS\SHEET 34 - DETAILS 01-09-13.DWG

Environmental Consultants
and Contractors

2060 Reading Road
Suite 200
Cincinnati, OH 45202-1497

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www.scsengineers.com

SCS ENGINEERS

February 6, 2013
File No. 23211003.00

Ms. Charlene S. Fitch, P.E.
Chief, Engineering Section
Solid Waste Management Program
Missouri Department of Natural Resources
1730 East Elm Street
Jefferson City, MO 65101

Subject: Gas Interceptor Well Expanded Design (Permit #0118912) at Bridgeton Landfill
Bridgeton Landfill, Bridgeton, Missouri

Dear Ms. Fitch:

Attached please find our Gas Interceptor Well System Expanded Design. This Design Plan is a revision of the permit approved on January 11, 2013, and represents additional Temperature Monitoring Probes (TMPs) as well as additional Gas Interceptor Wells (GIWs).

1 INTRODUCTION

This Design Plan describes the Gas Interceptor Well System originally submitted to Missouri Department of Natural Resources (MDNR) on January 10, 2013 and approved on January 11, 2013, as well as the additions made for this expanded design.

In an effort to minimize or stop movement of subsurface heat from the south quarry to the north quarry, additional special purpose, interceptor gas wells are being proposed. There are two rows of wells being proposed. The first row of wells is planned approximately 50 feet north of the first line of temperature monitoring probes (TMPs 7R, 8, and 9) installed at the facility. The second row of wells is proposed to be installed 50 feet north of the first row of wells, and staggered in between the first row of wells. In addition to the gas interceptor well installations, six additional temperature monitoring probes (TMPs) are being proposed (See Drawing 2 – Well Layout Plan). A description of the design approach and contingencies is described below.

2 DESIGN APPROACH

The location of the first row of interceptor wells is 50 feet north of a theoretical line that would run from TMP-7R through TMP-8 and then to TMP-9. The location of the second row of interceptor wells is 50 feet north of a theoretical line that would run from GIW-1 through GIW-7 (inclusive).

The first row Gas Interceptor Wells (GIWs) has been planned so the first well is located approximately 75 feet from the west edge of the quarry (south quarry). The remaining wells in this row begin 50 feet from the first well and are spaced 50 feet from one another along the line described above (50 feet north of the theoretical TMP line). The GIWs are labeled on the Site Map – GIW-1 through GIW-7. The wells are grouped into two separate collection lines – four wells in one group and three wells in the other group. Each well group has a common header manifold that connects all the wells of that group and then connects to the existing header system. The western group of wells (group of four wells) connects into the existing 18-inch header along the western perimeter of the landfill, in the amphitheater area. The eastern group of wells connects to the existing 16-inch header, which runs east and west at the narrow part of the landfill at the North and South Quarry boundaries. Each well group has a main header valve and the potential for a bypass to a cooling device if needed, and each well has a control valve. Additionally, each well has a 6-inch Tee which has been designed to accommodate the use of a phase separation tank, if required.

The second row of wells has their own manifolds and is also broken into two groups – one manifold connects four wells and the other manifold connects two wells. Each of these manifolds connects to the other manifolds before the by-pass loops, which then connects to the existing headers (west manifold connects to first row west header and east manifold connects to east header)

The well spacing design will provide heavy vacuum overlap from well to well. This will create a low pressure area “wall” (vacuum curtain) that will allow heated and pressurized gas a controlled means of escape where it can be safely destructed in the current GCCS.

3 WELL DESIGN

The wells are designed to be drilled a maximum depth of 150 feet below ground surface. However, due to the bottom surface grades, GIW-1 can only achieve a depth of approximately 57 feet below ground surface. A well schedule has been provided on the detail sheet drawing.

The wells will be constructed of carbon steel and be 6-inch in diameter. The wells will have 25 feet of solid pipe and the rest will be perforated pipe, as shown on the well detail (Detail 3 on Sheet 3). Each well will have a flanged cast iron knife valve (McMaster-Carr Model #6312T35 or equivalent) for control of heated gas and potential liquids that may be collected. This knife provides maximum flexibility in adjusting to actual conditions that may be encountered. The top of each well will be a steel flange that can either accept a custom steel wellhead or a Landtec wellhead. Each well head will be approximately 4-5 feet above ground when completely constructed.

The new gas interceptor wells will be constructed using the same configuration and well components that were previously approved by MDNR on January 11, 2013.

4 WELL DESIGN CONTINGENCIES

Due to the nature of the heat generating reaction at the Bridgeton Landfill, it is possible that the collected gas may be heated above normal operating temperatures or may be heated gas along with liquids. Both of these situations have been identified and worked into the design of the system.

If the collected gas is a heated gas with the extra liquids, each GIW had been design with a tee and blind flange that can be utilized to direct the collected gas to a phase separation device and then be re-inserted into the header piping. If the collected gas is only a heated gas (without the extra liquids) then a bypass line has been designed into each well group header that can direct the gas into a cooling device before continuing to the blower/flare station.

5 HEADER SYSTEM

The header system of the proposed GIW collection system will be tied into the existing 16-inch diameter header located approximately at the North/South Quarry boundary and the 18-inch header along the western perimeter in the amphitheater area. The existing header is located approximately 4 feet below ground surface and slopes both to the east and the west from the high point approximately at the midpoint of the header. The header from each new well group will be sloped downhill to the existing header, running above ground until it gets close to the tie-in with the existing header, where it will go below ground to make the connection to the existing header.

The main header from each well group, as well as the common collector pipe for each well group, is a 10-inch diameter pipe. The lateral to each GIW is a 4-inch diameter pipe. Steel piping for the header and the common collection manifolds will be used on the well side of the contingency cooling device flange. HDPE pipe will be used from this flange north to the 16-inch header tie-in. The 4-inchlateral lines will also be constructed of steel (See detail drawing).

6 TEMPERATURE MONITORING PROBES

In addition to the six new gas interceptor wells, six new temperature monitoring probes (TMPs) are being proposed. The TMPs will be constructed in the same configuration and using the same method as previously approved plan, approved by MDNR on September 27, 2012. The proposed location of the new TMPs is south of a line that goes from existing TMP-1 through TMP-4. A new TMP (TMP-15) will be installed 50-feet south of TMP-8.

The existing TMPs are located on the site map (Sheet 2 of 3) and highlighted in yellow. The proposed six additional TMPs are shown on the plan sheet highlighted in a light purple.

Sincerely,

F. Daniel Brennan

Deborah A. English

F. Daniel Brennan, P.E.
Ohio PE#57,293
Senior Project Engineer
SCS ENGINEERS

Deborah A. English, P.E.
Missouri PE#2005-006304
Project Director
SCS ENGINEERS

cc Craig Almanza, Bridgeton Landfill, LLC



MDNR APPROVAL LETTER

ORIGINAL GAS INTERCEPTOR WELL DESIGN

JANUARY 11, 2013

STATE OF MISSOURI
Jeremiah W. (Jay) Nixon, Governor • Sara Parker Pauley, Director
DEPARTMENT OF NATURAL RESOURCES
www.dnr.mo.gov

JAN 11 2013

Mr. Craig Almanza
Area Environmental Manager
Republic Services, Inc.
13570 St. Charles Rock Road
Bridgeton, MO 63044

RE: Gas Interceptor Well Design, Bridgeton Landfill LLC, Permit Number 0118912, St. Louis County

Dear Mr. Almanza:

This letter is in response to your email submittal dated January 10, 2013, to the Missouri Department of Natural Resources' (Department) Solid Waste Management Program (SWMP). The submittal included a narrative and a set of plan sheets entitled "2013 Gas Interceptor Well Design Bridgeton Landfill." The submittal proposed the installation of seven Gas Interceptor Wells (GIW) in order to remove heated and pressurized gas near the neck of the landfill. The GIWs are located approximately 50' north of TMPs 7, 8, and 9 and will be connected to the existing gas collection and control system.

The SWMP has reviewed the submittal and hereby approves the proposed design as being in substantial compliance with the Missouri Solid Waste Management Law and regulations. The following conditions are integral to this approval. Compliance with these conditions shall, in part, determine compliance with Permit Number 0118912.

CONDITIONS:

1. The submittal and individual plan sheets need to be signed and sealed by a professional engineer. In addition, please verify the scale on Drawing 2. Please submit two (2) hard copies to the SWMP for our records.

2. A Construction Quality Assurance (CQA) Report should be submitted when the installation is completed. It shall include Daily Logs, Boring Logs, Construction Diagrams, and signed and sealed as-built drawings.

3. Drawing 2 indicates that the proposed location of GIW-3 is on the temporary liner. In the CQA Report, please detail the procedures used to maintain the integrity of the liner during the drilling and installation. In addition, please provide the necessary records that the flexible membrane liner is properly repaired around the well.

4. The Gas Interceptor Well Detail on Drawing 3 shows a 36 inch borehole, but the submittal did not indicate what type of drilling method will be used. Please specify this information in the CQA Report.

5. The Well Schedule on Drawing 3 indicates proposed well depths of 150' for GIWs 2 through 7. Prior approval from the SWMP is required to deviate from these depths.

6. The plan states "each well has a 6" Tee which has been designed to accommodate the use of a phase separation tank, if required." Please specify if this tank will be operational at the same time as well installation or provide the projected timeframe for the tank to be installed and operational if ejected liquid is encountered.

This approval should not be construed as compliance with any existing federal or state laws other than the Missouri Solid Waste Management Law; nor should this be construed as a waiver for any other regulatory requirements. This approval is not to be construed as compliance with any existing local permitting or zoning ordinances; nor does it supersede any local permitting and/or zoning requirements.

The Department reserves the right to revoke, suspend, or modify Permit Number 0118912 after due notice, if the permit holder fails to operate the facility in compliance with the Missouri Solid Waste Management Law and regulations, terms and conditions of the permit, and the approved engineering plans and specifications.

If you have any questions or comments regarding this letter, please contact Mr. J P Boessen of my staff at (573) 526-3940 or P.O. Box 176, Jefferson City, Missouri 65102-0176.

Sincerely,

SOLID WASTE MANAGEMENT PROGRAM

Charlene S Fitch

Charlene S. Fitch, P.E.
Chief, Engineering Section

CSF:brl

c: Mr. Larry Lehman, Chief, Compliance/Enforcement Section, SWMP
Ms. Brenda Ardrey, Chief, Operations Section, SWMP
Ms. Laura Yates, St. Louis County Department of Health
St. Louis Regional Office

ORIGINAL TMP PLAN

SUBMITTED TO MDNR SEPTEMBER 14, 2012

MDNR APPROVAL LETTER

ORIGINAL TMP INSTALLATION PLAN

SEPTEMBER 27, 2012

Ms. Charlene S. Fitch, P.E.
Missouri Department of Natural Resources
Solid Waste Management Program
1738 East Elm Street
Jefferson City, Missouri 65101

September 14, 2012

Dear Ms. Fitch:

Temperature Monitoring Point Installation Plan
Bridgeton Landfill, LLC – Permit #118912
Bridgeton, Missouri

Attached please find the Temperature Monitoring Point (TMP) Plan (Plan) which demonstrates how Bridgeton Landfill intends to construct the TMP's within the waste mass to observe temperatures at a consistent frequency down to the waste/quarry floor interface. The Plan was developed by P.J. Carey & Associates, PC (P.J. Carey) in conjunction with Bridgeton Landfill management. P.J. Carey has extensive experience designing, engineering, and overseeing the installation of systems such as is proposed in the Plan at other solid waste landfills throughout the United States.

The Plan proposes 9 TMP's set up along a primary and secondary line with intermediate TMP's in between to establish a rate of temperature advance through the waste mass to (or regression from) the north quarry near the boundary of the north and south quarries. It also includes details of the construction of each monitoring point and a proposed schedule for installation.

This submittal is intended to partially address Action Item #2 of the July 23rd, 2012 MDNR letter responding to the Contingency Plan and Summary Report submitted by the Bridgeton Landfill on April 6th, 2012. As was discussed and agreed upon in the August 29th, 2012 meeting at the Jefferson City, MO MDNR-SWMP office, a plan proposing the design, locations, and installation schedule of the TMP's was to be submitted by September 14, 2012.

13570 St. Charles Rock Road
Bridgeton, MO 63044
314.744.8166 - Office
Dvasbinder@republicservices.com

As is described in the Plan, Bridgeton Landfill is diligently working towards initiating the installation of these monitoring points within the next three weeks. That said, it is requested that an expedited review of this Plan be completed so that installation is not delayed. If additional information or clarifications are needed, please feel free to contact me at 314-744-8166 at your earliest convenience.

Sincerely,

Bridgeton Landfill, LLC.

David Vasbinder
Environmental Manager

Cc: John Haasis – St. Louis County Department of Health

Enclosures

STATE OF MISSOURI
DEPARTMENT OF NATURAL RESOURCES
Jeremiah W. (Jay) Nixon, Governor • Sara Parker Pauley, Director
www.dnr.mo.gov

SEP 27 2012

CERTIFIED MAIL #7009 3410 0001 9190 5805
RETURN RECEIPT REQUESTED

Mr. David Vasbinder
Environmental Manager
Republic Services, Inc.
13570 St. Charles Rock Road
Bridgeton, MO 63044

RE: Temperature Monitoring Point Installation Plan, Bridgeton Landfill, L.L.C., Permit Number 0118912, St. Louis County

Dear Mr. Vasbinder:

This letter is in response to a submittal, "Temperature Monitoring Point Installation Plan for Bridgeton Landfill L.L.C.", dated September 14, 2012, received September 17, 2012, by the Missouri Department of Natural Resources' (Department) Solid Waste Management Program (SWMP). The submittal consisted of a two (2) page cover letter from you, addressed to Ms. Charlene S. Fitch, P.E. and a TMP Installations proposal for Bridgeton Landfill, LLC attached, prepared by P.J. Carey & Associates, P.C., Sugar Hill, Georgia, dated September 13, 2012.

The submittal is proposing the installation of nine (9) thermocouple string probes in the saddle area of the landfill to document any advancement of the Subsurface Smoldering Event (SSE). The thermocouples will start at a depth of no more than 285 feet, be placed in 20 foot increments to the top of the landfill. They will be drilled using roto-sonic drilling technique, installed in a sheath and grouted in place. The proposed locations are shown on Figure 1.

The SWMP has reviewed this report in accordance with the Missouri Solid Waste Management Law and regulations. The SWMP hereby **approves** the location and installation of the Temperature Monitoring Points at the Bridgeton Sanitary Landfill with the following conditions. Compliance with these conditions will, in part, determine compliance with Solid Waste Disposal Area Permit Number 0118912.

CONDITIONS:

1. Within 15 days, submit action levels/trigger values for future actions. These levels and/or triggers are to be established before the sensors are placed to ensure that all parties are in agreement with the established value that represents a problem or an impact.

2. Within 15 days submit a plan stating how the monitoring data will be collected and reported to SWMP. Explain whether the thermocouples will be connected to a real-time system that records the data or if it will be a manual read system? Explain what the monitoring frequency will be, along with the timeframe for reporting the results to the SWMP.

3. Within 15 days submit a proposal to define the temperatures of the waste in the south edge of the SSE, so that both edges of the event are characterized as discussed during our August 29, 2012, meeting.

4. Submit a list of SSE isolation break options that will be considered if the action levels/trigger values are exceeded with the Isolation Break Implementation Plan.

5. Submit a list of contractors that would be able to construct the different kinds of SSE breaks that may be used with the Isolation Break Implementation Plan.

6. Provide an estimate for the amount of time it will take from the action level/trigger value being reached, to notifying and getting contractor on site and the amount of time it will take to construct the different isolation breaks with the Isolation Break Implementation Plan.

7. You must contact the SWMP five (5) days before installation of the Temperature Monitoring Points begins.

DOCUMENT:

"Temperature Monitoring Point Installation Plan for Bridgeton Landfill L.L.C.", dated September 14, 2012, received September 17, 2012, by the Missouri Department of Natural Resources' Solid Waste Management Program. The submittal consisted of a two (2) page cover letter addressed to Ms. Charlene S. Fitch, P.E. and a TMP Installations proposal for Bridgeton Landfill, LLC attached, prepared by P.J. Carey & Associates, P.C., Sugar Hill, Georgia, dated September 13, 2012.

This approval is not to be construed as compliance with any existing federal or state environmental laws other than the Missouri Solid Waste Management law; nor should this be construed as a waiver for any other regulatory requirements. This approval is not to be construed as compliance with any existing local permitting or zoning ordinances; nor does supercede any local permitting and/or zoning requirement.

The Department reserves the right to revoke, suspend, or modify this approval and /or Permit Number 0118912 after due notice, if the permit holder fails to maintain the facility in compliance with the Missouri Solid Waste Management Law and regulations, the terms and conditions of the permit, and the approved engineering plans and specifications.

We appreciate your continued efforts toward environmentally sound solid waste management practices. If you have any questions or comments, please contact Mr. J. P. Boessen of my staff at (573) 526-3940 or at P.O. Box 176, Jefferson City, Missouri 65102-0176.

Sincerely,

SOLID WASTE MANAGEMENT PROGRAM

Charlene S. Fitch

Charlene S. Fitch, P.E.
Chief, Engineering Section

CSF:jpj

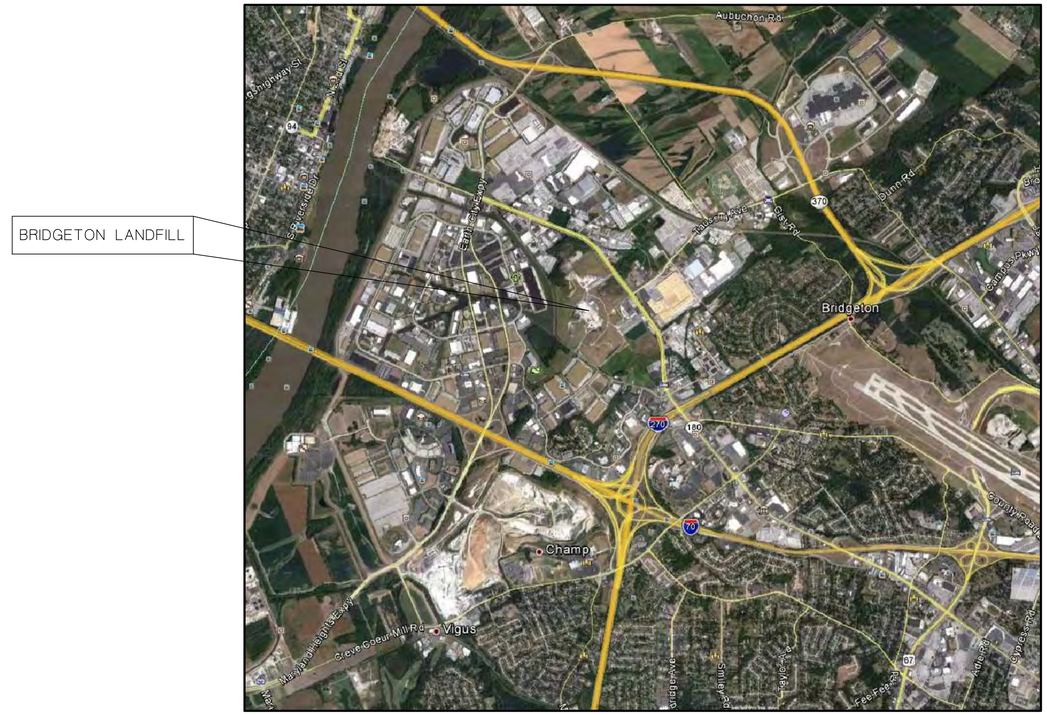
c: Mr. John Haasis, P.E., St. Louis County Department of Health
Mr. Larry Lehman, Chief, Compliance/Enforcement Section, SWMP
Mr. Joe Trunko, St. Louis Regional Office

DRAWINGS

2013 GAS INTERCEPTOR WELL SYSTEM - EXPANDED DESIGN
BRIDGETON LANDFILL
BRIDGETON, ST. LOUIS COUNTY, MISSOURI

DRAWING INDEX

DRAWING NO.		DRAWING TITLE
1	–	COVER SHEET
2	–	WELL LAYOUT PLAN
3	–	CARBON STEEL INTERCEPTOR WELL DETAILS



LOCATION MAP

0.5 mi. 0 0.5 mi. 1 mi.
SCALE FEET

PREPARED FOR:

BRIDGETON LANDFILL, LLC
13570 ST. CHARLES ROCK ROAD
BRIDGETON, MO 63044

PREPARED BY:

SCS ENGINEERS
2060 READING ROAD
SUITE #200
CINCINNATI, OHIO 45202-1497
PHONE (513) 421-5353
FAX (513) 421-2847

JANUARY 3, 2013
REVISED: JANUARY 30, 2013

REV.	DATE	DESCRIPTION	CK. BY
1	1/30/13	Added Proposed GWIs and TMPs	CES

SHEET TITLE: COVER SHEET

PROJECT TITLE: BRIDGETON LANDFILL
2013 GAS INTERCEPTOR WELL SYSTEM - EXPANDED DESIGN

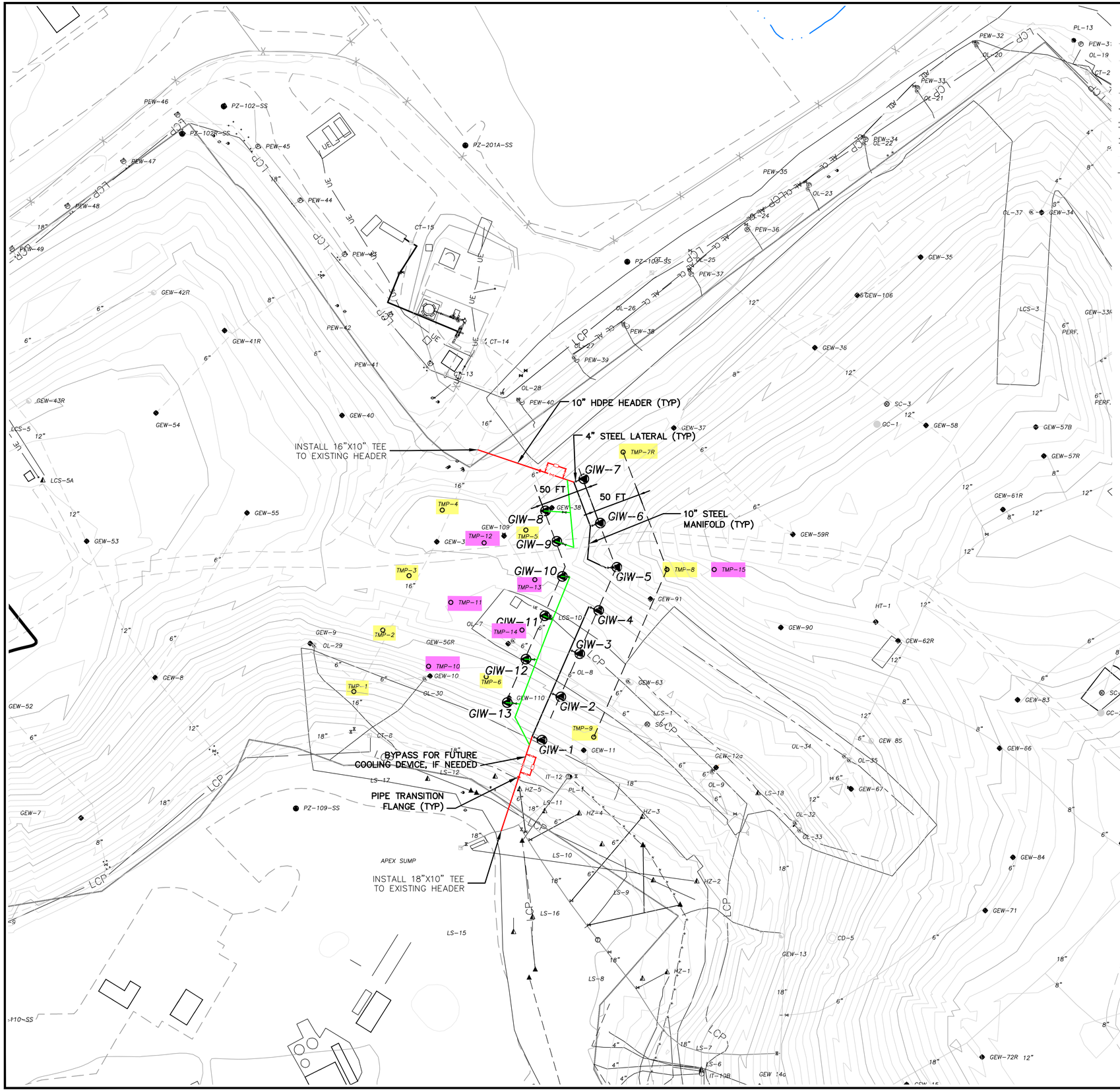
CLIENT: BRIDGETON LANDFILL, LLC
BRIDGETON LANDFILL
13570 ST. CHARLES ROCK ROAD
BRIDGETON, MO 63044

SCS ENGINEERS
STEARNS, CONRAD AND SCHMIDT
CONSULTING ENGINEERS, INC.
2060 READING ROAD, SUITE #200, CINCINNATI, OHIO 45202
PH. (513) 421-5353 FAX NO. (513) 421-2847

PROJ. NO: 23211003.00
DSN. BY: FDB
DWN. BY: FDB
CHK. BY: JJW
O/A R/W APP.
DATE

CADD FILE: COVER SHEET
DATE: 1/3/2013
SCALE: NONE
DRAWING NO. 1 of 3

I: \PROJECT\2011 PROJECTS\23211003 BRIDGETON LF ENG ASSISTANCE\DELIVERABLES--REPORTS\INTERCEPTOR WELLS\COVER SHEET 1-30-13.DWG



LEGEND

- EXISTING 10' CONTOURS
- EXISTING 2' CONTOURS
- BUILDING
- FENCE
- WATER
- PAVED ROAD
- UNPAVED ROAD
- PERMITTED WASTE LIMITS
- LFG COLLECTION PIPE
- GEW-34 LFG COLLECTION WELL
- GEW-2 LFG DUAL-EXTRACTION WELL
- VALVE
- SC-1 SURFACE COLLECTOR
- OL-1 OVER LINER TIE-IN POINT
- WB-1 WELL BORE BOOT
- CLEANOUT
- STORM WATER OUTFALL
- PL
- ELECTRIC LINE
- CT-4 CONDENSATE SUMP
- 2012 HEADER PIPE
- GEW-100 2012 PROPOSED WELLS
- LEACHATE COLLECTION PIPE
- LEACHATE DISCHARGE
- LCS-1D LEACHATE COLLECTION SUMP
- GMP-12 LFG MONITORING PROBE
- PGW-39 PERIMETER LFG COLLECTION WELL
- PERIMETER CONNECTION PIPE
- 100-SD LFG INTERCEPTION TRENCH WELL
- GROUNDWATER WELL
- LFG INTERCEPTION TRENCH
- PROPERTY LINE
- POWERPOLE

NOTES:

1. EXISTING GRADE CONTOURS SHOWN ARE FROM AERIAL SURVEY COMPLETED BY THE SANBORN MAPPING COMPANY ON FEBRUARY 19, 2009. CONTOURS WITHIN THE WASTE BOUNDARY ON THE SOUTH END ARE TAKEN FROM A GROUND SURVEY COMPLETED BY SHERBUT-CARSON-CLAXTON, LLC IN MAY 2011.
2. LOCATION OF LANDFILL GAS COLLECTION AND CONTROL SYSTEM COMPONENTS IS BASED ON AS-BUILT INFORMATION, WHERE AVAILABLE, AND APPROXIMATED OTHERWISE.
3. CONSTRUCTED COMPONENT TYPES, DIMENSIONS, AND LOCATIONS ARE BASED ON AS-BUILT INFORMATION, WHERE AVAILABLE, OTHERWISE THEY ARE APPROXIMATE.
4. BASE MAP PROVIDED BY AQUATERRA ENVIRONMENTAL SOLUTIONS, INC.

REV.	DATE	DESCRIPTION	CK. BY
1	1/30/13	Added Proposed GWs and TMPs	CES

SHEET TITLE: WELL LAYOUT PLAN

PROJECT TITLE: BRIDGETON LANDFILL 2013 GAS INTERCEPTOR WELL SYSTEM - EXPANDED DESIGN

CLIENT:
BRIDGETON LANDFILL, LLC
BRIDGETON LANDFILL
13570 ST. CHARLES ROCK ROAD
BRIDGETON, MO 63044

SCS ENGINEERS
STEARNS, CONRAD AND SCHMIDT
CONSULTING ENGINEERS, INC.
2060 READING ROAD, SUITE #200, CINCINNATI, OHIO 45202
PH. (513) 421-5353 FAX NO. (513) 421-2847

PROJ. NO.	DSN. BY:	DWG. BY:	CHK. BY:	Q/A RVW BY:
23211003.00	FDB	FDB	JJW	DAE

CADD FILE: SITE MAP

DATE: 1/10/2013

SCALE: AS SHOWN

DRAWING NO. 2 of 3

E:\PROJECT\2011 PROJECTS\23211003 BRIDGETON LF ENG ASSISTANCE\DELIVERABLES-REPORTS\INTERCEPTOR WELLS\SITE MAP 2-06-13.DWG

TMP SCHEDULE

Well No.	Location Coordinates N-S	Location Coordinates E-W	Surface Elevation (ft MSL)	Waste Bottom Elevation (ft MSL)	Landfill Depth (ft)	TMP Target Depth (ft)
TMP-10	1,067,871	516,294	482.7	328.9	154	154
TMP-11	1,067,847	516,362	498.2	262.3	236	210
TMP-12	1,067,812	516,425	500.2	272.1	228	210
TMP-13	1,067,758	516,386	498.9	270.2	229	210
TMP-14	1,067,772	516,332	496.0	274.9	221	210
TMP-15	1,067,568	516,396	520.3	263.8	256	210

TMP drill depth equals landfill bottom or 210 feet maximum

WELL SCHEDULE

Well No.	Location Coordinates N-S	Location Coordinates E-W	Surface Elevation (ft MSL)	Waste Bottom Elevation (ft MSL)	Landfill Depth (ft)	Borehole Depth (ft)	Well Pipe Depth (ft)	Slotted Pipe Depth (ft)	Solid Pipe Depth (ft)	Above Grade Riser (ft)	Thickness of Gravel Pack (ft)
GIW-1	1,067,752	516,216	477.4	420.4	57	57	56	31	25	5	34
GIW-2	1,067,732	516,261	490.6	280.0	211	150	149	124	25	5	127
GIW-3	1,067,712	516,307	495.9	275.9	220	150	149	124	25	5	127
GIW-4	1,067,692	516,353	501.1	270.2	231	150	149	124	25	5	127
GIW-5	1,067,672	516,399	511.8	270.0	242	150	149	124	25	5	127
GIW-6	1,067,690	516,446	510.0	270.0	240	150	149	124	25	5	127
GIW-7	1,067,707	516,493	501.9	329.1	173	150	149	124	25	5	127
GIW-8	1,067,748	516,459	502.2	270.0	232	150	149	124	25	5	127
GIW-9	1,067,736	516,426	507.4	270.0	237	150	149	124	25	5	127
GIW-10	1,067,730	516,389	503.2	270.0	233	150	149	124	25	5	127
GIW-11	1,067,749	516,347	496.8	273.4	224	150	149	124	25	5	127
GIW-12	1,067,769	516,301	495.2	277.6	219	150	149	124	25	5	127
GIW-13	1,067,789	516,255	481.8	335.8	146	146	145	120	25	5	123
Total						1,853	1,840	1,515	325	65	1,554

NOTES:

1. THIS DRAFT WELL SCHEDULE IS NOT INTENDED FOR CONSTRUCTION UNTIL ACTUAL SURVEY DATA IS OBTAINED AND THE WELL SCHEDULE IS REVISED BY THE ENGINEER.
2. SURVEYOR SHALL LOCATE WELLS AND VERIFY SURFACE ELEVATIONS BEFORE CONSTRUCTION. A PRE-CONSTRUCTION SURVEY (NORTHING/EASTING/ELEVATION DATA) SHALL BE PROVIDED TO THE ENGINEER A MINIMUM OF 2 WEEKS PRIOR TO CONSTRUCTION. ENGINEER SHALL VERIFY THE WELL SCHEDULE BASED ON THE PRE-CONSTRUCTION SURVEY.
3. FOLLOWING REVIEW OF SURVEY DATA, CONTRACTOR SHALL GET AUTHORIZATION FROM OWNER AND ENGINEER PRIOR TO DRILLING.
4. WELL DEPTHS BASED ON TOPOGRAPHIC SURVEYED BY SHERBERT-CARSON-CLAXTON, DATED MAY 2011, AND BASE GRADES OBTAINED FROM MIDWEST ENVIRONMENTAL CONSULTANTS APRIL 1998 LANDFILL GAS RECOVERY SYSTEM DESIGN.

DESIGN FIRM QA/QC REVIEWER ACKNOWLEDGEMENT: _____ DATE

DESIGN FIRM PROJECT MANAGER ACKNOWLEDGEMENT: _____ DATE

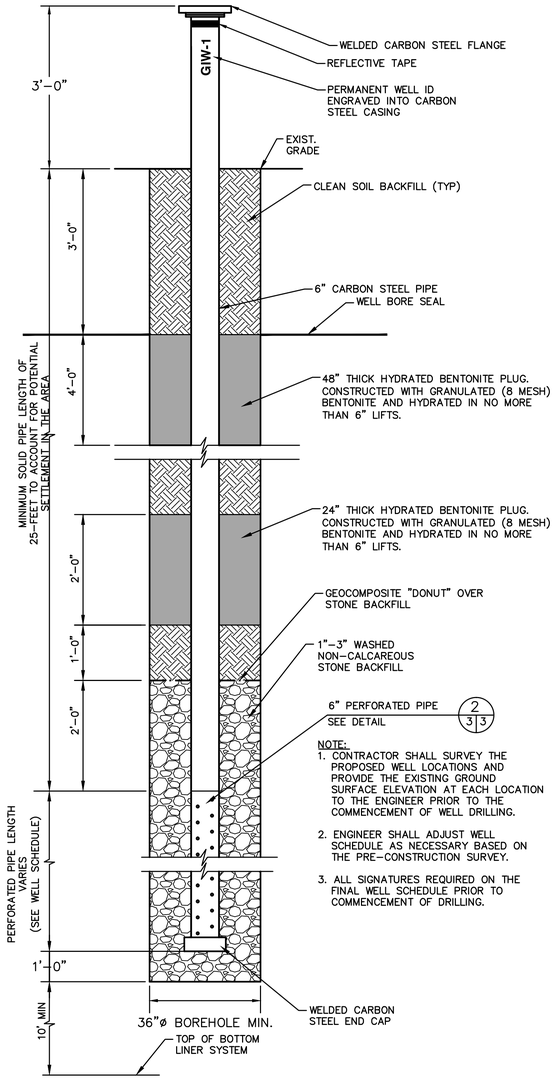
ENVIRONMENTAL MANAGER: _____ DATE

CQA INSPECTOR: _____ DATE

SURVEYOR ACKNOWLEDGEMENT: _____ DATE

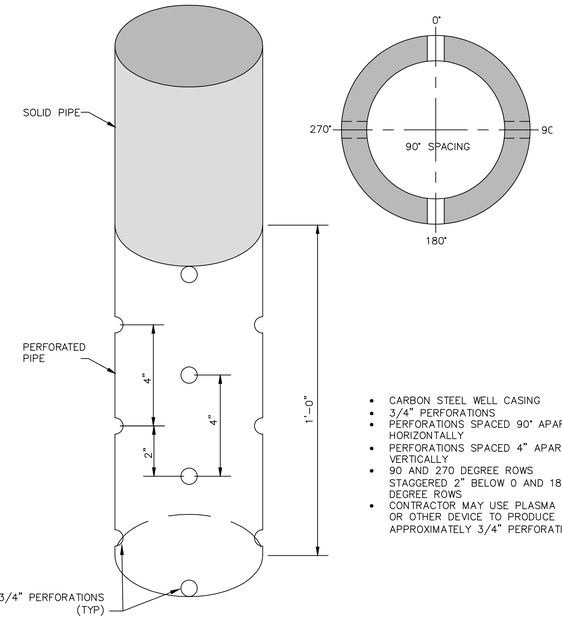
DRILLER ACKNOWLEDGEMENT: _____ DATE

UNDER NO CIRCUMSTANCES SHALL DRILLING ACTIVITIES BEGIN WITHOUT PROVIDING THE ABOVE SIGNATURES. ANY CHANGES TO WELL LOCATIONS OR DEPTHS SHALL REQUIRE THESE SIGNATURES TO BE OBTAINED AGAIN.



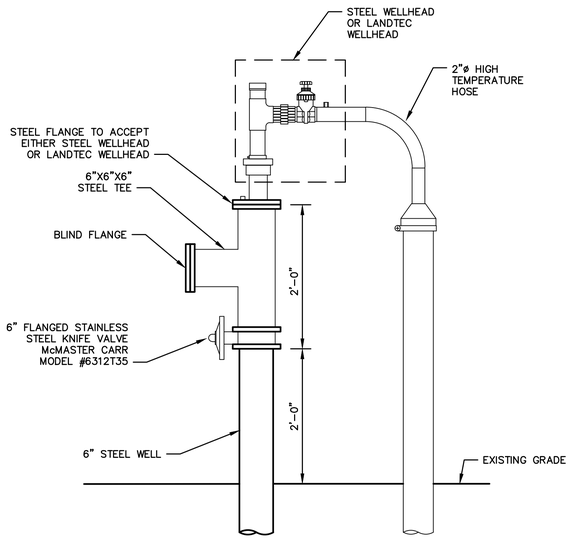
NOTE:
1. CARBON STEEL WELL SECTIONS CAN BE CONNECTED USING OUTSIDE THREADED COUPLERS, OR WELDED STEEL FLANGES.

GAS INTERCEPTOR WELL DETAIL 1/2|3
NOT TO SCALE



- CARBON STEEL WELL CASING
- 3/4" PERFORATIONS
- PERFORATIONS SPACED 90° APART HORIZONTALLY
- PERFORATIONS SPACED 4" APART VERTICALLY
- 90 AND 270 DEGREE ROWS STAGGERED 2" BELOW 0 AND 180 DEGREE ROWS
- CONTRACTOR MAY USE PLASMA TORCH OR OTHER DEVICE TO PRODUCE APPROXIMATELY 3/4" PERFORATIONS

PERFORATION DETAIL 2/3
NOT TO SCALE



WELLHEAD DETAIL 3/3
NOT TO SCALE

CLIENT:
BRIDGETON LANDFILL, LLC.
BRIDGETON LANDFILL
13570 ST. CHARLES ROCK ROAD
BRIDGETON, MO 63044

REV.	DATE	DESCRIPTION	CK. BY
1	1/30/13	Added Proposed GIWs and TMPs	CES

SHEET TITLE: CARBON STEEL INTERCEPTOR WELL DETAILS

PROJECT TITLE: BRIDGETON LANDFILL 2013 GAS INTERCEPTOR WELL SYSTEM - EXPANDED DESIGN

SCS ENGINEERS
STEARNS, CONRAD AND SCHMIDT CONSULTING ENGINEERS, INC.
2060 READING ROAD, SUITE #200, CINCINNATI, OHIO 45202
PH: (513) 421-5353 FAX NO. (513) 421-2847

PROJ. NO. 23211003.00 | DSN. BY: FDB | DWN. BY: FDB | CHK. BY: JJW | Q/A RVW BY: DAE

CADD FILE: SHEET 3

DATE: 1/9/2013

SCALE: NONE

DRAWING NO. 3 of 3

I:\PROJECT\2011 PROJECTS\23211003 BRIDGETON LF ENG ASSISTANCE\DELIVERABLES-REPORTS\INTERCEPTOR WELLS\SHEET 34 - DETAILS 02-06-13 - PESTAMPED.DWG

March 29, 2013

Ms. Charlene S. Fitch, Chief, Engineering Section
Missouri Department of Natural Resources
P.O. Box 176
Jefferson City, Missouri 65102-0176

SUBJECT: BRIDGETON LANDFILL, LLC
SW PERMIT NUMBER 0118912
BRIDGETON LANDFILL FACILITY
BRIDGETON, MISSOURI 63044

Dear Ms. Fitch:

This Letter Report has been prepared in support of Solid Waste Permit Number 0118912 issued to Bridgeton Landfill, LLC by the Missouri Department of Natural Resources (MDNR), and in follow up to the *February 27, 2013* meeting between Bridgeton Landfill, LLC representatives and MDNR, the *February 8, 2013* "Gas Interceptor Well Expanded Design Conditional Approval" letter, the *February 6, 2013* "2013 Gas Interceptor Well System-Expanded Design Bridgeton Landfill", the *January 11, 2013* "Gas Interceptor Well Design Approval" letter, the *January 4, 2013* "North Quarry Heat Barrier System" report, and the *September 14, 2012* "Temperature Monitoring Point Installation Plan". Specifically, the work is related to subsurface smoldering event (SSE) at Bridgeton Landfill in Bridgeton, Missouri.

We appreciate your consideration of the enclosed materials and look forward to continuing working with MDNR regarding the management plan and systematic monitoring, response and planning activities for the Bridgeton Landfill. Specifically, we are available at your convenience to review the updated data and discuss the technical merits of the potential contingencies with representatives from MDNR.

As you are aware from our ongoing work on this matter since the SSE began, this is a complex event that has required careful evaluation and management. Our continuing investigation and evaluation of the SSE have revealed a wealth of information about the event, and will provide a solid basis for assessing contingency options now and in the future. We look forward to continue working with MDNR to gather additional data and prepare plans that are appropriate and responsive to the situation, while ensuring ongoing protection of human health and the environment.

Executive Summary

This Letter Report is intended to provide an update of the subsurface smoldering event, together with an engineering feasibility evaluation of existing and potential future contingency containment systems. The report will address the following key elements:

1. Overview of the Current Management and Monitoring System

Bridgeton Landfill installed and proposed to expand its temperature monitoring system, per the approved *September 14, 2012* "TMP Installation Plan." Utilizing the temperature monitoring system, Bridgeton Landfill can monitor the effectiveness of the interceptor well system and continue to develop data regarding the extent and migration of the SSE.

Bridgeton Landfill has also installed the gas interceptor well system. This system is intended to facilitate more rapid heat removal, limiting the progression of heat past the interceptor well system. While we expect the interceptor well system to be an effective, permanent first line of defense, we have created and continue to refine contingency strategies to ensure that the radiologically impacted materials in the West Lake OU-1 are not impacted by the SSE.

We agree with MDNR that this evaluation of appropriate contingency planning is of critical importance, but the available data indicates that continued monitoring and study is appropriate before undertaking the invasive work of any barrier system, which carries risk. If this event follows the current pattern of development, as witnessed at other similar hydrogen gas producing sites, the reaction will not spread to shallower portions of the landfill. In these shallower zones, significant losses of energy occur and lead to rapid cooling. Additionally, energy can be lost to the underlying ground surface (i.e. rock surfaces or other native material).

Currently, the limited northward migration of the event is moving primarily east - towards the quarry wall, rather than the neck at the northwest. However, even if the current rate of migration is presumed to not only be directly in the direction of the radiologically impacted materials, but also continue migration in that direction at that rate consistently moving forward (neither of which is an assumption supported by current facts), it would take more than seven years to reach the buffer area outside of the radiologically impacted materials. Based on the data, it is clear that there is sufficient time to monitor the effectiveness of the interceptor well system, when activated, while improving upon our existing understanding of the SSE extent and impact.

2. Update on the Evaluation of the Extent of the Settlement and Heat Impact

Bridgton Landfill implemented an improved system for detecting settlement in a way that can accurately document the rate, extent and direction of settlement movement. The new additional data reveals that settlement is focused in a relatively localized location beneath the wells GEW-60R, GEW-61R, and GEW-62R. Visual settlement on the surface is primarily a product of the lateral spreading of settlement due to the depth at which volume is reducing. The energy spreads laterally from this localized reaction spot, resulting in settlement in areas beyond the location of the actual SSE. Any remedial measures must take this type of settlement into account, since settlement in one location is not necessarily indicative of an ongoing reaction at that location or of a spreading heat event

The modest rates of heat rise and lack of movement of heat fronts support the concept that hydrogen liberation is the only significant heat producing event ongoing at the Bridgeton Landfill. This is based on temperature evaluation and heat calculations. If other waste oxidation events were occurring and responsible for any significant amount of the volume reduction at the Bridgeton Landfill, they would add a large amount of energy to the Bridgeton Landfill and temperature rises would be much greater than those seen to date.

3. Evaluation of Additional Containment Contingencies

This Letter Report revisited several physical barrier evaluations reviewed in depth as part of the January 4, 2013 "North Quarry Heat Barrier System" heat dissipation approach. Evaluating potential displacement and resulting settlement issues makes it clear that many alternative barrier systems are not feasible. Thin barrier systems would all rely on some heat removing component to function. Additionally, and depending on the type physical barrier, construction timelines range from one to two years. Lengthy construction obviously makes rapid deployment difficult, and it also increases the challenges relative to managing odors, nuisance issues like vectors and truck traffic. Physical barrier construction in the "neck area of the landfill" is also complicated by the need to abide by certain airport covenants. Therefore, the heat removal identified by Bridgeton Landfill in the "North Quarry Heat Barrier System" report is preferable to other physical barrier systems located in the "neck area of the landfill" because it offers superior protection with reduced construction time that can be organized to possibly comply with the airport easement and covenants.

In response to MDNR's direction, this Letter Report also considered the viability of an injection system. There are no reported uses of inert gas in landfills other than at fires that are quite shallow (less than 50 feet) and isolated in nature. There is no evidence that such injections could occur at the depths of this SSE. Since there is currently no evidence of free oxygen at depth, the only possible purpose of gas injection is to remove heat. This is much more efficiently accomplished by the proposed heat barrier system presented in the January 4 "North Quarry Heat Barrier System" report.

Finally, Bridgeton Landfill has evaluated other possible contingencies to prevent the heat reaction from advancing into the West Lake OU-1 area. This Letter Report evaluates the excavation of waste to create an isolation barrier south of the southern limit of where no radioactive material above background was found. The shallower depth and ability to anchor the barrier prevents many of the feasibility concerns seen in deeper excavations. Such an approach would also limit the volume of waste excavation, consistent with concerns raised by the Airport Authority. Finally the relative speed of construction, just three months, allows such a system to be implemented quickly. This isolation barrier located south of the southern limit of where no radioactive material will provide the physical barrier that MDNR has requested, it just requires that we must locate it further north of the requested "neck area of the landfill" in order to make it technically competent should it need to arrest an advancement of heat, and make it constructable.

4. Conclusion

The onsite monitoring systems continues to reveal that any detectable rate of movement toward the north is relatively slight and is slowing over time. Bridgeton Landfill requests that data from

the monitoring systems that MDNR and Bridgeton Landfill mutually established should continue to be watched closely in order to keep current data and expand understanding of the extent and impact of the SSE. This data can be monitored while the first line of defense gas interceptor well system is activated and used to effectively and efficiently remove energy from the SSE. The data and monitored performance of the gas interceptor well system can be utilized to more effectively evaluate and plan any contingency to ensure that there is no impact to the radiologically impacted materials at the West Lake OU-1 site without undue increases in odor and complications with the airport easement and covenants.

Summary Table of Containment Evaluation:

The following summary table was created in effort to help Bridgeton Landfill and MDNR track the various systems and broadly compare and contrast their relative strengths and weaknesses.

		Current Systems			**Contingency Barrier Approaches at Neck**			**Contingency Barrier Approaches at North Limits of the North Quarry Fill**
Criteria		Interceptor Wells – First Line of Defense	Temperature Monitoring Probes (TMPs)	Settlement Assessment	North Quarry Heat Barrier System	Alternative Barrier Plan	Alternative Injection System	North Excavation and Barrier
	Technically feasible	Yes	Yes	Yes	Yes	No	Yes	Yes
	Previously proven technology	Yes	Yes	Yes	No	No	No	Yes
	Secure approval from MDNR	Yes	Yes	Yes	Not currently approved	Suggested by MDNR	Suggested by MDNR	Pending
	Complies with Airport restrictions and covenants	Yes	Yes	Yes	Yes	No	Yes	Pending
	Reasonable timeline	Yes	Yes	Yes	Yes	No	Yes	Yes
	Length of construction implementation	Current	Current	Current	1 year	2 years	2 years	3 months

Through the implementation and expansion of our temperature monitoring system and improvements in our settlement data collection, Bridgeton Landfill has developed, when coupled with landfill gas collection wellhead temperatures, strong, reliable data which can be used to analyze and understand the subsurface smoldering event (SSE). Further, this data, which is collected weekly and monthly, respectively, provides us with a system to promptly detect any changes in the SSE (including both the direction and the rate of movement) and provide an early warning system as any changes might arise. Based on a review of the most recent data available, it appears that to the extent the SSE is moving, it is moving for the most part in a southwestern direction, away from the radiologically impacted materials.

While these data indicates that the progression of the reaction may not necessitate any physical barrier, we have nonetheless continued evaluation of potential contingency plans. In response to MDNR's request, this Letter Report provides an updated assessment of potential physical barrier systems installed at the neck. Unfortunately, similar to the conclusions reached in the January 4, 2013, North Quarry Heat Barrier System report, we have not identified any physical systems for the "neck area of the landfill" that will adequately meet the mutual needs of the MDNR and Bridgeton Landfill due to technical inadequacies and unsuitable construction schedules.

Finally, this Letter Report presents an additional contingency plan that would create a physical barrier between the Bridgeton Sanitary Landfill and the West Lake site where radiological wastes are located. We welcome the opportunity to meet with MDNR to discuss this additional contingency plan and the findings and evaluations using the most current data detailed in this Letter Report.

Update on Current Management and Monitoring System

MDNR has requested that Bridgeton Landfill design a system to prevent the spread of the SSE to the northern section of the quarry fill. Bridgeton Landfill provided MDNR an evaluation of possible measures of achieving this goal in the North Quarry Heat Barrier System report (dated January 4, 2013). In that report a heat removal system was identified as being most suitable for achieving the goal. Other means of arresting the spread of heat were assessed and rated as unfeasible, with the exception of a wide cementious barrier fill placed under slurry conditions and reinforced. This system was identified as technically feasible but not able to be constructed in short enough time periods and still susceptible to failure due to uncertainty as to how much settlement may occur.

Subsequent to the submittal of the North Quarry Heat Barrier System report, Bridgeton Landfill requested approval to install a series of interceptor wells along with additional TMPs. MDNR provided approval of the proposed installation but required that Bridgeton Landfill begin designing and installing a system at the quarry narrow point "neck" that would act as a temporary barrier to resist thermal transfer of heat from one side to the other. The February 8, 2013 letter required *"that the design must include a rationale for and calculations supporting the thickness of the barrier, depth of the barrier and thermal modeling for heat transfer. The goal is for the barrier to maintain its integrity for a 3-6 month window of time once the reaction reaches the barrier."*

In the same letter the Solid Waste Management Program (SWMP) requested *"that Bridgeton begin designing and selecting an injection system backup plan for the barrier system in case the gas interceptor well system and the barrier systems do not stop the advance of the SSE."*

Bridgeton Landfill does not believe that measures designed to only last a few months of performance are reasonable to install given the time and effort required to install any barrier system at all. It is the opinion of Bridgeton Landfill that a suitable system was presented, along with the rationale for design, in the aforementioned report dated January 4, 2013. In that report the heat barrier system based on heat removal was identified as the most feasible system. A rationale for design was presented.

MDNR cited the increased temperatures at the southernmost TMPs (8 and 9) as part of the basis for the demand for immediate action. It should be mentioned that Bridgeton Landfill specifically placed the southernmost row of TMPs, including TMPs 8 and 9, in areas they expected to have the heat front pass through, for the purpose of gaining information. These were not intended to act as a trigger mechanism for additional action. Based on the March 11th measurements at the Bridgeton Landfill and an evaluation by our Consultants of progression rates, the expected arrival date for the heat/settlement front is further away than earlier estimated (approximately 16 months) from reaching the TMP 1-4 line where the North Quarry Heat Barrier System report identified the trigger. This is based on a 13 ft/month advance rate (February 2013) versus the 18 ft/month (November 2012) in the report. This slowing of the advance rate will allow for more time for evaluation and to let the impact of the gas interceptor well system be assessed.

In an effort to minimize or stop movement of subsurface heat from the south quarry to the north quarry, additional special purpose, gas interceptor wells were installed, consistent with MDNR approved plans. The gas interceptor well system consists of two rows of wells. The first row of wells was installed approximately 50 feet north of the first line of temperature monitoring probes (TMPs 7R, 8, and 9). The second row of wells was installed 50 feet north of the first row of wells, and staggered in between the first row of wells. The gas interceptor well system is designed to allow for more rapid removal of heated gas allowing a release point for heat generated by and emanating from the SSE, which will effectively and efficiently remove energy.. The gas interceptor wells are spaced more closely together than traditional gas extraction wells to allow for more heat removal from any heat front. When activated, it is expected that the gas interceptor wells will initially draw the heat towards them. But the combined rows of wells will remove heat, reducing the energy and heat, limiting the migration of heat past the gas interceptor well system, as has been effectively used at other similar sites experiencing subsurface smoldering events. Additionally, because these wells are relatively fast to install, this system can continue to be added upon as needed in order to increase its effectiveness. These wells also conform to the existing airport easements and covenants, and are installed with methods that manage construction-generated odors better than can be managed in other forms of invasive construction.

Building upon the current TMP system, six additional TMPs are currently being installed in between the gas interceptor well system and the TMPs located at the narrow point "neck" of the landfill. This will allow for more extensive monitoring of any heat that might move past the gas interceptor well system in order to evaluate the effectiveness of the system on a more timely basis and provide us the ability to respond with additional and precisely targeted gas interceptor

wells.

Additionally, continued monitoring of the expanded TMP system will improve any design rationale of a heat removal barrier, or selected barrier approach, should MDNR continue to believe that such a barrier is warranted. The added data will be useful in the determination of heat energy flowing toward the proposed heat removal and/or barrier location that needs to be removed. Our Consultants' estimated heat energy rate, as presented in the North Quarry Heat Barrier System report, was 12 watts per square meter. Using the information currently available this appears to be an overestimate, meaning that the heat front would actually place less demand on the heat removal system than previously calculated.

Update on the Extent of Reaction and Associated Characteristics

Bridgeton Landfill engineers have implemented an extensive monitoring systems (TMP and settlement assessment) to more accurately, when coupled with landfill gas collection wellhead temperatures, document and monitor the extent of the heat and settlement impact from the SSE. A robust system for settlement assessment was developed by creating a more detailed grid in order to consistently gather equivalent data during each monitoring event. Over the last several months the Bridgeton Landfill has expanded the TMP system to include the installation of probes directly into the center of the reaction, the installation of probes proximate to the reaction, and installation of probes both in advance of and beyond the installed gas interceptor well system. These expanded monitoring systems have provided significantly more data regarding the SSE, its extent, and its changes. As of February 2013, two complete monthly settlement monitoring events using the grid method have been completed and a third will occur at the end of March 2013. The results have been, and will continue to be, shared with MDNR.

Settlement (Volume Reduction / Zone of Accelerated Settlement)

Analysis of the waste settlement data by our Consultants indicates that the volume reduction associated with the SSE continues. Settlement continues to occur at an elevated rate in the areas that have already settled substantially. For example, in locations where the total settlement since March 2011 is approximately 30 feet, the rate of settlement was 1.0 ft/month or more. This indicates that the waste in this area is still actively settling. The North Quarry Heat Barrier System report) identified a vertical settlement rate of 1.35 ft/month as indicative of accelerated, as compared to typical, settlement. The location of the vertical settlement rate of 1.35 ft/month has continued to expand outwardly. This expansion is referred to as the zone of accelerated settlement and is shown on Drawing 1.

The northern movement of the zone of accelerated settlement has slowed from the average rate of 18 ft/month in November 2012, to 13 ft/month in February 2013 (assuming a 30 day month). However, the expansion of the zone of accelerated settlement in the southern direction, defined by the same current rate of 13 ft/month, has increased during this same time period. Also evident in the zone of the accelerated settlement is that the northern movement is more towards the east at present, instead of heading toward the narrow point (neck) of the quarry. The southern acceleration combined with this eastern movement on the north part results in an overall rounding of the zone of accelerated settlement, which is discussed in greater detail below.

Analysis of the Shape of the Zone of Accelerated Settlement

Analysis of settlement shapes, by our Consultants, based on the settlement that has occurred since March 2011 suggests that settlement shape to the east from the low area near GEW-60R is consistent with the subsidence shape associated with volume reduction of the waste occurring only under the zone of accelerated settlement, as revealed in Drawing 1.

The surface manifestation of reduction in waste volume occurring centered at depths of 140 feet, which is consistent with elevated temperatures measured in TMP-8, was used by our Consultant to analyze the extent of the zone of accelerated settlement. Our Consultant's comparative analysis suggests a volume reduction of approximately 38 feet has occurred near points of maximum observed settlement since March, 2011. (Note that we acknowledge that certain quantities of soil were placed across many portions of the landfill prior to March 2011. The shape manifested by the settlement that has occurred since March 2011 is still valid for purposes of this particular evaluation, however Bridgeton Landfill can investigate soil depths in interest of continued full cooperation if MDNR prefers to incorporate settlement that could be masked by the soil placed prior to March 2011.) Based on mine subsidence literature, (reported settlements associated with tunnel collapse and finite element simulations) volume reduction sufficient to cause 30 feet or more of surface settlement would have wide spread effects. This is the case near GEW-61R and GEW-62R, as illustrated in Drawing 2

Based on the analysis by our Consultants of the settlement shapes and predictions using either mine subsidence, tunnel collapse or finite element simulation methods, settlements occurring at depths of 135 feet bgs will result in settlement at locations greater than 150 feet laterally. The vertical settlement at a distance of 150 feet laterally from a significant settlement event occurring at 135 feet below the ground surface (bgs) is still 5% of the total vertical settlement of the event. The settlement directly over the event is approximately 85% of the volume reduction. This suggests an "angle of draw", to use a mine subsidence term, approximately equivalent to slightly more than 50 degrees measured from the vertical, or 40 degrees or less measured from the horizontal. Significant ground motions toward the settlement locations occur at a significant distance from the SSE, since the settlement from this reaction appears to be occurring at depths that average more than 135 ft bgs.

As a result of the analysis of the zone of accelerated settlement, it is clear that volume reduction of the waste at depth results in very significant lateral spreading of settlement. Therefore, settlement at any given location is not, by itself, indicative that a volume reducing activity is occurring directly underneath that location, thus accelerated rate of settlement alone cannot be used as indicative of the extent of the SSE. This needs to be included in the conclusions drawn about the ongoing reactions at the Bridgeton Landfill and the design of any remedial measures.

TMP Observations

Since the fall of 2012, the Bridgeton Landfill has installed and monitored nine temperature monitoring points (TMP). These TMPs collect data spanning the full vertical depth of the waste at 85 points using thermocouples. Seventy five of the original thermocouples are functioning to date. In addition, six more TMPs are being installed south of the quarry narrow point to allow further definition of temperature gradients in both the vertical and horizontal directions.

As of March 19, 2013, the temperature front has moved north of TMP 8 and 9. This front is characterized by the increase in temperature from < 185 °F to temperatures > 210 °F. Examination of the TMPs that have experienced temperature rise shows the temperatures are typically elevated within a certain depth range, and that above and below this depth range the temperature is reducing. Using the average value with the range that is elevated, and not dissipating in the upward or downward direction, provides some detail as to how the heat front is progressing. These average temperatures, depicted in the attached Average Temperature plots generated by our Consultant, show increases in temperature typically into January 2013, followed by a period of nearly constant temperatures or slight rises in temperature. The more rapid rises in temperature associated with the heat front are apparent in TMP 8 and TMP 9, presented in the attached Average Temperature plots. TMPs 1, 3 and 4 showed no upward trends as is apparent in the weekly temperature readings. It should be noted that in the above presentation, the non-functioning thermocouplings were not used in the average calculation. Given the depth of the zones used for the temperature average, the behavior is not affected significantly by ambient temperature trends. Based on the average temperature values the heat front is progressing at a slowing rate to the north.

Additional information on gradients of temperature surrounding TMPs will be provided to MDNR in subsequent reports on TMP results as evidence of SSE.

Overall Heat Balance and Correlation to Collected Hydrogen

An overall approximate heat balance calculation was performed by our Consultants. This analysis utilized the premise that the hydrogen being generated at the Bridgeton Landfill is indicative of a metal oxidation process, whether from metal hydroxides, or metal oxides, and whereby the hydrogen is liberated from water molecules as a product of the reaction with metals. At present, Bridgeton Landfill has not identified other sources of hydrogen generation at the temperature ranges measured within the landfill.

The elevated temperature of the landfill results in heat losses to the landfill surface, heat removal in the form of landfill gas, heat removal in the form of water vapor in the landfill gas (originating as liquid and being vaporized), heat being used to warm the waste as the heat front advances, general warming of the waste and liquid, and heat losses to the ground at the perimeter and bottom of the landfill.

Using the temperature gradients measured at the TMPs, total hydrogen collected at the flare station, flow rates and temperatures of the gasses, estimates of water vapor generated contained in the gas, and the zone of accelerated settlement rate in February 2013; an approximate heat accounting was performed by our Consultants. A total heat energy rate of 2.16×10^6W was determined, based on the calculations ignoring the average rise in temperature of the landfill that has occurred in general. This calculated value should be considered a lower range estimate, given that some of the warm wells in the south quarry area do not have measured flow rates which results in the underestimation the energy used in vaporizing water. This is contrasted with a heat energy value of approximately 4.58×10^6W indicated by the 11% of the average flow rate of 3800 scfm of gas processed at the flare. The excess rate of energy production would account for raising the average temperature of the waste. A rough calculation shows the excess energy

would raise the temperature of a waste mass 200 ft thick over twenty acres approximately 20 °F per year.

Based on our Consultants' calculations, and acknowledging the total hydrogen is likely higher than being collected, it does not appear that rates of heat rise or movement of heat fronts support the concept that significant heat producing events (i.e. a combustion event) are ongoing at the Bridgeton Landfill, other than those associated with the hydrogen liberation. If such waste oxidation events were occurring and responsible for any significant amount of the volume reduction at the Bridgeton Landfill, they would add a large amount of energy to the Bridgeton Landfill and temperature rises would be much greater than those seen to date. This is consistent with Bridgeton Landfill's data that do not indicate free oxygen at depth, where the volume reduction is occurring, and the overall lack of any fire type behavior or residues encountered in the sampled TMPs. At the present time the pyrolyzation of the waste, occurring at low temperature was assumed to be energy neutral so no energy loss or gain is associated with the volume reduction in the calculations.

According to our Consultants, this suggests that current energy production (assuming just metal oxide reactions are occurring) accounts for all the excess temperature at the Bridgeton Landfill and that remedial measures should be focused on the behaviors associated with this type of heat producing event.

Conclusions Based on Data Gathered to Date

The current monitoring systems at the Bridgeton Landfill show the settlement and temperature fronts continue to expand from a centralized deep settlement point. However, this is not revealing since the spreading of both settlement and elevated temperature would be expected to continue even if the actual heat generation was declining, given the significant storage of heat energy in the landfill.

As addressed in the discussion of Settlement, the rate of the expansion of the zone of accelerated settlement to the north is slowing, even without the installed first line of defense of gas interceptor wells being activated and in a state of full operation whereby they will remove heat energy from the SSE.

Settlement at any location is influenced by settlements occurring at depth in other locations. As this Letter Report has demonstrated, the temperature levels and rates of advance are consistent with a non-combustion based metal oxidation reaction that liberates hydrogen. The rates of hydrogen collection would account for all elevated temperature behaviors seen at the landfill

Notably, no evidence of smolder has been observed in the samples from the TMP borings, including those installed in the warmest area of the Bridgeton Landfill.

Evaluation of Contingency Options

Evaluation of Physical Thermal Barriers

Notwithstanding the slowing of the zone of accelerated settlement northward or the mounting evidence that the reaction causing heat at the Bridgeton Landfill is not related to the combustion of waste, Bridgeton Landfill has evaluated physical barriers that could be installed at the entry to the north quarry to prevent advancement of the temperature front. The types of barriers evaluated were identified in Table 1 of the North Quarry Heat Barrier System report. They included some of those that MDNR or its advisors have proposed as well as others. In response to the request of MDNR, Bridgeton Landfill has further considered physical barriers beyond the level presented in the North Quarry Heat Barrier System report.

Structural Barriers

Conductivity

Specifically, non-open space barriers structurally supported barriers, which included tangent pile walls, sheet barriers and structural slurry walls were considered. The thinner barriers, e.g. tangent piles, sheet pile, thin structural slurry walls, were identified as being technically unfeasible due to the uncertainty as to the development of bending moments and shear forces associated with advance of settlement fronts. In addition these thinner type systems are thermally more conductive than waste material. Heat energy arriving at a concrete barrier will pass directly through it, thus, the system composed of concrete would require it be made of insulating concrete, which is too weak, or that heat exchanging devices be embedded in the concrete to remove the heat, which makes this type of barrier a very expensive version of the heat removal system already proposed but with additional problems because it is has structural issues as well.

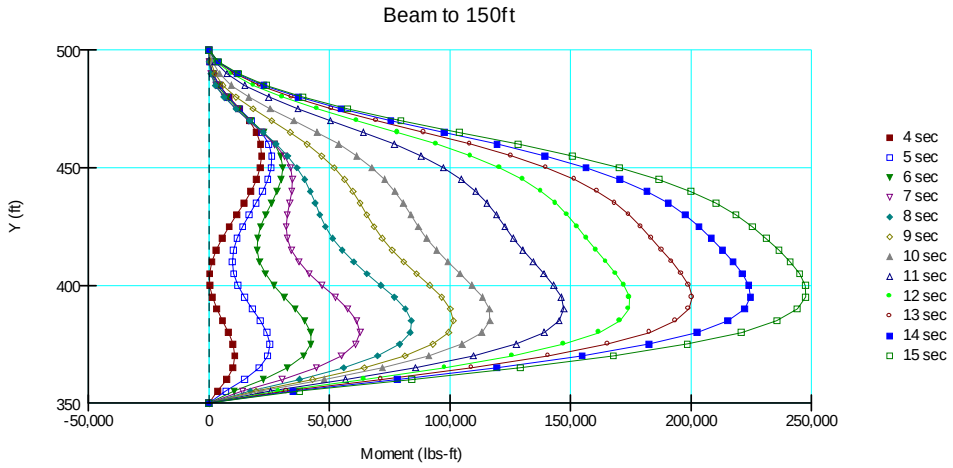
Stiffness

Approximation of the lower limit of settlement induced stresses was performed using finite element methods (FEM). A settlement varying from 2 to 10 ft/month occurring at 135 feet bgs and at a distance 75 foot in south of the barrier was simulated. The waste was assumed to be a homogeneous elastic/plastic media. It was found that significant displacements were predicted and bending moments were, as expected, a function of the stiffness of the wall section used. Ideally the design moment for vertical barrier wall of minimal stiffness would still be in excess of 250,000 ft lbs (unfactored) even with the settlement front 75 feet away. As the settlement front approached the barrier this would worsen. In addition, moments were based on the assumption that a rectangular wall section was used. If a tangent pile system was used, and steel included in the piles, the overall stiffness of the cracked sections would increase and the moments would be higher. It should be noted that the deflections at the wall were on the order of feet and the depth of the wall stopped at 150 feet below grade.

Bending moments

A bending moment diagram is presented below from the simulation. The settlement at each time step to 10 sec is 0.5 ft, after 10 sec the step was increased to 1 ft sec. The total settlement at 75 foot away is 10 foot at 135 feet and 8.5 feet at the ground surface over the maximum settlement. The original ground surface is at elevation 500 in the simulation. Surface settlement at the

barrier beam were only 1.5 ft for the 15 sec time step. (note the times are not material in the duration but just a calculation step)



The required reinforcing to remain intact for this type of installation is approximately 3 square inches per foot of wall length for the depth of the wall if the average distance of the reinforcing steel is 3 feet from the average wall face. This requires large diameter wall elements if concrete tangent piles were used and a double structural row. This type of system would also need follow up jetting and grouting to remove all waste between piles or initial special low strength caisson filler piles with large diameter 48 inch piles and a single row of structural caissons nearly touching to create a seal. In any case the number of piles would be approximately equivalent of 1 -36 inch diameter pile every 24 inches. Given the width of the quarry at the narrowest point this would result in approximately 140 piles to a depth of 150 feet. Holes would have to be drilled under slurry or cased in order to remain open and alignment would be challenging, likely requiring additional piles. The result of such work would not reduce the need to install thermal extraction units. These could presumably be included in the design. This system would take significant time to install and have little to no advantage over the heat removal barrier system. The system could also be done using a narrow structural slurry wall with the same issues relative to the time and uncertainty in performance as well as also requiring heat removal elements.

Insulating Barrier

Barrier systems that would be non-structural in nature, for example creating a continuous or nearly continuous disruption in the waste mass and filling it with an insulation material, such as a urethane based mineral grout, are technically possible. It should be mentioned that all insulating systems would use some gas entraining method within a cementious matrix and mineral fillers for strength. As such they are all subject to crushing and possess limited shear strengths. Increasing the strength is done at the expense of the insulation quality.

The placement of the material would require a large number of holes be drilled (approximately 200) to depths of greater than 150 foot and filled with a mixture of urethane foam and inert mineral to act as insulation. This would require a greater drilling period than for a structural barrier or a similar slurry excavation period. In addition, the grout is subject to crushing and displacement, making it doubtful that it would remain intact since settlements and subgrade movements would be non-uniform. It is possible that insulating materials could be installed

between or behind structural elements, such as a structural slurry wall with an insulation zone on the warm or cool face. Combining structural and insulating materials complicates the barrier construction, significantly increasing the time. Insertion of insulating panels in the slurry filled trench is not possible given their light weight relative to the slurry. For the depths being considered the buoyancy force per 1 foot wide panel 2 feet thick and 150 foot deep is approximately 8 tons. This would require a steel case approximately 1.25 inches thick fully encasing the foam panel to sink it in the slurry. It also requires panels of this dimension to pre-assembled over the trench and inserted. This is not practically feasible and identifies that insulation construction in the ground would require a second excavation, doubling the time of construction. This would also be true of tangent pile systems.

Conclusions on Barriers

The evaluation of displacements and forces resulting from settlement events occurring at depth and distance from a barrier show the forces generated by structural requirements are significant even when the event is 75 feet away from the wall and with favorable assumptions concerning homogeneity. The barriers of this type can be made wide enough to resist forces but, as noted in the North Quarry Heat Barrier System report (see Sec. 5.4.4) they would take approximately 1 year to construct and would still require heat removal systems to be installed.

Structural systems do not represent thermal barriers as they are made of materials that are no less than 2 to 5 times more conductive than the solid waste. As such, all require heat removal elements that are equivalent to those needed for the system Bridgeton Landfill has already identified as feasible in the North Quarry Heat Barrier System report.

Insulation systems could be constructed but would take significantly more time since they would require a structural component to prevent crushing or the loss of integrity. The increase in construction time is approximately twice the time associated with a structural system.

Thin barrier systems in the end would all rely on some heat removing component to function. Therefore, they do not offer any improvement over the system of heat removal identified in the North Quarry Heat Barrier System report while at the same time increasing the time of construction.

Injection Systems

Bridgeton Landfill is not aware of any injection systems that would have any significant impact on the advance of a heat front. It is our understanding that MDNR is referring to systems that would inject cool inert gasses into the waste, although the request does not provide any reference to the types of systems MDNR would like to consider. Other possible injection materials may include water.

The injection of gasses into the landfill at depth is theoretically possible. However, the injection of gas at depths of interest, 80 to 150 ft or deeper, is problematic. At these depths the average pore spaces in the waste are small, as is evidenced by the specific yield of or drainable porosity dropping to only a few at 60 ft (200kPa) and zero at 120 ft (400 kPa). This is based upon the unit weight of waste. At these low pore space sizes and in the presence of a moist environment,

the liquid within the waste is continuous and injection of gas is controlled by the permeability of waste for a liquid permeant. The permeability of solid waste at vertical stresses of 200 to 400 kPa are reported in the literature to be in the range of the low 1E-6 to 1E-7 cm/sec (Beaven et al ASCE GSP #209, 2008). Under these conditions the rate of injection would be similar to the rate of injection into a clay of water in piezometer, very low. The only method of injection that would yield a significant injection volume would involve hydro-fracture. As hydro-fracturing occurred the gas flow would increase, but only in narrow zones and along unknown pathways. The gas fracturing would propagate upward, as the minor principal stresses would decrease in this direction. Flow would exit at the surface or possibly be collected partially in nearby wells. If a significant number of wells in an area were to be injected simultaneously along a line or within a limited area, the fracture systems would likely combine and increase the gas flow within a limited fracture system.

The cooling impact of gas is limited to the heat capacity of gas injected. For example CO_2 has a heat capacity of approximately 860 joules per kilogram per degree K. Across the narrow of the quarry this would require injecting approximately 550 to 1000 cu ft per minute equivalent scfm of gas continuously just to hold the temperature constant at 130 degrees or 100,000 to 180,000 lbs per day of gas, depending on the heat flux rate assumed. This is not a feasible method for controlling temperatures.

There are no reported uses of inert gas in landfills other than at fires that are quite shallow (less than 50 feet) and isolated in nature. There is no evidence that such injections could occur at the depths at issue here. Further, if it were possible to inject that amount of dry gas through the waste it would dehydrate the existing waste creating a dry waste mass and conditions that are favorable to combustion, presenting an additional risk not currently present.

Since there is currently no evidence of free oxygen at depth, the only possible purpose of gas injection is to remove heat. This is much more efficiently accomplished by the proposed heat barrier system presented in the North Quarry Heat Barrier System report.

Other Possible Location Actions

Bridgeton Landfill has evaluated other possible actions that may be taken to prevent the heat SSE from advancing into the areas where the radioactive materials have been documented at above background levels. The studies that have been performed for the West Lake facility have identified a southern limit of where no radioactive material above background was found. Excavation of waste south of this limit to create an isolation barrier was evaluated on a conceptual basis. The results of the evaluation are described subsequently.

Conceptual Barrier Types at the North Limits of the North Quarry Fill

The barrier types at the North Limits of the North Quarry Fill for the isolation barrier all involve the removal of waste material and replacement with inert materials to the base of the waste. The removal methods considered included: open excavation without support; partial open excavation down to within 15 feet of the bottom of waste where a digging box could be used to finish the waste removal; and a slurry wall excavation with vertical sides to the bottom of waste.

The inert material would consist of earthen, cementious backfill. All barrier systems would include the installation of heat removing devices that would prevent elevated temperatures from passing through the barrier. All open excavations at the North Limits of the North Quarry Fill would be backfilled to near existing grade so that drainage patterns could be maintained.

With the exception of the slurry wall sections, a significant portion of the excavated waste is placed back in the excavation area, with the inert barrier on the north side. This significantly reduces the amount of material that will have to be taken off site which should improve the construction time for the operation, while having no impact on the performance of the barrier.

Excavation Location and Quantities

The approximate bottom of waste materials was estimated by our Consultants utilizing results of the WL series borings from the West Lake Area 1 evaluation, along with the quarry mapping dated 1979 provided by Aquaterra. The depth to waste varies in the area with location and ground surface elevation. The approximate bottom of waste and quarry bottom contours are depicted in Drawing C-0, along with the ground surface base and WL boring locations. This information demonstrates that the average depth to the bottom of waste materials is between 25 to 70 feet in the area of interest, as opposed to more than 200 feet at the quarry narrow point to the south. This decreased excavation depth allows for faster construction time, and minimizes the volume of excavated materials, which is relevant to concerns raised by the Airport Authority regarding the excavation of waste materials.

In general the thickness of waste material is lower the further north the excavation is. However, it is critical to ensure that the extent of the excavation can occur outside the boundary previously identified as having no radiological material. Along the east side the quarry bottom is encountered and the waste becomes deeper as the quarry deepens and the existing grades increase. This places practical limits on moving the barrier to the south to increase the buffer from waste that contains radioactive materials above background levels. Therefore, it is beneficial to insert the barrier as far north as possible without encountering radioactive materials.

Excavations on the shallow side (north) were assumed to be at 1H:1V, for open excavations down to the bottom of waste. This temporary slope of limited depth is considered safe for short periods. The longer excavations on the south, where possible leachate seepage may be encountered were assigned a 1.5H:1V slope.

When a digging box was assumed to be used, the slopes on both sides of the excavation were assumed to be 1.5H:1V to reflect the fact that the excavation and backfilling would require more personnel time outside the excavation vehicles and the free open areas at the bottom of the excavation would be of limited size. The digging box was assumed to have a minimum width of 4 feet.

Slurry wall excavations were assumed to be near vertical.

Three alignments for excavation were analyzed as part of the work. They are shown in plan and profile views on drawing C-0 through C-4.

The excavation volumes are summarized below.

Alignment	Excavation Section	Volume of Excavation
		(cubic yards)
NE-1	Open Excavation to Waste Bottom	140,600
NE-1	Excavation with 15 ft Digging box	97,300
NE-2	Excavation with 15 ft Digging box to Sta 6+00 then Slurry wall to end (Sta 11+39)	38900 of which 4000 is within slurry wall
NE-3	Excavation with 15 ft Digging Box	119,000
NE-3	Open Excavation to Waste Bottom	180,750

As can be seen on drawings C-2 through C-4 the NE-1 alignment resulted in some incursion beyond the southern limit of the defined non-radiological area. Alignment NE-2 is essentially the same as NE-1 but curves were introduced to allow slurry wall type construction. The limits of the slurry wall section were selected to maintain a significant buffer from the aforementioned southern limit (approximately 50 foot). No assessment of the other options was made along this alignment. However the volume associated with open cut to waste to Sta. 6+00 is 66,600 yd^3 so the total would be 70,000 if the open excavation and slurry wall combination were chosen along NE-2.

The NE-3 alignment provides a minimum buffer of 40 feet from the southern limit and the option with the 15 foot digging box reduces the minimum buffer to approximately 20 feet.

Engineering Features of the Possible Barriers at the North Limits of the North Quarry Fill

The open excavation with and without the digging box utilize earth or cementious backfill materials to create a non-combustible barrier. The thermal isolation is provided by the heat extraction system that is installed as the backfill material is placed and possibly drilled in once the barrier is finished. Because the proposed backfills are inclined against the north side of the excavation or cementious at the base, they do not have stability issues associated with settlement of the waste on the south side. Backfilling the entire system to grade removes surface water management and long term stability issues.

The slurry wall sections can be designed assuming complete elimination of material support on the south side. The placement of permanent anchorage into the upper section of the barrier wall and pinning some amount of reinforcing tendons into the underlying bedrock or alluvium allows a stable wall section to be made. The wall sections could be done in panels using standard slurry panel construction techniques but with weaker concrete and low levels of reinforcement. Thicker wall sections are imagined (approximately 10 feet) to create a better thermal mass and to

counteract stresses. Calculations at this conceptual stage have shown that stability can be achieved for a 65 foot high wall with no waste on the south side.

Conclusions Concerning Barrier Feasibility at the North Limits of the North Quarry Fill

All of these options are technically feasible, within the confines of the airport easements and covenants and are quickly implemented for odor and vector control, but would require further definition and approval/agreement of parties involved at the Bridgeton Landfill or with whom the Bridgeton Landfill has pre-existing agreements.

It should be noted that at the present time the heat front is more than 1200 feet south of the closest point along the limit of excavation depicted in Drawing C-4. At current rates of progress, even if it were assumed that the heat even would migrate into the North Quarry, this distance would require more than 7 years for the heat front to traverse.

In order to monitor any movement of an SSE heat front across the north quarry, a continued system of TMPs could be deployed. The final set of TMPS that would trigger the start of construction of this barrier north of the north quarry should be selected at a distance approximately one year away from the limit of excavation on the south side. This would be a sufficient distance for completion of construction. The location of this is dependent on the rate of front advance and whether or not it appears to be increasing in rate of slowing, all of which can be observed through on-going monitoring of settlement and temperature monitoring. .

It should be pointed out that if the SSE follows the current pattern of development, and as witnessed at other hydrogen gas producing site, it will not spread to the shallower portions of the fill to the west. It is also possible the SSE would not be able to supply heat sufficiently after the fill elevations drop to below 480 feet to the northwest side, given the fill depth is only heat losses occur along the top and bottom surfaces with an average width of quarry of only 200 feet.

An agreed upon location where gas well temperatures would exceed 170 °F measured at the well head or TMP temperatures would exceed 185 °F could be determined based on the history of movement that would be observable in the monitoring systems along with overall heat balance considerations and collected hydrogen amounts. Because gas monitoring wells are already present within the North Quarry and because TMPs may be installed quickly, the monitoring systems can continue to be expanded as appropriate if the reaction reaches the North Quarry.

A work plan has been prepared that identifies the steps for designing permitting and procuring the contractors needed for the barrierwork at the North Limits of the North Quarry Fill. The plan is provided in Attachment A. Included in the plan are steps to identify permitting issues, fully define the bottom of waste along proposed alignment areas, verification of the absence of radioactive materials in the excavation areas, and documentation of liquid levels along the proposed alignment areas. The outline contains a listing of all tasks.

The time to perform the work as outlined is dependent on several triggers but should be able to be completed in approximately 3 months, following agreement to proceed, to finished documents for procurement purposes. The intended field work is likely to consist of use of piezocone

soundings coupled with gamma detectors as opposed to borings in order to confirm that the locations for excavation are not impacted by radiological materials above background.

In addition to the field work associated with the design and construction of the barrier system at the North Limits of the North Quarry Fill, settlement monitoring data would be gathered at grid locations across the northern quarry zone to represent baseline elevation data. Baseline hydrogen content readings should be obtained from gas wells in the northern area also to identify any SSE activity in the area north of the entry to the north quarry section. In the event that isolated hydrogen generation is detected, it may be appropriate to install heat removal systems, like the gas interceptor well system, in the area to prevent the initiation of larger events.

Conclusion

In conclusion, Bridgeton Landfill, LLC continues to develop and refine contingency strategies to ensure that the radiologically impacted materials in the West Lake OU-1 are not impacted by the SSE. While we agree with MDNR that this evaluation is of critical importance, the available data indicates that more monitoring and study is appropriate before undertaking the invasive work of any barrier system.

It should be pointed out that if the SSE follows the current pattern of development, and as witnessed at other hydrogen gas producing site, it will not spread to the shallower portions of the fill to the west. It is also possible the SSE would not be able to supply heat sufficiently after the fill elevations drop to below 480 to the northwest side, given the fill depth is only heat losses occur along the top and bottom surfaces with an average width of quarry of only 200 feet.

Further, even if the current rate of migration is presumed toward the radiologically impacted material, , it would take seven years to reach the outer limit of the proposed barrier system at the North Limits of the North Quarry Fill, several hundred feet outside the radiologically impacted materials.

It is clear that there is sufficient time to gather results from the monitoring systems in place and improve upon our collective understanding of the SSE's extent and impact, while evaluating the effect of the interceptor well system.

If you have any questions or comments regarding this Letter Report, please contact me at 314-744-8195 or calmanza@republicservices.com.

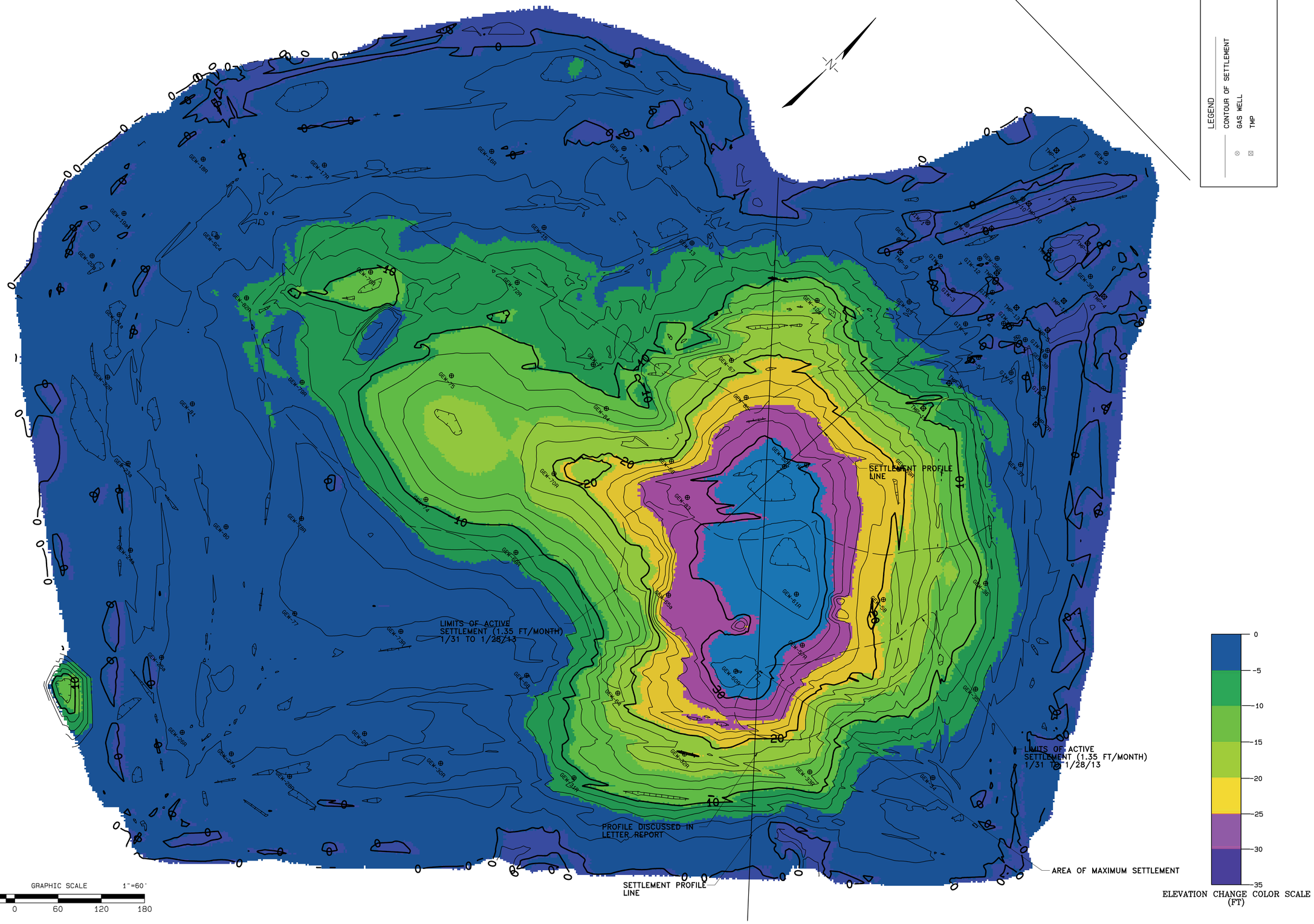
Sincerely,

Craig Almanza
Area Environmental Manager
Bridgeton Landfill, LLC

Attachment A – Scope of Work
Enclosures:

- Drawing 1 – Zone of accelerated settlement
- Drawing 2 – Surface elevation change
- Hydrogen Data Map February 2013
- Average Temperature Plots (TMP 2, 5, 6, 7, 8, 9)
- Drawing C0-C5 – Plan and profile views

Attachment A



REVISION	DATE
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P. J. CAREY & ASSOCIATES, P.C.
5979 VALINE WAY, SUGAR HILL, GA. 30518

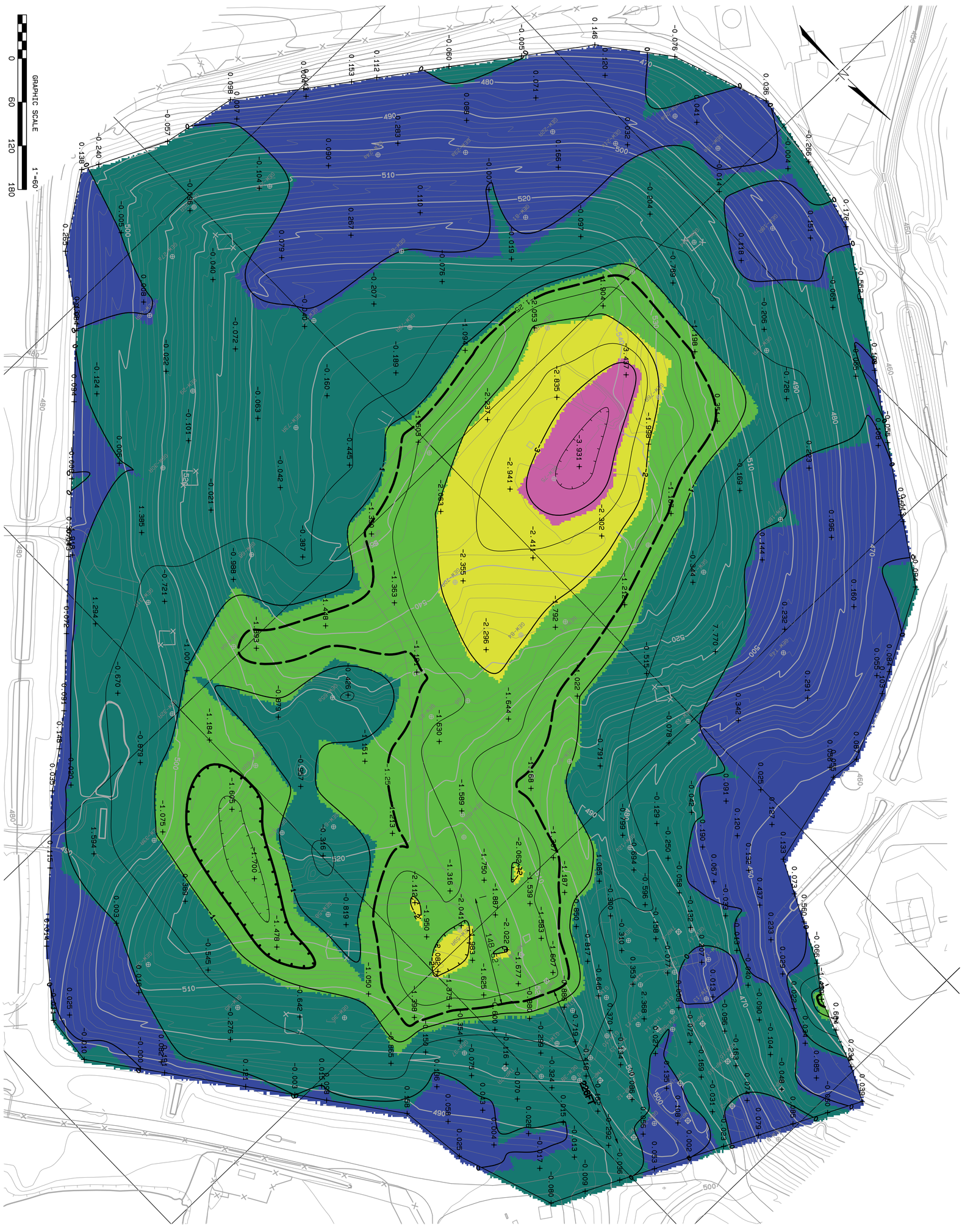
PROJ. NO.: project no
DATE: 3/29/2013
DESIGNED BY: PJC
DRAWN BY: PJC/KLCH
CHECKED BY: PJC
APPROVED BY: PJC

SETTLEMENT 3/2011 TO 2/13/13

BRIDGETON LANDFILL BRIDGETON, MO.

DRAWING 1

SHEET 1 OF 1



ELEVATION CHANGE COLOR SCALE (FT)

COUNTOUR AT -1.25 FT IS SHOWN AS APPROXIMATE BOUNDARY OF SETTLEMENT FRONT AS OF 2/28/2013

GENERAL NOTES

TOPOGRAPHY SHOWN BASED ON PHOTOGRAPHY DATED 2-23-2013

SETTLEMENT NOTES

CONTOURS ARE OF CHANGE IN ELEVATION FROM 1-31-2013 TO 2-28 & 3-1 2013 PERFORMED AT GRID POINTS USING GPS METHODS

POINTS HAVING POSITIVE ELEVATION CHANGES >0.3 FT WERE EXCLUDED FROM CONTOURING AS THEY REFLECT SOIL PLACEMENT

SETTLEMENT IS REPORTED AS A NEGATIVE CHANGE IN ELEVATION

LEGEND

- EXISTING TOPOGRAPHIC CONTOUR
- GAS WELL
- TMP
- SETTLEMENT GRID SURVEY POINT

BRIDGETON LANDFILL
SETTLEMONITORING

PLOT OF ELEVATION CHANGE BETWEEN 1/31/13 & 2/28/13

PROJ. NO.: 179.002
DATE: 3/29/2013
DESIGNED BY: PJC
DRAWN BY: PJC/KLCH
CHECKED BY: PJC
APPROVED BY: PJC

P. J. CAREY & ASSOCIATES, P.C.
5079 VALINE WAY, SUGAR HILL, GA. 30518

REVISION	DATE
1	
2	
3	
4	
5	

BRIDGETON LANDFILL, LLC

SHEET 2 OF 3
DRAWING

LEGEND

= Well Location

Hydrogen

		<	10%
	10	<	20%
	20	<	30%
	30	<	40%
		>	40%

NOTES:

Hydrogen represents the laboratory reported concentration for samples collected during the month.

Only points monitored during the report period show data.

PEW-60
GEW-01
GEW-03
GEW-02
GEW-04
GEW-05
LCS-6B
GEW-46R
GEW-48
GEW-47R
GEW-45R
T-56
GEW-06
GEW-49
GEW-50
GEW-44
GEW-51
GEW-52
LCS-5A
GEW-43R
GEW-53
GEW-07
GEW-54
GEW-42R
GEW-08
GEW-41R
GEW-55
GEW-09
GEW-40
GEW-10
GEW-39
GEW-56R
GEW-109
GEW-38
GEW-11
GEW-91
LCS-1D
GEW-37
GEW-63
GEW-12A
GEW-90
GEW-59R
GEW-14A
GEW-13
GEW-36
GEW-106
GEW-67
GEW-85
GEW-62R
GEW-16R
GEW-15
GEW-58
GEW-35
GEW-72R
GEW-71
GEW-66
GEW-61R
GEW-34
GEW-57R
LCS-4B
GEW-57B
GEW-17R
GEW-84
GEW-83
GEW-70R
GEW-65A
GEW-60R
GEW-33R
GEW-18B
GEW-18R
GEW-76R
GEW-75
LCS-3C
GEW-82R
GEW-79R
GEW-64
GEW-32R
GEW-19A
GEW-74
GEW-69R
GEW-68
GEW-31R
GEW-81
GEW-78R
GEW-73R
GEW-20A
GEW-21A
GEW-80
GEW-77
GEW-30R
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GEW-27A
GEW-26R

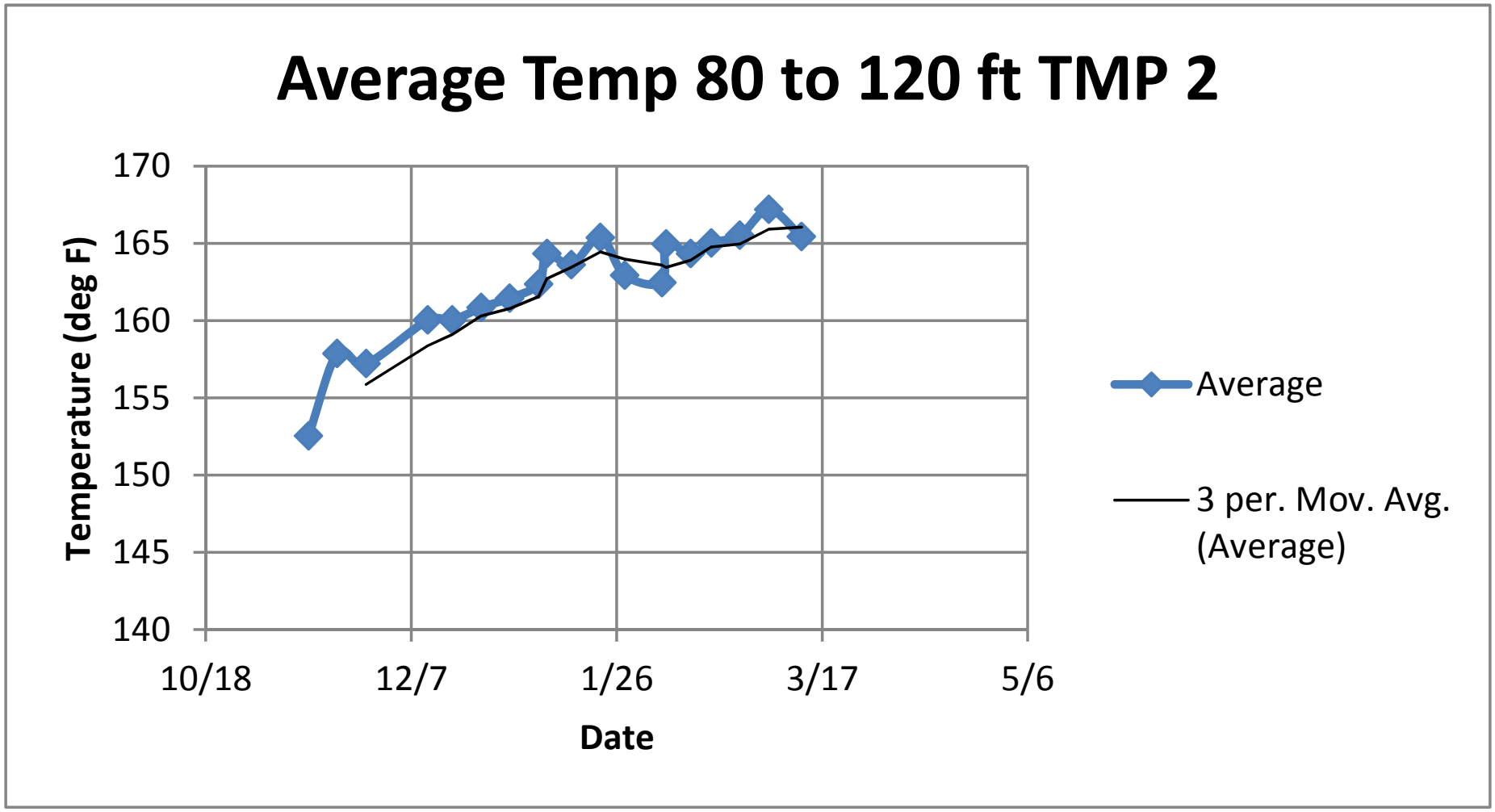
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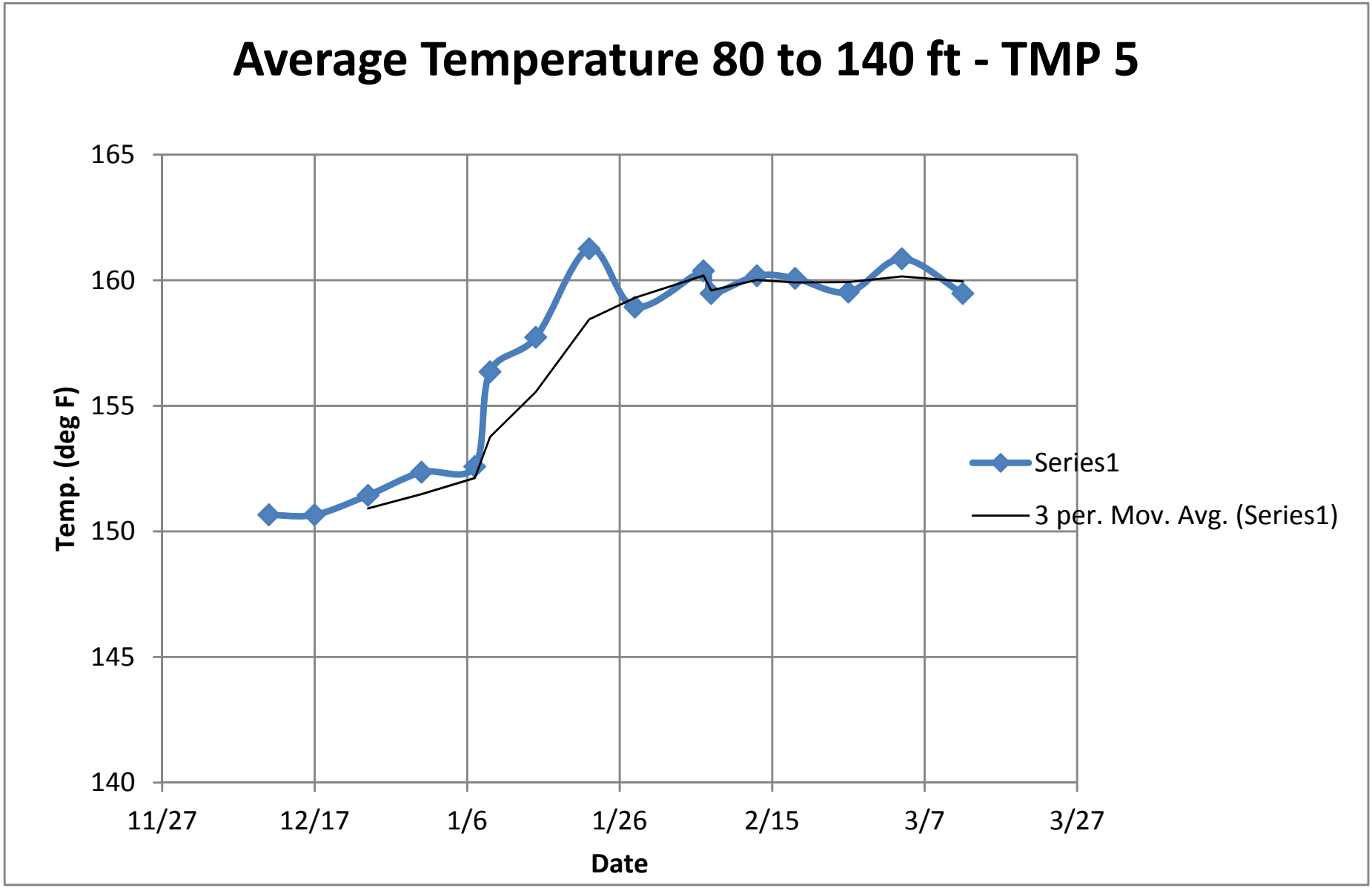
1 inch = 70 meters

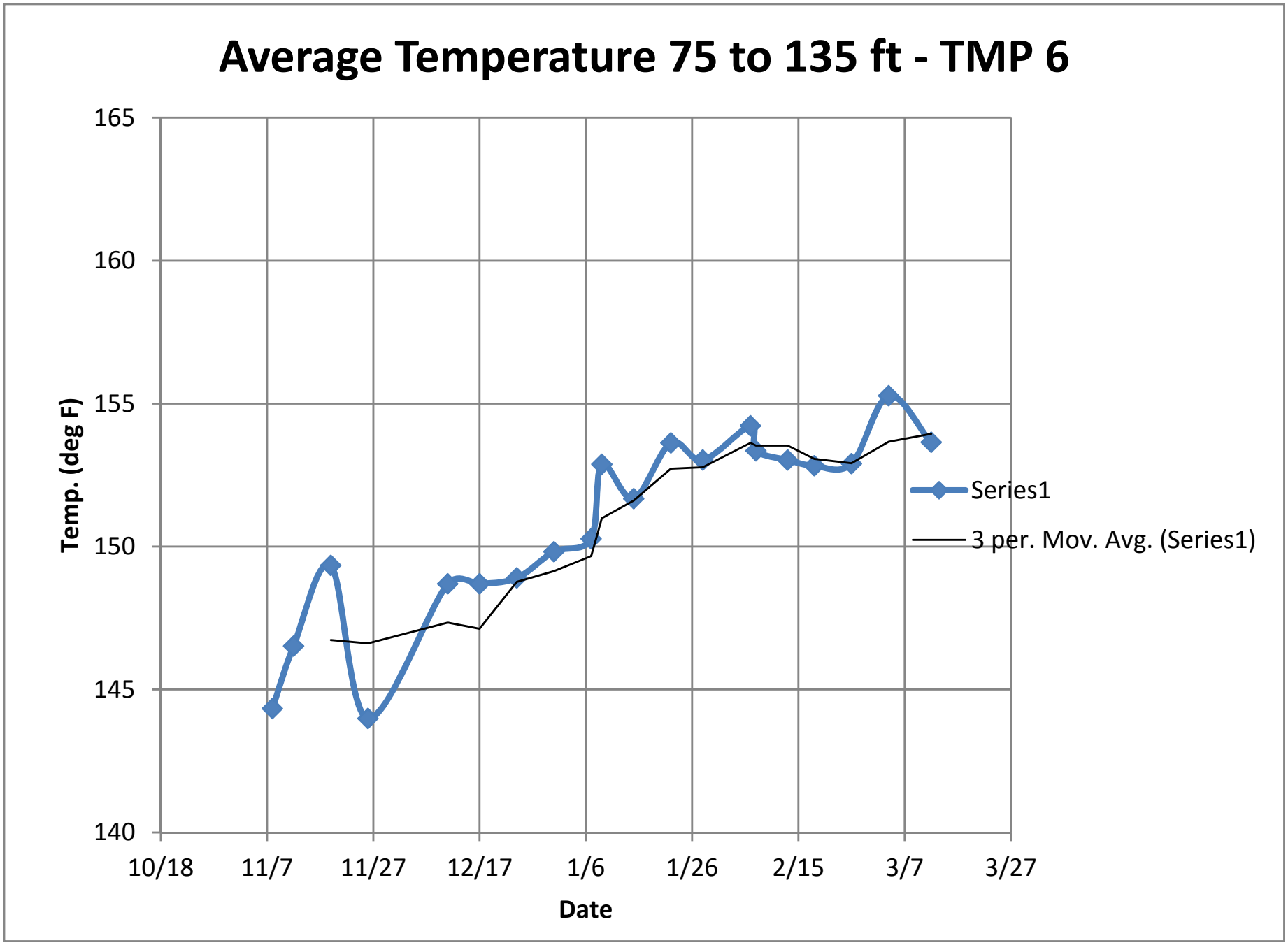
0 35 70 105 140

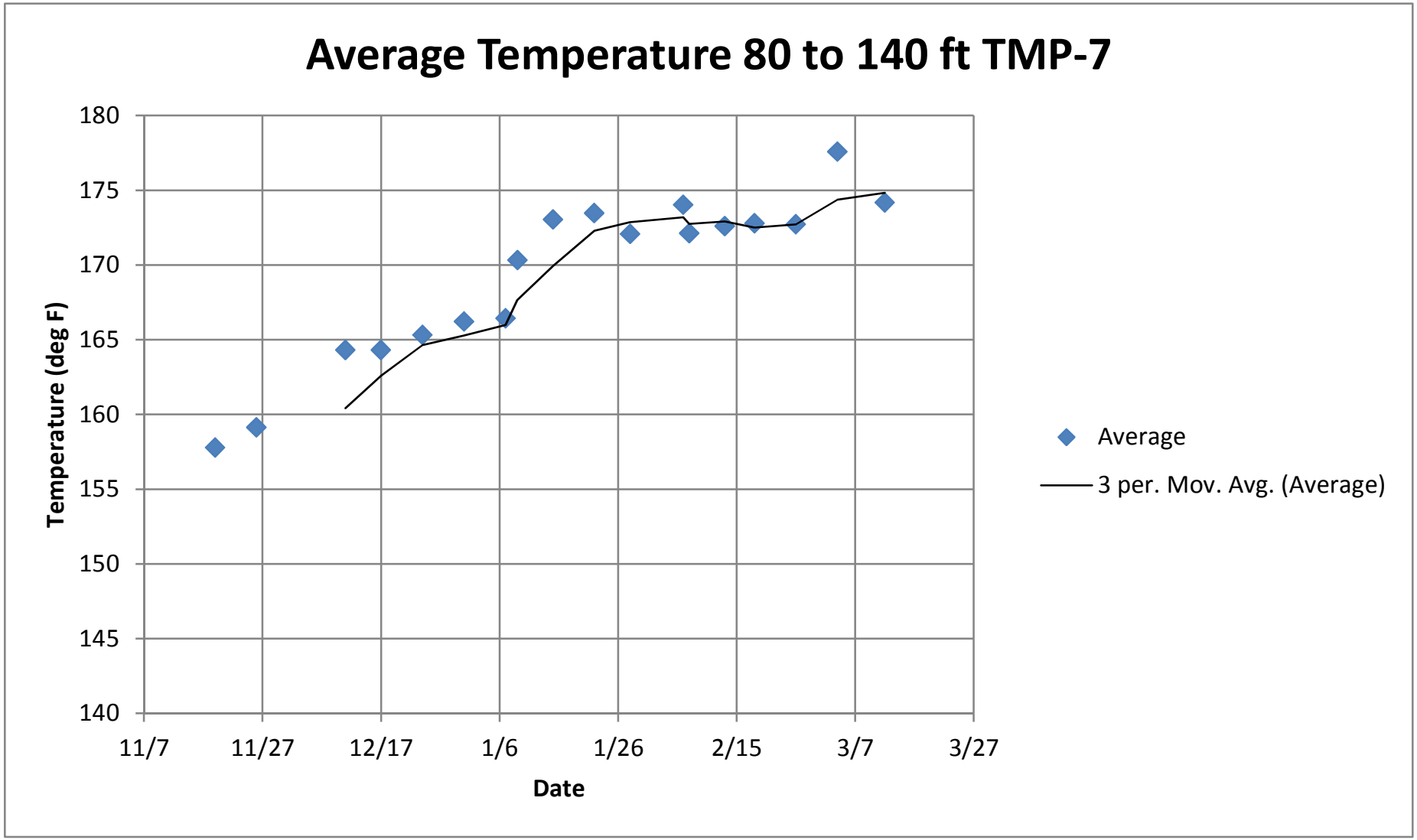
Hydrogen Data Map - February 2013 - Bridgeton Landfill

SCS ENGINEERS

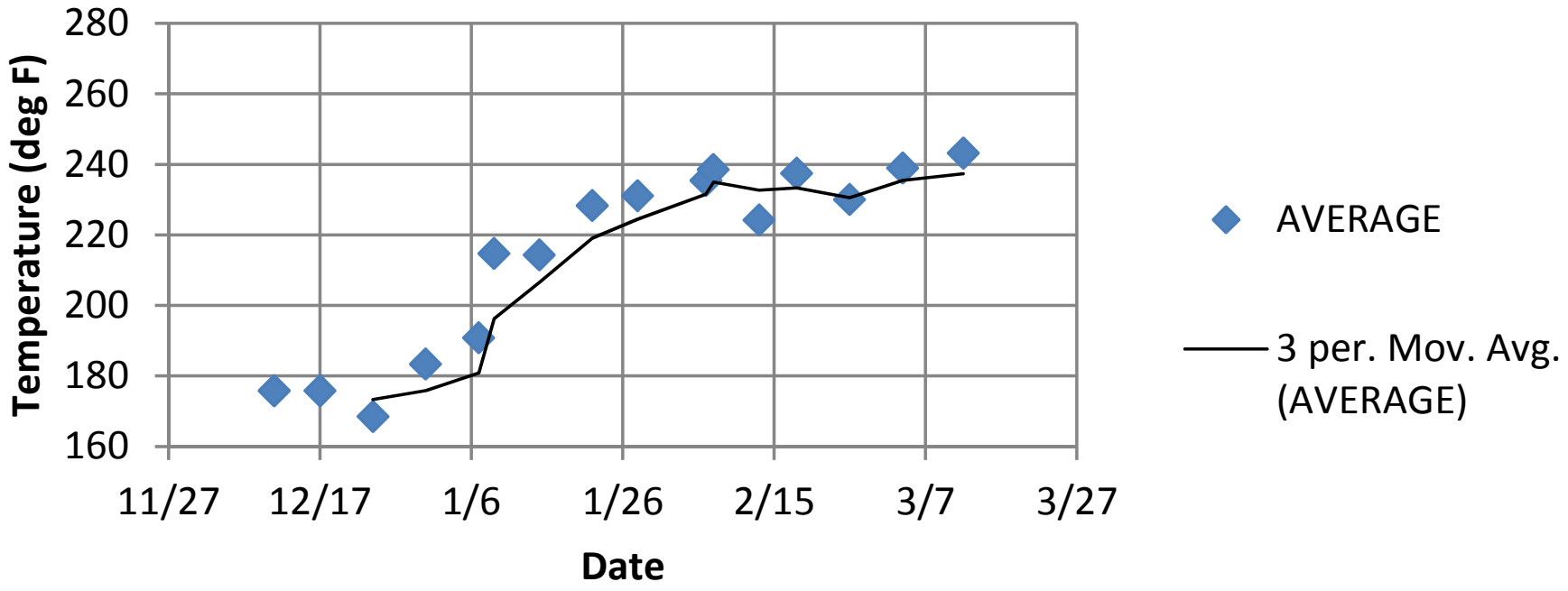

Average Temp 80 to 120 ft TMP 2
Temperature (deg F)
170
165
160
155
150
145
140
10/18
12/7
1/26
3/17
5/6
Date
Average
3 per. Mov. Avg. (Average)

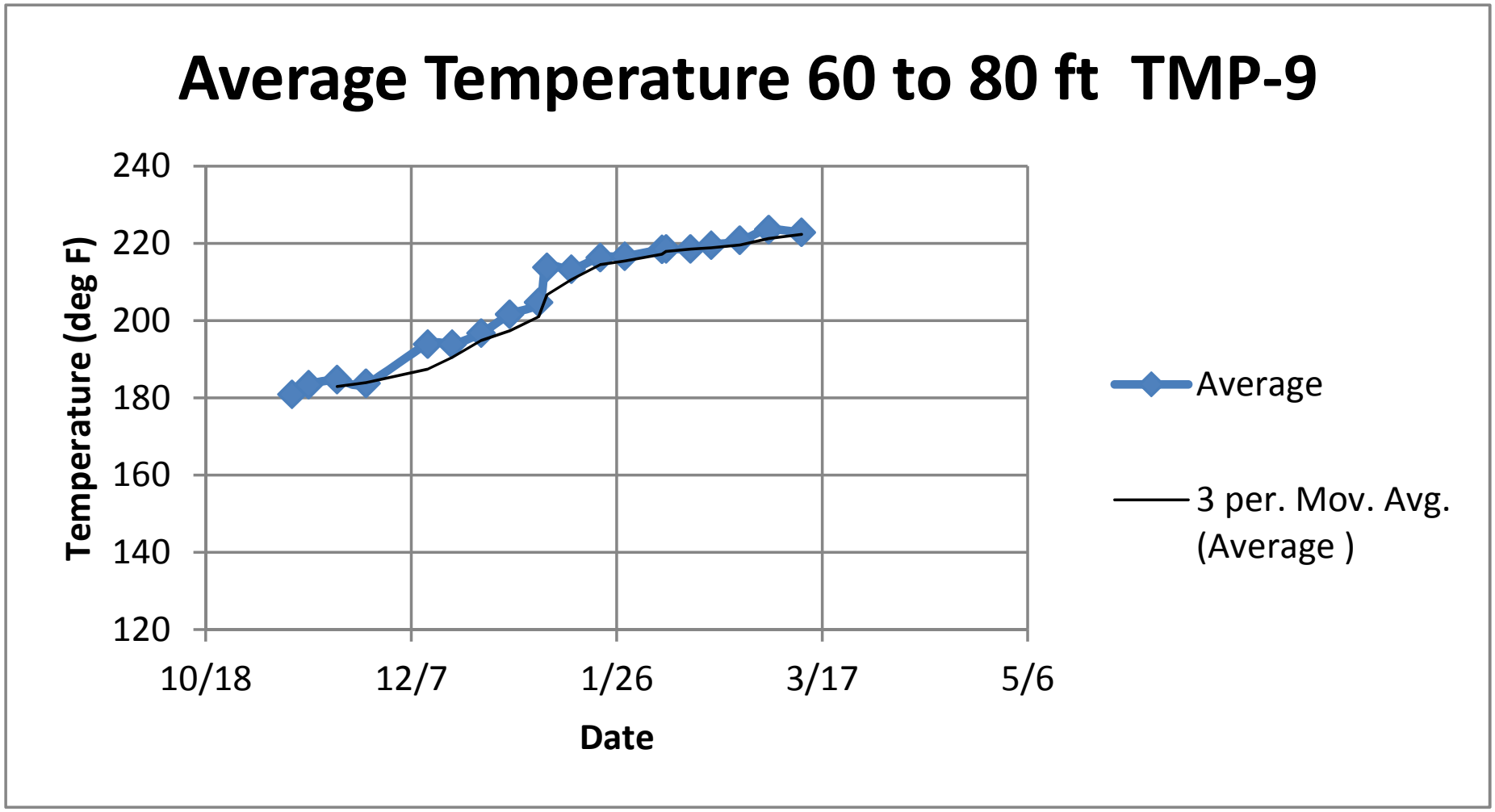

Average Temperature 80 to 140 ft - TMP 5
165
160
155
150
145
140
Temp. (deg F)
11/27
12/17
1/6
1/26
2/15
3/7
3/27
Date
Series1
3 per. Mov. Avg. (Series1)


Average Temperature 75 to 135 ft - TMP 6
165
160
155
150
145
140
Temp. (deg F)
10/18
11/7
11/27
12/17
1/6
1/26
2/15
3/7
3/27
Date
Series1
3 per. Mov. Avg. (Series1)


Average Temperature 80 to 140 ft TMP-7
Temperature (deg F)
180
175
170
165
160
155
150
145
140
11/7
11/27
12/17
1/6
1/26
2/15
3/7
3/27
Date
Average
3 per. Mov. Avg. (Average)

Average Temperature 80 to 120 ft TMP-8




Average Temperature 60 to 80 ft TMP-9
240
220
200
180
160
140
120
Temperature (deg F)
10/18
12/7
1/26
3/17
5/6
Date
Average
3 per. Mov. Avg. (Average)

AREA 1 LIMITS (RAD AREA) Based on Non-RIM Limit
from 004 page 241(pdf page)
Area 1-RIM 2 Development
Draft Supplemental Feasibilty Study
dated 7-23-2010 by EMS Inc.

439.50 WL-101
424.50 WL-113
WL-118
428.30 WL-114
429.60 WL-112
438.80 WL-106A
WL-106
434.90 WL-115
439.80 WL-102
430.60 WL-117
441.41 QBOTTOM
411.11 QBOTTOM
424.50 WL-111
439.43 QBOTTOM
398.98 QBOTTOM
409.46 QBOTTOM
435.70
436.00 WL-105C
437.20 WL-105B
WL-105A
Limit of RAD area generally
shown the Draft Feasibility Study
WL-108
ALIGNMENT N-1
WL-116
425.04 QBOTTOM
ALIGNMENT N-2
404.14 QBOTTOM
433.40 WL-119
ALIGNMENT N-3
415.20 QBOTTOM
421.95 QBOTTOM
435.90 WL-109C
429.50 WL-109D 109B
386.11 QBOTTOM
435.10 WL-107
1122.00
434.41 WL-110
433.02 QBOTTOM
445.73 QBOTTOM
440
435.00 EST PT
436.00 EST POINT
436.00 EST PT
444.86 QBOTTOM

QUARRY BOTTOM
CONTOURS BASED ON
1979 TOPO (FROM AQUATERRA)
(10 FT INCREMENTS)

LEGEND

- EXISTING GROUND CONTOUR
- QUARRY BOTTOM BASED ON '79 MAPPING
- ESTIMATED BOTTOM OF WASTE
- BOTTOM OF WASTE OBSERVATIONS OR ESTIMATES

ELEVATION → 430.00 ⊙
OBSERVATION NAME → WL-115

BRIDGETON LANDI
BRIDGETON, MC

DATE
REVISION
1 2 3 4 5

P. J. CAREY & ASSOCIATES, P.C.
5979 VALINE WAY, SUGAR HILL, GA. 30518

PROJ. NO.: Set by PAUINFO command 4
DATE: 3/28/2013
DESIGNED BY:
DRAWN BY:
CHECKED BY: PAUCHK 6
APPROVED BY: PAUCHK 7

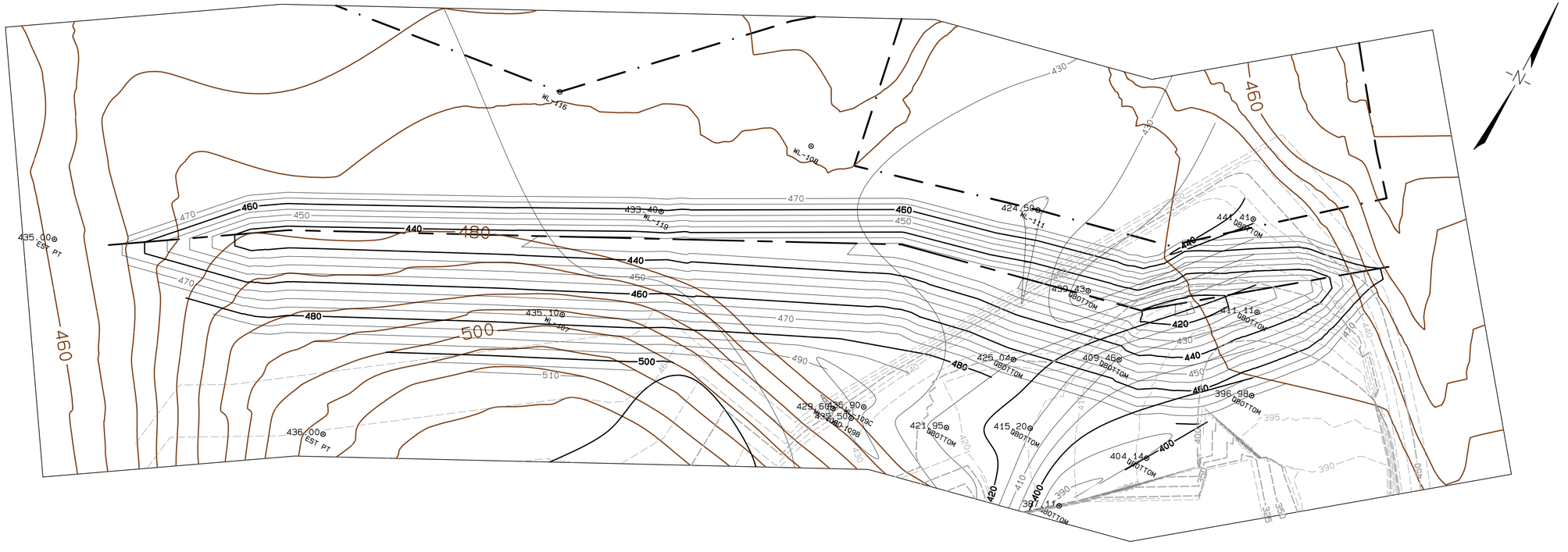
NORTH BARRIER CONCEPT
PLAN VIEW

NORTH QUARRY BARRIER
CONCEPTUAL PLANNING
BRIDGETON LF

DRAWING
C-0

SHEET 1
OF 5

Project Desc.: Path: N:\RAD\Barrier\bridgeton hbarrier1.prg Plot Date/Time: Thu Mar 28,2013 / 15:47:00



EXCAVATION QUANTITY FOR GRADING SHOWN
IS 140,600 CU YDS

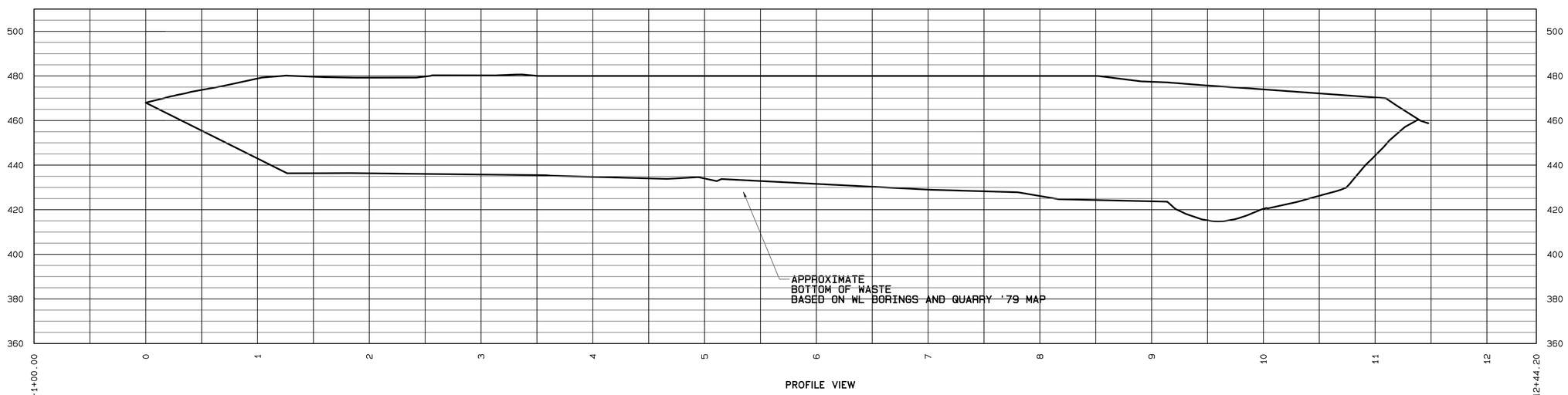
ALIGNMENT N-1

PLAN VIEW

Scale: 1" = 50'

GRAPHIC SCALE 1"=50'

0 50 100 150



PROFILE VIEW

Horz. Scale: 1" = 50'

EXCAVATION TO BOTTOM
OF WASTE, 1.5:1 ON SOUTH
1:1 ON NORTH, 1.5:1 ON SOUTH

NORTH QUARRY BARRIER
CONCEPTUAL PLANNING
BRIDGETON LF

BRIDGETON LANDI
BRIDGETON, MC

DATE
REVISION
1 2 3 4 5

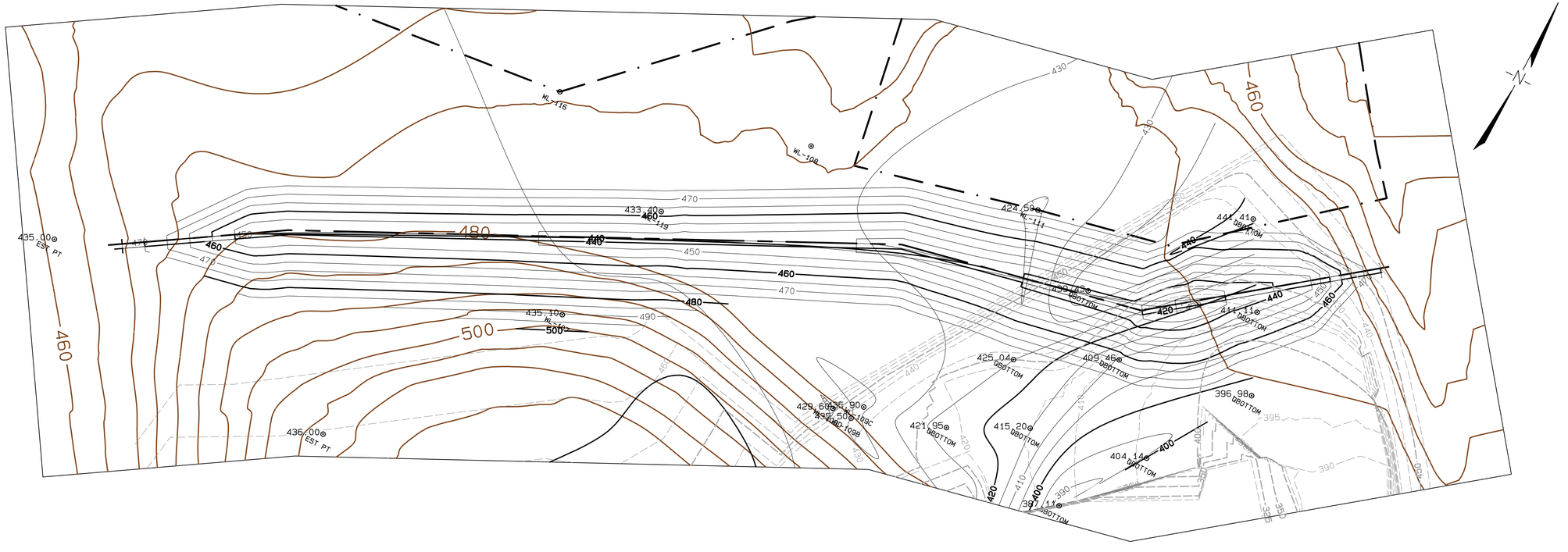
P. J. CAREY & ASSOCIATES, P.C.
5878 VALINE WAY, SUGAR HILL, GA. 30518

PROJ. NO.: Set by PRJINFO command 4
DATE: 3/28/2013
DESIGNED BY:
DRAWN BY:
CHECKED BY: PRJCLNT 6
APPROVED BY: PRJCLNT 7

DRAWING
C-1

SHEET 2
OF 5

Project Desc.: Path: N:\RAD\Barrier\bridgeton nbarrier1.pro Plot Date/Time: Thu Mar 28,2013 / 15:47:25



ALIGNMENT N-1

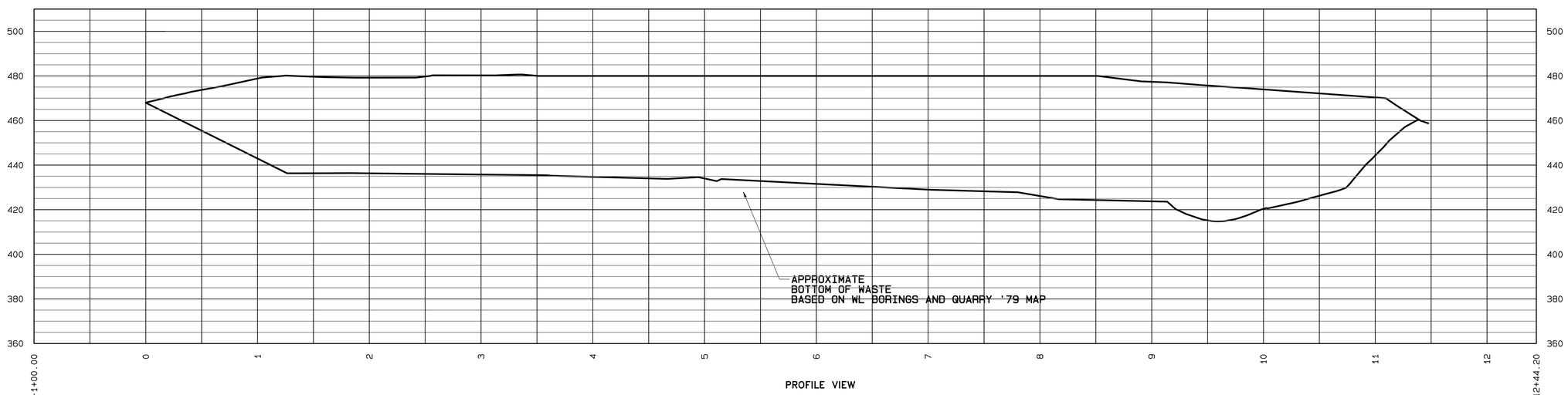
PLAN VIEW

Scale: 1" = 50'

GRAPHIC SCALE 1"=50'

0 50 100 150

EXCAVATION QUANTITY FOR GRADING SHOWN
IS 97,300 CU YDS



PROFILE VIEW

Horz. Scale: 1" = 50'

BRIDGETON LANDI
BRIDGETON, MO

DATE

REVISION

1 2 3 4 5

P. J. CAREY & ASSOCIATES, P.C.
5878 VALINE MKT. SUGAR HILL, GA. 30518

PROJ NO.: Set by PRJINFO command 4
DATE: 3/28/2013
DESIGNED BY:
DRAWN BY:
CHECKED BY: PRJCLNT 6
APPROVED BY: PRJCLNT 7

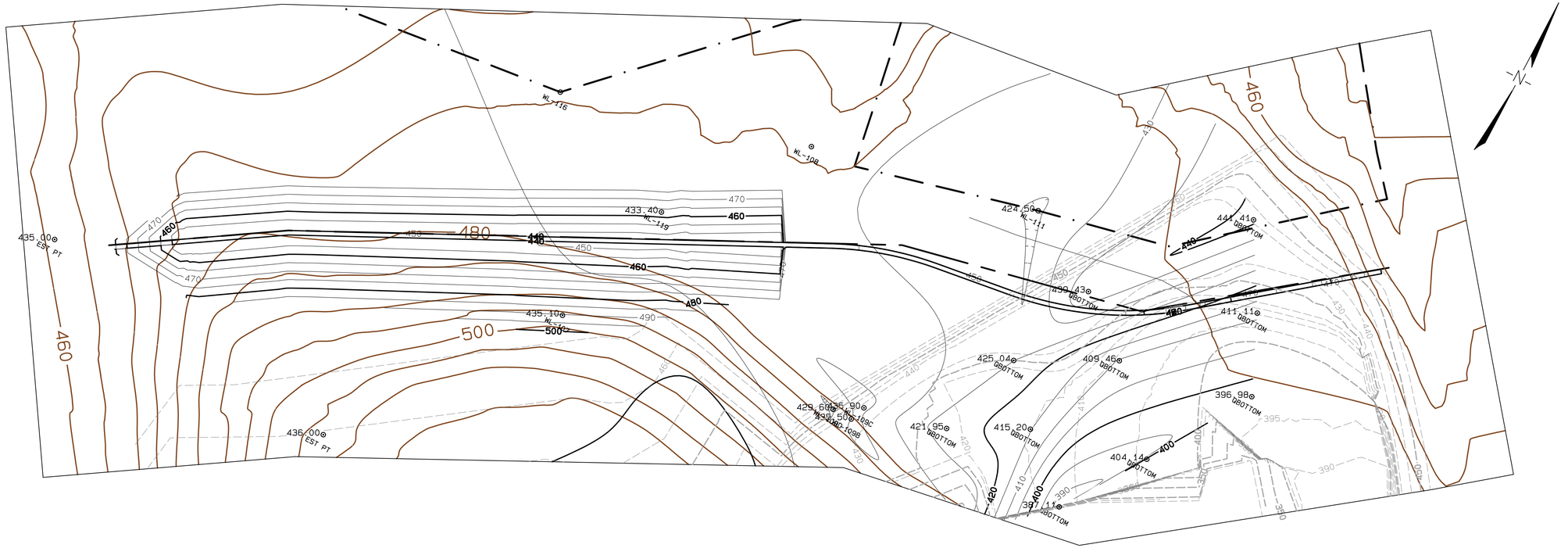
EXCAVATION ON N-1
USING 15 FT D. BOX
1.5:1 SLOPES

NORTH QUARRY BARRIER
CONCEPTUAL PLANNING
BRIDGETON LF

DRAWING
C-2

SHEET 3
OF 5

Project Desc.: Path: N:\RAD\Barrier\bridgeton nbarrier1.pro Plot Date/Time: Thu Mar 28,2013 / 15:47:32



ALIGNMENT N-2

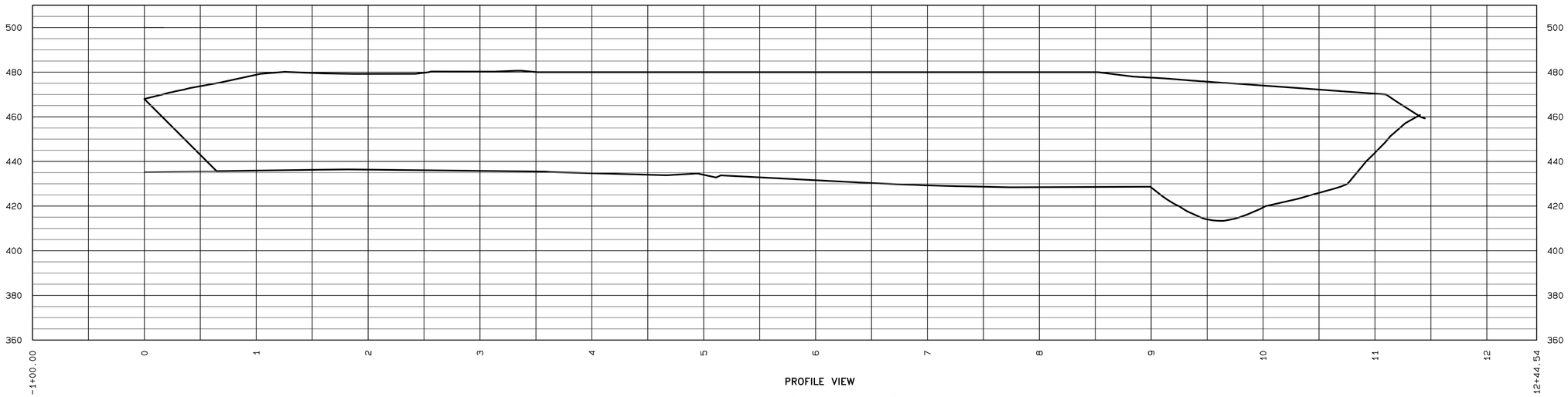
EXCAVATION QUANTITY FOR GRADING SHOWN
IS 38,900 CU YDS

PLAN VIEW

Scale: 1" = 50'

GRAPHIC SCALE 1"=50'

0 50 100 150



PROFILE VIEW

Horz. Scale: 1" = 50'

Project Desc.: Path: N:\RADWBarrier\Bridgeton hbarrier1.prg Plot Date/Time: Thu Mar 28,2013 / 15:47:41

BRIDGETON LANDI
BRIDGETON, MO

REVISION	DATE
1	
2	
3	
4	
5	

P. J. CAREY & ASSOCIATES, P.C.
5979 VALINE WAY, SUGAR HILL, GA. 30518

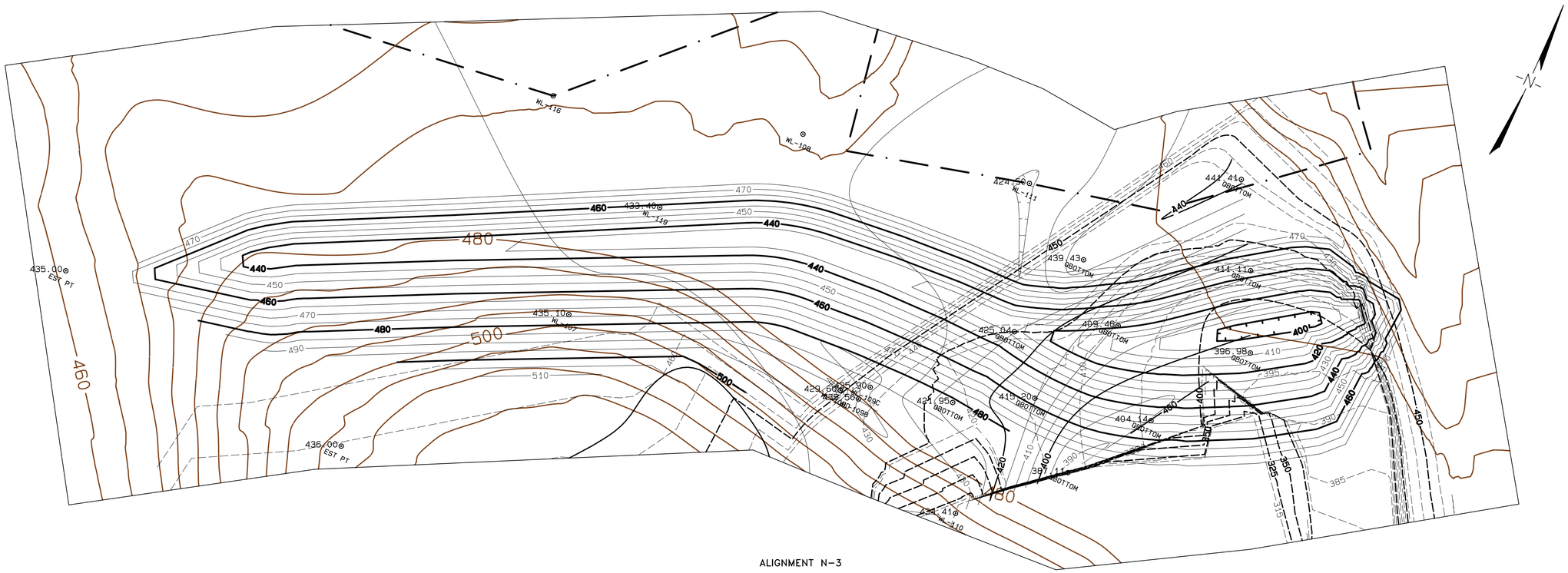
PROJ. NO.: Set by PRJINFO command 4
DATE: 3/28/2013
DESIGNED BY:
DRAWN BY:
CHECKED BY: PRJCHK 6
APPROVED BY: PRJCHK 7

EXCAVATION TO BOTTOM
OF WASTE
USING 15 FT D.BOX TO STA 6
THEN SLURRY WALL

NORTH QUARRY BARRIER
CONCEPTUAL PLANNING
BRIDGETON LF

DRAWING
C-3

SHEET 4
OF 6



ALIGNMENT N-3

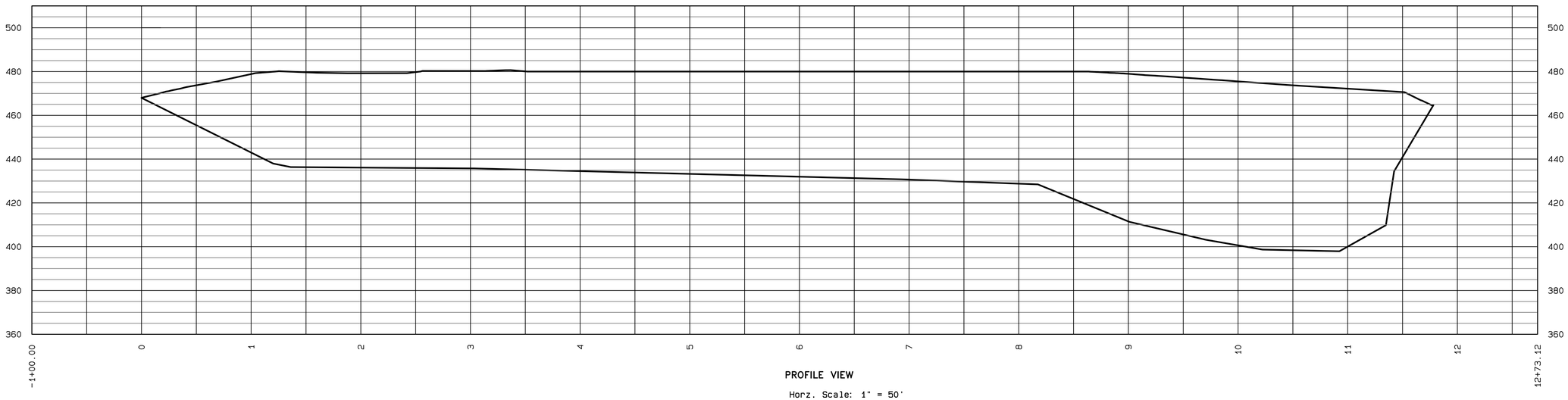
PLAN VIEW

Scale: 1" = 50'

GRAPHIC SCALE 1"=50'

0 50 100 150

EXCAVATION QUANTITY FOR GRADING SHOWN
IS 180,750 CU YDS



PROFILE VIEW

Horz. Scale: 1" = 50'

EXCAVATION N-3
1:1 ON NORTH
1.5:1 ON SOUTH

NORTH QUARRY BARRIER
CONCEPTUAL PLANNING
BRIDGETON LF

DRAWING
C-4

SHEET
OF 5

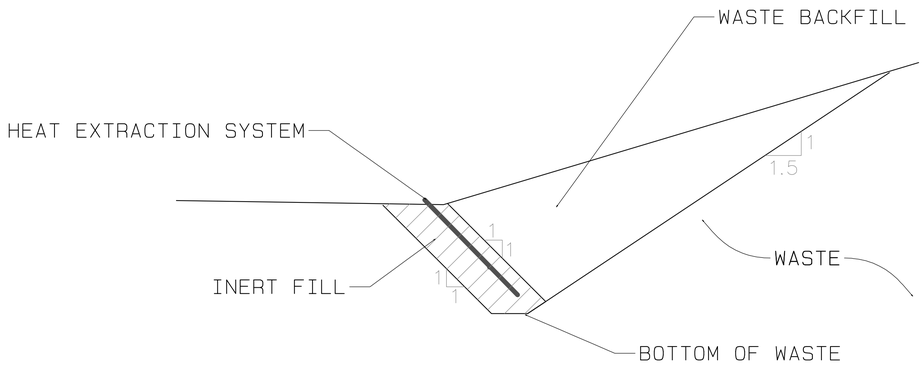
BRIDGETON LANDI
BRIDGETON, MO

REVISION | DATE
1 2 3 4 5

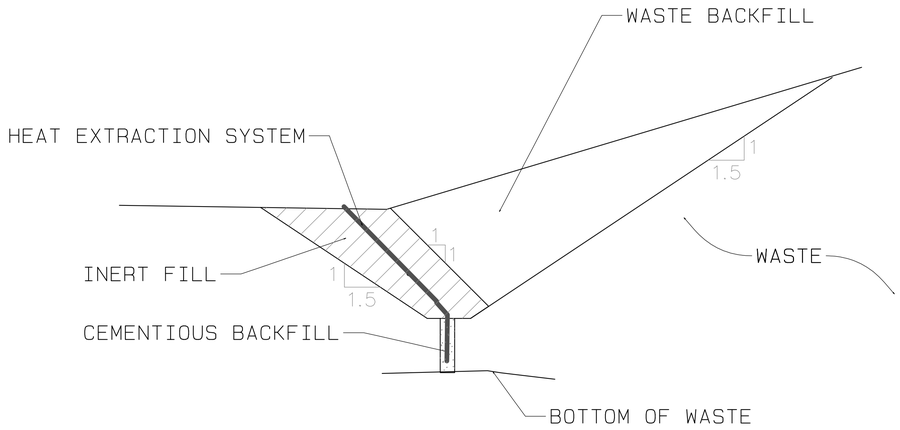
P. J. CAREY & ASSOCIATES, P.C.
5979 VALINE WAY, SUGAR HILL, GA. 30518

PROJ. NO.: Set by PRJINFO command 4
DATE: 3/28/2013
DESIGNED BY:
DRAWN BY:
CHECKED BY: PRJCLNT 6
APPROVED BY: PRJCLNT 7

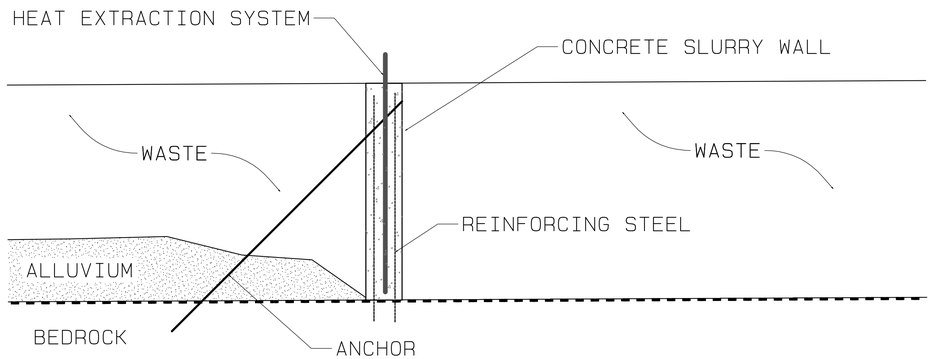
Project Desc.:
Path: N:\RADNBarrier\Bridgeton nbarrier1.pro Plot Date/Time: Thu Mar 28,2013 / 15:47:48



OPEN EXCAVATION



OPEN EXCAVATION
WITH 15 FOOT TRENCH BOX



SLURRY WALL
AT MAXIMUM DEPTH

BRIDGETON LANDI
BRIDGETON, MC

DATE

REVISION

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P. J. CAREY & ASSOCIATES, P.C.
5878 VALINE WAY, SUGAR HILL, GA. 30518

PROJ. NO.: Set by PAJINFO command 4
DATE: 3/28/2013
DESIGNED BY:
DRAWN BY:
CHECKED BY: PAJCLNT 6
APPROVED BY: PAJCLNT 7

CONCEPTUAL
CROSS SECTIONS

NORTH QUARRY BARRIER
CONCEPTUAL PLANNING
BRIDGETON LF

DRAWING
C-5

SHEET 6
OF 6

Project Desc.: Path: N:\PAJMsBarrier\bridgeton hbarrier1.prg Plot Date/Time: Thu Mar 28,2013 / 15:47:55

Work Plan for the Barrier at the North Limits of the North Quarry Fill

1 Tasks

1.1 Preliminary Layout and Concept

1.2 Confirmation of No Rad Waste in Excavation Area –

1.2.1 Evaluate current knowledge base

1.2.2 Determine if added information is needed to insure no RIM is encountered in the excavation

1.2.3 Develop plan (if required) for Gathering Supplemental RIM information

1.2.4 Perform Supplemental RIM Identification Field Work (if needed)

1.2.5 Finalize southernmost Limits of RIM waste to use for project

1.2.6 Perform any Field work needed to finalize concept (borings, test pits etc)

1.3 Finalization of Alignment and Concept

1.3.1 Modify Alignment and Concept to Avoid All RAD waste

1.3.1.1 Adjust alignment and slopes/excavation methods as required

1.3.1.2 Identify locations for access, staging and stormwater management

1.3.1.3 Deposition of waste materials (on site of off site)

1.3.1.4 Identification of permits required and time frames needed for approvals from regulatory agencies

1.3.2 Obtain Approval of Finalized Concept

1.4 Detailed Design

1.4.1 Preliminary Design Work

1.4.1.1 Develop design details for anticipated support system on NE end of work

1.4.1.2 Develop sequence of operations

1.4.1.3 Stormwater management integration for temporary excavation work

1.4.1.4 Air(dust and odor) management practices

1.4.1.5 Decon Area requirements

1.4.1.6 Heat Exchange System and Earthen fill requirements

1.4.1.7 Excavated waste disposition

1.4.1.8 Preparation of permit packages if needed

1.4.2 Final Design

1.4.2.1 Plans clearly identifying work need

1.4.2.2 Finalize Analyses

1.4.2.3 Finalize Monitoring and QA/QC requirements

1.4.2.4 Complete permit application packages

1.5 Construction Package Development

1.5.1 Plans

1.5.2 Specifications

1.5.3 Quantities

1.5.4 Bid Documents

APPENDIX B

EXCERPTS FROM DRAWINGS OF EXISTING MITIGATIVE MEASURES

NOTES:

1. EXISTING GRADE CONTOURS OBTAINED FROM THE FOLLOWING SOURCES:
   - 1.1. AERIAL SURVEY COMPLETED BY THE SANBORN MAPPING COMPANY ON JULY 20, 2011; AND
   - 1.2. TOPOGRAPHIC SURVEYS COMPLETED BY AQUATERRA ENVIRONMENTAL SOLUTIONS ON AUGUST 7, 2012, NOVEMBER 1, 2012, AND NOVEMBER 15, 2012.
2. THE LOCATION OF LANDFILL GAS COLLECTION AND CONTROL SYSTEM COMPONENTS ARE BASED ON ONGOING SURVEYS COMPLETED BY AQUATERRA, WHERE AVAILABLE, AND APPROXIMATE OTHERWISE.
3. CONSTRUCTED COMPONENT TYPES, DIMENSIONS AND LOCATIONS ARE BASED ON AS-BUILT INFORMATION, WHERE AVAILABLE, AND APPROXIMATE OTHERWISE.
4. THE LOCATION OF THE 118912R WASTE BOUNDARY OBTAINED FROM "WASTE LIMITS INVESTIGATION SUMMARY REPORT", AQUATERRA ENVIRONMENTAL SOLUTIONS, INC. DATED AUGUST 29, 2011.

LEGEND:

- 320 — EXISTING 10' CONTOURS
- BUILDING OR STRUCTURE
- FENCE
- POWER POLE
- BOLLARDS
- GUY POLE
- ELECTRIC BOX/PANEL
- TREE LINE
- PAVED ROAD
- UNPAVED ROAD
- ABOVEGROUND LFG COLLECTION PIPE
- UNDERGROUND LFG COLLECTION PIPE
- GEW-34 — LFG COLLECTION WELL
- GEW-2 — LFG DUAL EXTRACTION WELL
- GEW-100 — 2013 LFG EXTRACTION WELL
- GIW-12 — 2013 LFG INTERCEPTOR WELL
- PERIMETER LFG COLLECTION PIPE
- PGW-1 — PERIMETER LFG COLLECTION WELL
- CT-4 — CONDENSATE SUMP
- VALVE
- MAIN VALVE
- AIR LINE
- CONDENSATE FORCEMAIN
- COMBINED AIR & FORCEMAIN
- HZ-2 — HORIZONTAL COLLECTION SUMP
- LCS-6B — LEACHATE COLLECTION SUMP
- LCP — LEACHATE COLLECTION PIPE
- LEACHATE DISCHARGE
- GMP-8 — LFG MONITORING PROBE
- GMP-12 — PUBLIC SAFETY MON. PROBE
- TMP-1 — TEMPORARY LFG MONITORING PROBE
- TMP-1 — THERMOCOUPLE MONITORING PROBE
- PZ-204-SS — GROUNDWATER WELL
- UE — ELECTRIC LINE
- GAS — GAS LINE
- #006 — STORMWATER OUTFALL
- SC-2 — SURFACE COLLECTOR
- OL-1 — OVER LINER TIE-IN POINT
- WB-1 — WELL BORE BOOT
- PL-1 — PERIMETER LINE COLLECTION
- CLEANOUT
- TS #1 — TRENCH SUMP
- IT-1 — INTERCEPTION TRENCH WELL
- PERIMETER SWALE GATE VALVE
- INTERCEPTION TRENCH
- GEOMEMBRANE
- 118912R PERMIT BOUNDARY
- BUBBLE SUCKER
- PL — PROPERTY LINE
- GAS — GAS LINE

ABANDONED LCP LINE
FRAC TANK AREA
118912R PERMIT BOUNDARY
ABANDONED LCP LINE
FRAC TANK AREA
FRAC TANK AREA
NEW LEACHATE TANK
ABANDONED 6" LCP LINE
FLARE
APEX SUMP

SCALE: 1" = 100'
0 50' 100' 200'

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WEAVER BOOS CONSULTANTS

1834 A WALLACE DRIVE
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CHICAGO, IL
CLEARWATER, FL
DENVER, CO
FORT WORTH, TX
GRAND RAPIDS, MI
KNOXVILLE, TN
SYRACUSE, NY

REVISION DESCRIPTION
DATE
No.

PREPARED FOR
REPUBLIC SERVICES, INC.

SITE LAYOUT
GCCS LOCATIONS
BRIDGETON LANDFILL, LLC

REUSE OF DOCUM
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DESIGNED BY:
REVIEWED BY:
DATE: 05/1
FILE: 0120-13
BLD000011 (9) 05181

SHEET 1

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EXISTING ZINK FLARE

EXISTING CALLIDUS FLARE

PROPOSED 18" PIPING

PROPOSED 18" PIPING

PROPOSED 63" ø KNOCKOUT POT

PROPOSED 20" PIPING

PROPOSED 18" PIPING

PROPOSED 20" PIPING

INSTALL NEW 20" TEE

NEW 16" UTILITY FLARE

RELOCATED LIQUID SEAL

FLOW METER

NEW 16" UTILITY FLARE

RELOCATED LIQUID SEAL

PROPANE TANK

PROPANE TANK

30 30 30

480 481 482 483 484 485 479 478

10 0 5 10 20 30

SCALE: 1"=10'

N

REV.	DATE	DESCRIPTION	CK. BY

SHEET TITLE
PROPOSED FLARE AND PIPING LAYOUT

PROJECT TITLE
BRIDGETON LANDFILL
2013 BLOWER/FLARE STATION MODIFICATIONS

CLIENT:
BRIDGETON LANDFILL, LLC.
13570 ST. CHARLES ROCK ROAD
BRIDGETON, MO 63044

SCS ENGINEERS
STEARNS, CONRAD AND SCHMIDT
CONSULTING ENGINEERS, INC.
2060 READING ROAD, SUITE #200, CINCINNATI, OHIO 45202
PH: (513) 421-5353 FAX NO. (513) 421-2847

PROJ. NO. 23211003.01
DSN. BY: FDB
DWN. BY: FDB
CHK. BY: CES/MSB
O/A RVW BY: MSB

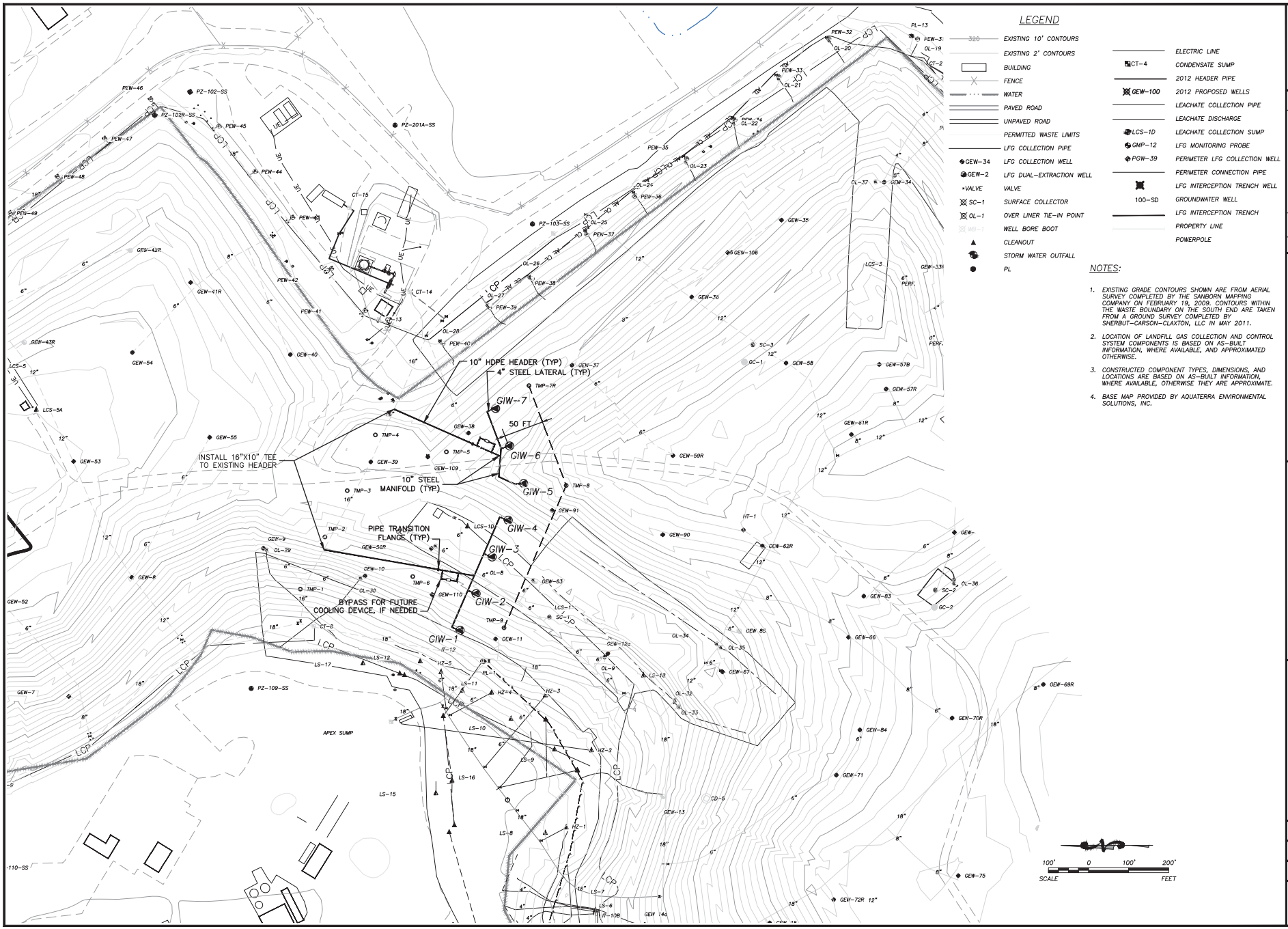
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AS-BUILTS V2

DATE:
6/4/13

SCALE:
AS SHOWN

DRAWING NO.
5 of 12

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REV.	DATE	DESCRIPTION	CK. BY

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PROJECT TITLE: BRIDGETON LANDFILL 2013 GAS INTERCEPTOR WELL DESIGN

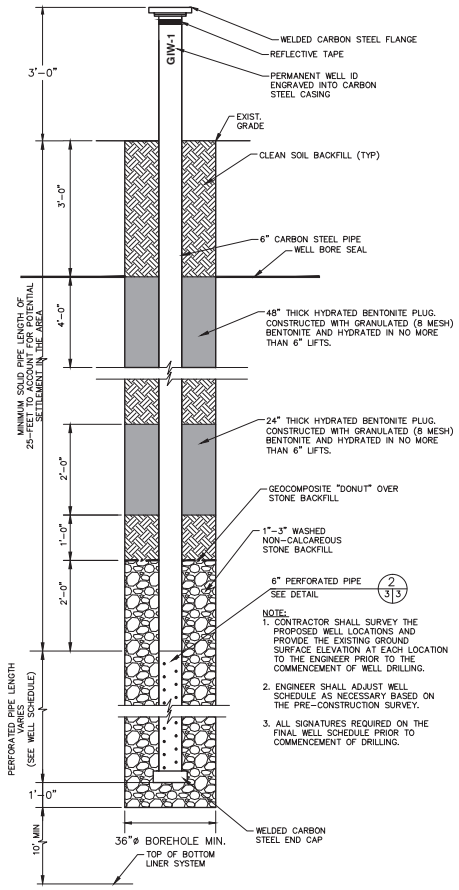
CLIENT: BRIDGETON LANDFILL, LLC
BRIDGETON LANDFILL
13570 ST. CHARLES ROCK ROAD
BRIDGETON, MO 63044

SCS ENGINEERS
STEARNS, CONRAD AND SCHMIDT
CONSULTING ENGINEERS, INC.
CONSULTING ENGINEERS, 2000 CRESCENT DRIVE, SUITE 2000, FAIRFIELD, OHIO 45202
PH. (513) 421-5353 FAX NO. (513) 421-2847

PROJ. NO. 23211003.00 | DWN. BY: FDB | CK'D BY: DAE
SSK TEE: FDB | CHK. BY: JJW

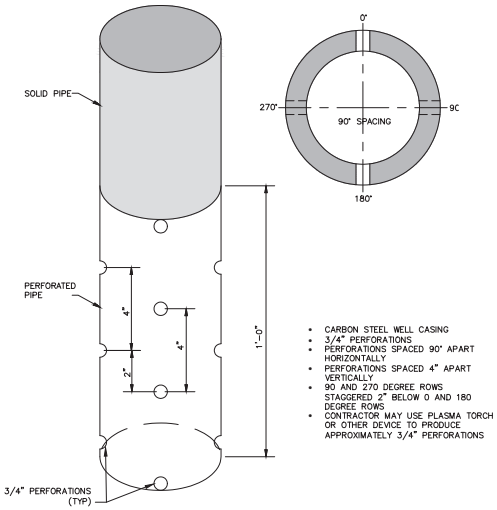
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SCALE: AS SHOWN
DRAWING NO. 2 of 3

C:\WORK\23211003.BRIDGETON LF ENG ASSISTANCE\DELIVERABLES-REPORTS\INTERCEPTOR WELLS\SITE MAP 1-9-13.DWG



NOTE:
1. CARBON STEEL WELL SECTIONS CAN BE CONNECTED USING OUTSIDE THREADED COUPLERS, OR WELDED STEEL FLANGES.

GAS INTERCEPTOR WELL DETAIL 1/2|3
NOT TO SCALE



- CARBON STEEL WELL CASING
- 3/4" PERFORATIONS
- PERFORATIONS SPACED 90° APART HORIZONTALLY
- PERFORATIONS SPACED 4" APART VERTICALLY
- 90 AND 270 DEGREE ROWS STAGGERED 2" BELOW 0 AND 180 DEGREE ROWS
- CONTRACTOR MAY USE PLASMA TORCH OR OTHER DEVICE TO PRODUCE APPROXIMATELY 3/4" PERFORATIONS

PERFORATION DETAIL 2/3|3
NOT TO SCALE

WELL SCHEDULE

LANDFILL GAS COLLECTION SYSTEM
WELL FIELD SCHEDULE

Well No.	Location Coordinates N-S	Location Coordinates E-W	Surface Elevation (ft MSL)	Waste Bottom Elevation (ft MSL)	Landfill Depth (ft)	Borehole Depth (ft)	Well Pipe Depth (ft)	Slotted Pipe Depth (ft)	Solid Pipe Depth (ft)	Above Grade Riser (ft)	Thickness of Gravel Pack (ft)
GW-1	1,067,752	516,216	477.4	420.4	57	57	56	31	25	5	34
GW-2	1,067,732	516,261	490.6	280.0	211	150	149	124	25	5	127
GW-3	1,067,712	516,307	495.9	275.9	220	150	149	124	25	5	127
GW-4	1,067,692	516,353	501.1	276.2	231	150	149	124	25	5	127
GW-5	1,067,672	516,399	511.8	270.0	242	150	149	124	25	5	127
GW-6	1,067,690	516,446	510.0	270.0	240	150	149	124	25	5	127
GW-7	1,067,707	516,493	501.9	329.1	173	150	149	124	25	5	127
Total						957	950	775	175	35	796

NOTES:

1. THIS DRAFT WELL SCHEDULE IS NOT INTENDED FOR CONSTRUCTION UNTIL ACTUAL SURVEY DATA IS OBTAINED AND THE WELL SCHEDULE IS REVISED BY THE ENGINEER.
2. SURVEYOR SHALL LOCATE WELLS AND VERIFY SURFACE ELEVATIONS BEFORE CONSTRUCTION. A PRE-CONSTRUCTION SURVEY (NORTHING/EASTING/ELEVATION DATA) SHALL BE PROVIDED TO THE ENGINEER A MINIMUM OF 2 WEEKS PRIOR TO CONSTRUCTION. ENGINEER SHALL VERIFY THE WELL SCHEDULE BASED ON THE PRE-CONSTRUCTION SURVEY.
3. FOLLOWING REVIEW OF SURVEY DATA, CONTRACTOR SHALL GET AUTHORIZATION FROM OWNER AND ENGINEER PRIOR TO DRILLING.
4. WELL DEPTHS BASED ON TOPOGRAPHIC SURVEYED BY SHERBERT-CARSON-CLAXTON, DATED MAY 2011, AND BASE GRADES OBTAINED FROM MIDWEST ENVIRONMENTAL CONSULTANTS APRIL 1998 LANDFILL GAS RECOVERY SYSTEM DESIGN.

DESIGN FIRM QA/QC REVIEWER ACKNOWLEDGEMENT: _____ DATE _____

DESIGN FIRM PROJECT MANAGER ACKNOWLEDGEMENT: _____ DATE _____

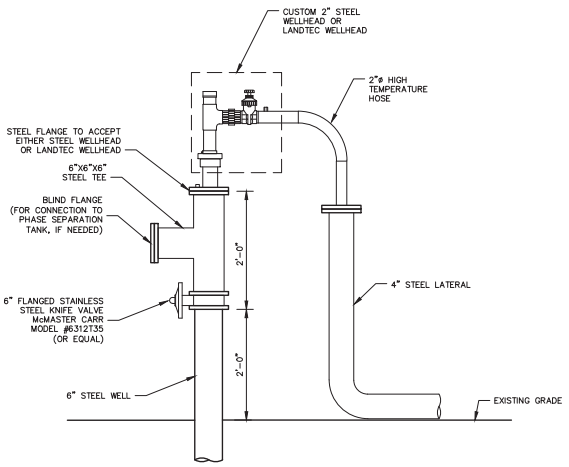
ENVIRONMENTAL MANAGER: _____ DATE _____

CQA INSPECTOR: _____ DATE _____

SURVEYOR ACKNOWLEDGEMENT: _____ DATE _____

DRILLER ACKNOWLEDGEMENT: _____ DATE _____

UNDER NO CIRCUMSTANCES SHALL DRILLING ACTIVITIES BEGIN WITHOUT PROVIDING THE ABOVE SIGNATURES. ANY CHANGES TO WELL LOCATIONS OR DEPTHS SHALL REQUIRE THESE SIGNATURES TO BE OBTAINED AGAIN.



WELLHEAD DETAIL 3/3|3
NOT TO SCALE

REV.	DATE	DESCRIPTION	OK. BY
1	7/27/13	RESPONSE TO MDNR COMMENTS	

SHEET TITLE: CARBON STEEL INTERCEPTOR WELL DETAILS

PROJECT TITLE: BRIDGETON LANDFILL
2013 GAS INTERCEPTOR WELL DESIGN

CLIENT:
BRIDGETON LANDFILL, LLC.
BRIDGETON LANDFILL
13570 ST. CHARLES ROCK ROAD
BRIDGETON, MO 63044

SCS ENGINEERS
STEARNS, CONRAD AND SCHMIDT
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2200 SYCAMORE ROAD, SUITE 100, DUBLIN, OHIO 43202
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PROJ. NO. 23211003.00 | DWN. BY: FDB | CHK. BY: JJW | QA/QC BY: DAE
DSK. BY: FDB

CADD FILE: SHEET 3

DATE: 1/10/2013

SCALE: NONE

DRAWING NO. 3 of 3

C:\WORK\23211003 BRIDGETON LF ENG ASSISTANCE\DELIVERABLES-REPORTS\INTERCEPTOR WELLS\SHEET 3 - DETAILS 01-09-13.DWG

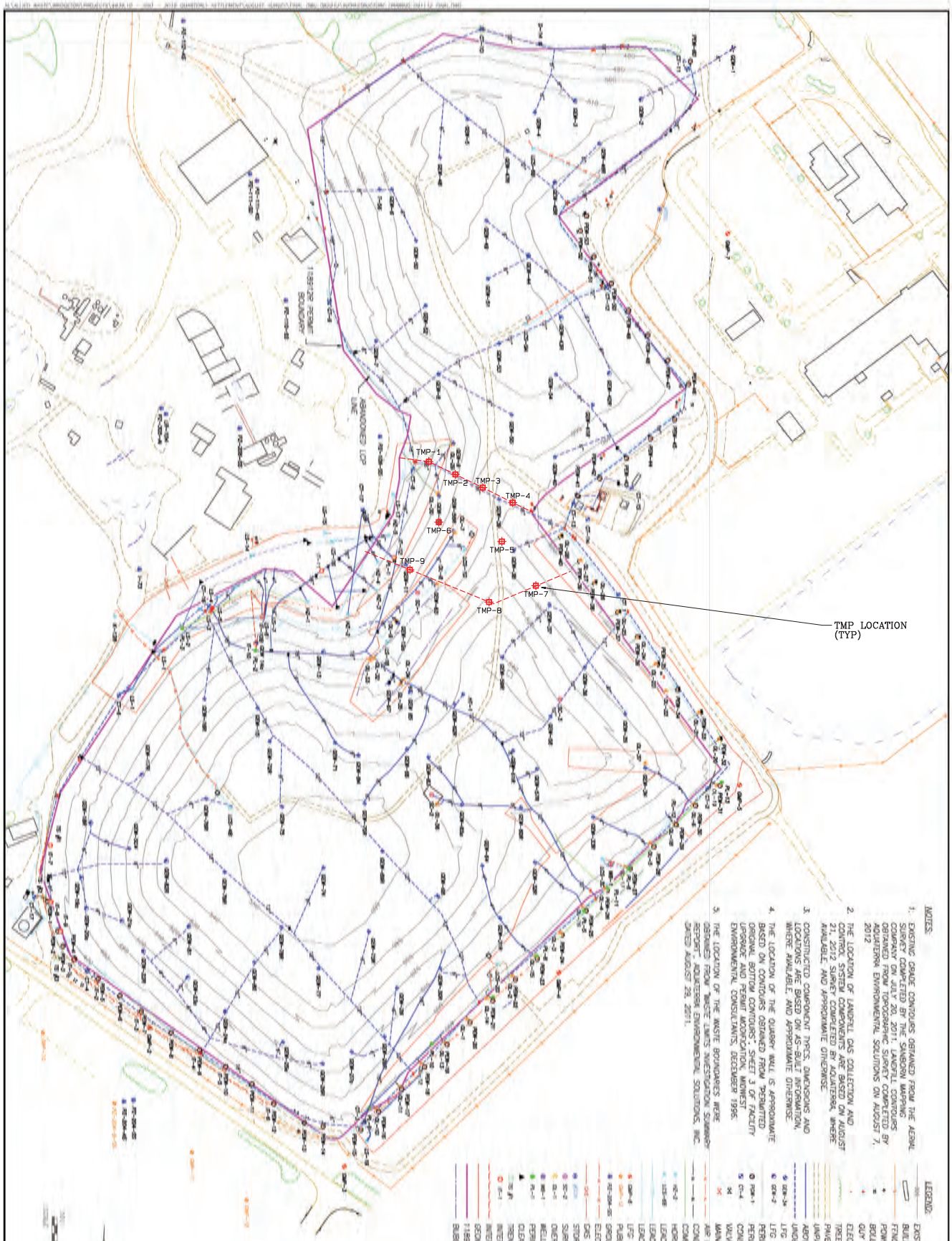
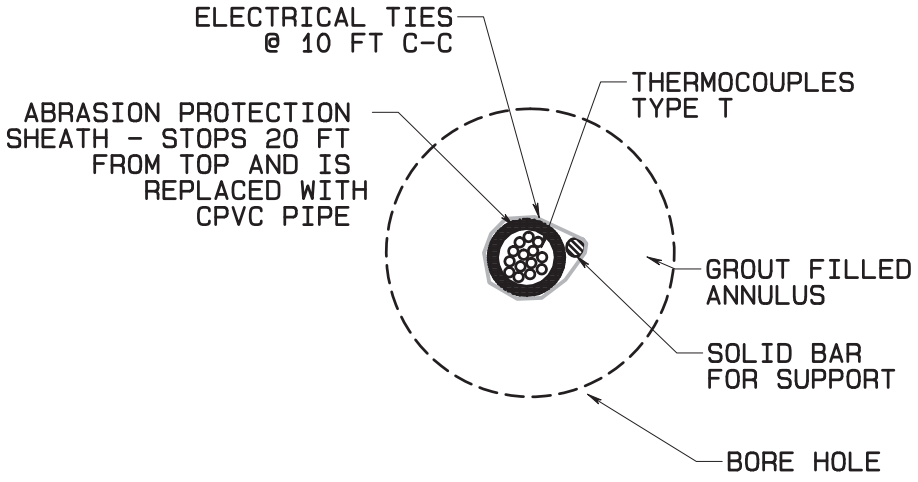


FIGURE 1

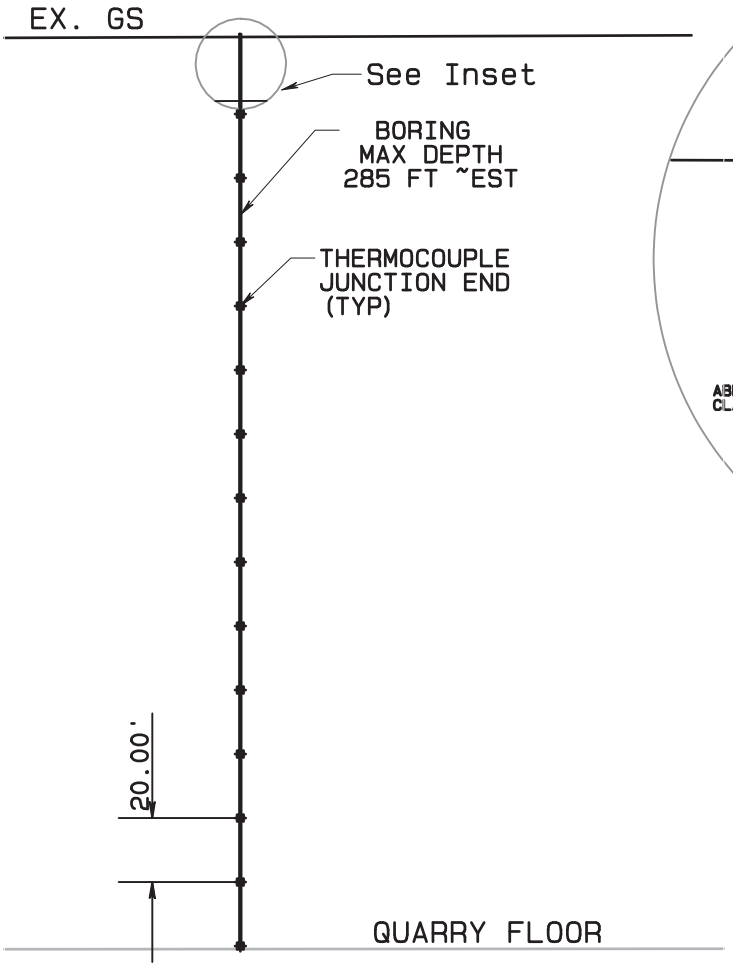
TMP LOCATION PLAN

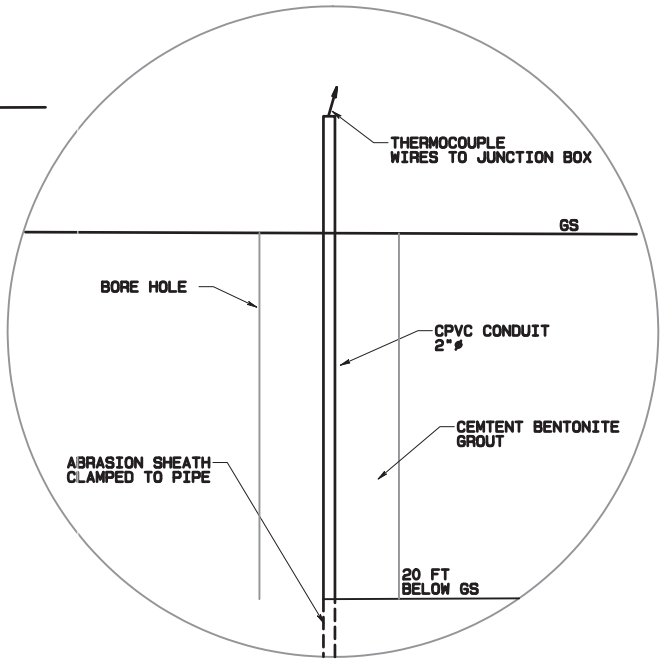
PREPARED BY: P. J. CAREY & ASSOCIATES, PC

SITE LAYOUT BRIDGETON INFRASTRUCTURE	BRIDGETON LANDFILL, LLC BRIDGETON LANDFILL BRIDGETON, MISSOURI	AQUATERRA ENVIRONMENTAL SOLUTIONS, INC. 7311 W. 130th St., Ste. 100 Overland Park, Kansas 66213	
REV: 0 DRAWING NUMBER: 1 PROJECT NUMBER: 4659.10 SHT. 1 OF 3	DRAWN BY: JWH DESIGNED BY: JWH PROJECT MGR: MAH ELECTRONIC FILE NAME: 9/11/12 DATE:	REV. DATE BY DESCRIPTION	



TMP
SECTION VIEW
1"= 4"





INSET

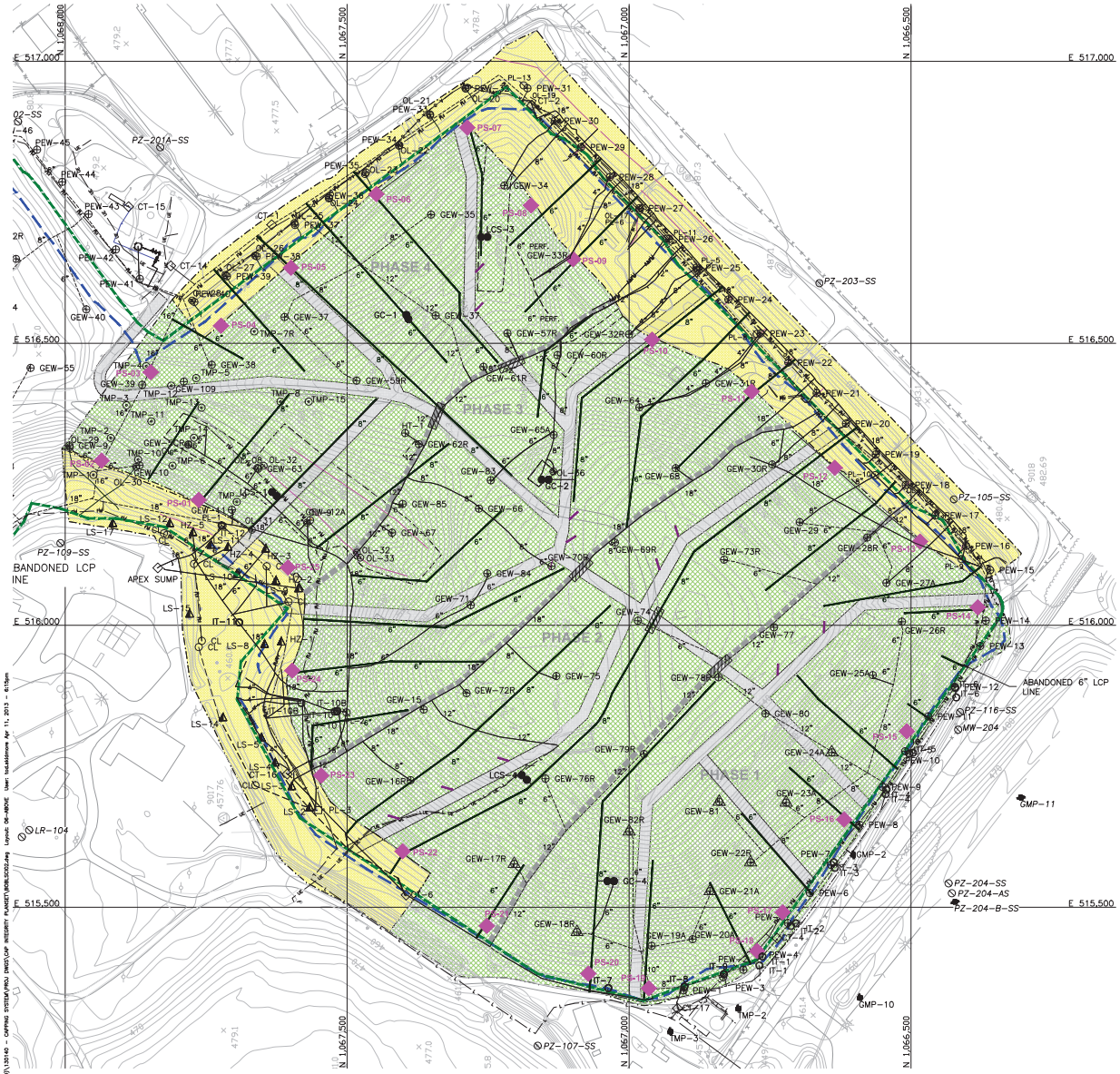
FIGURE 2
TMP INSTALLATION

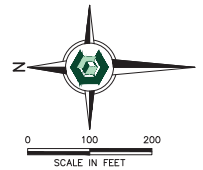
BRIDGETON LANDFILL
TEMPERATURE MONITORING

DESIGNED BY	P.J.C	CHECKED BY	
DRAWN BY	P.J.C	DATE	9/13/2012
SCALE: AS SHOWN	Drawing No. DRAWING	SHEET No. FIGURE 2	Revision No. 0

P. J. Carey & Associates, P.C.

Project Desc.: Path: N:\Bridgeton\Bridgeton Temps.prn Plot Date/Time: Thu Sep 13,2012 / 16:06:57





LEGEND

- EXISTING SOLID WASTE BOUNDARY
- PHASE BOUNDARY
- EXISTING QUARRY HIGH WALL
- EXISTING 10' CONTOUR
- EXISTING 2' CONTOUR
- EXISTING LANDFILL GAS HEADER
- EXISTING LANDFILL GAS HEADER – UNDERGROUND
- EXISTING HORIZONTAL LFG COLLECTOR
- EXISTING LEACHATE FORCEMAIN
- EXISTING CONDENSATE DRAIN LINE
- EXISTING AIR LINE
- EXISTING UNDERGROUND ELECTRIC
- EXISTING BUBBLE SUCKER
- EXISTING TEMPORARY CAP
- PROPOSED TEMPORARY CAP
- LIGHT-DUTY ACCESS ROADS (SEE DETAIL 1/10)
- GEW-81 — EXISTING LFG EXTRACTION WELL
- GEW-2 — EXISTING LFG EXTRACTION WELL – COMBO
- PEW-4 — EXISTING LFG PERIMETER EXTRACTION WELL
- PEW-4 — EXISTING LFG PERIMETER EXTRACTION WELL
- CT-1 — EXISTING CONDENSATE PUMP STATION
- TMP-1 — EXISTING TEMPERATURE MONITORING PROBE
- GMP-11 — EXISTING GAS MONITORING PROBE
- IT-3 — EXISTING INTERCEPTION TRENCH WELL
- PROPOSED LFG LATERAL (SEE DETAILS 2/10 AND 3/10)
- PS-07 — PROPOSED CONDENSATE PUMP STATION (SEE DETAIL 1/8)
- LCS-1 — PROPOSED RCP ABANDONMENT RISERS (SEE DETAIL 4/8)
- PROPOSED DEFLECTOR PIPE BERM (SEE DETAIL 9/10)
- PROPOSED CULVERT PROTECTION FOR GAS LATERAL

NOTES:

1. THE 2013 TOPOGRAPHIC MAP WAS PROVIDED BY COOP AERIAL SURVEYORS, CO., PHOENIX, AZ. DATE OF PHOTO: 02/13/2013.
2. UTILITIES SHOWN TAKEN FROM DRAWING 1 OF 1 "SITE INFRASTRUCTURE" BY AQUATERRA ENVIRONMENTAL SOLUTIONS, INC. DATED 01/09/13.
3. A NEW DOUBLE-WALLED 3" HDPE SDR 11 / 6" HDPE SDR 17 FORCEMAIN WILL BE CONSTRUCTED ABOVE THE CAP AROUND THE PERIMETER OF THE SOUTH QUARRY AS NECESSARY TO CONVEY LIQUID FROM THE PERIMETER COLLECTION SUMP (SHOWN IN DETAIL 1, SHEET 8) TO THE LEACHATE MANAGEMENT SYSTEM.
4. ALL OVER LINER TIE IN POINTS, PERIMETER LINE COLLECTION RISERS, AND INTERCEPTION TRENCH WELLS TO BE MAINTAINED AND BOOTED THROUGH THE NEW FML.



REV	DATE	DESCRIPTION	DWN BY	DES BY	CHK BY	APP BY
1	04/11/13	REVISED PER MDNR COMMENTS	TSS	JGW	ASL	BOS

DATE OF ISSUE 03/25/13
DRAWN BY TSS
DESIGNED BY TAB
CHECKED BY JGW
APPROVED BY BOS

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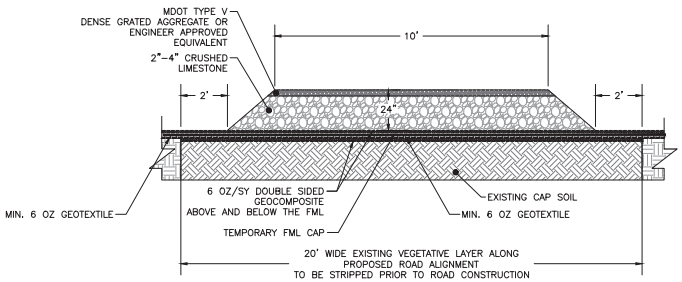
BRIDGETON LANDFILL, LLC.
BRIDGETON LANDFILL
BRIDGETON, MISSOURI

TEMPORARY CAP AND CAP INTEGRITY SYSTEM
CAP INTEGRITY SYSTEM - ABOVE TEMPORARY CAP

SHEET NO. 6

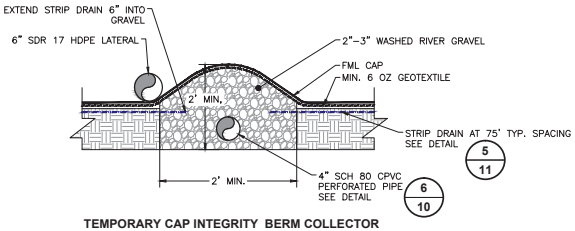
PROJECT NO. 130140

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LIGHT-DUTY ACCESS ROAD

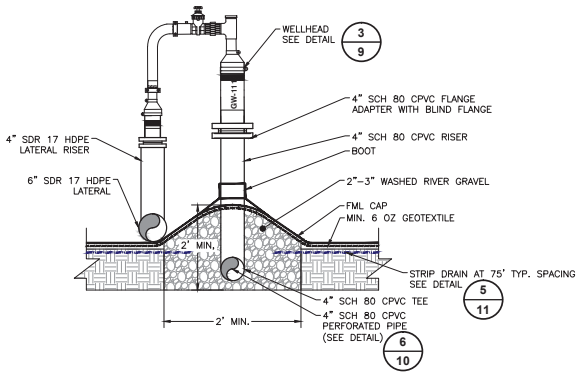
DETAIL 1/10
SCALE: NOT TO SCALE



TEMPORARY CAP INTEGRITY BERM COLLECTOR

DETAIL 2/10
SCALE: NOT TO SCALE

NOTE: WELLHEAD COLLECTION POINTS SHALL BE INSTALLED AT MAXIMUM 500' SPACING

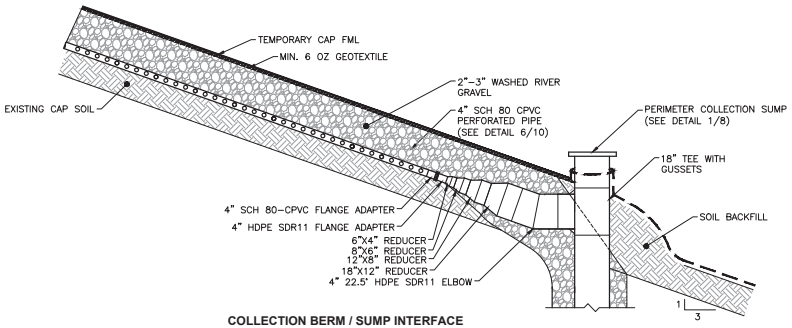


TEMPORARY CAP INTEGRITY BERM COLLECTOR WITH RISER

DETAIL 3/10
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NOTES:

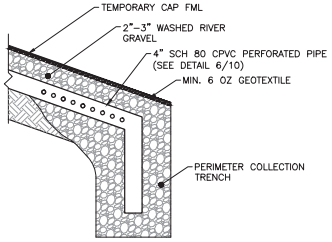
1. WELLHEAD COLLECTION POINTS SHALL BE INSTALLED AT MAXIMUM 500' SPACING.
2. SEE SHEET 5 FOR TEMPORARY CAP LINER TERMINATION LOCATIONS.



COLLECTION BERM / SUMP INTERFACE

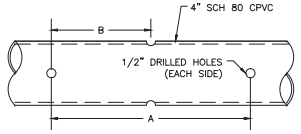
DETAIL 4/10
SCALE: NOT TO SCALE

NOTE: SEE SHEET 5 FOR TEMPORARY CAP LINER TERMINATION LOCATIONS.



COLLECTOR BERM TERMINATION

DETAIL 5/10
SCALE: NOT TO SCALE

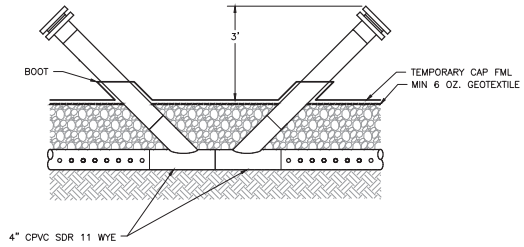


HORIZONTAL COLLECTION PIPE

NOTES:

1. A=20"
   B=10"
   90° ROTATION BETWEEN ROWS
2. ALTERNATIVE PATTERN MAY BE USED WITH APPROVAL OF EM.

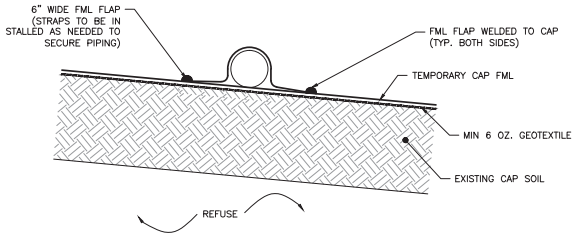
DETAIL 6/10
SCALE: NOT TO SCALE



PERIMETER COLLECTOR TRENCH CLEANOUT RISERS

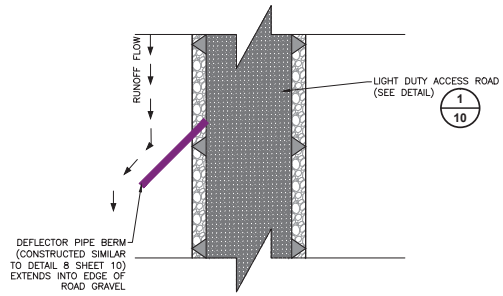
DETAIL 7/10
SCALE: NOT TO SCALE

NOTE: INSTALL AT 500' INTERVAL OR MID-POINT BETWEEN SUMPS.



ABOVE CAP PIPE ANCHOR

DETAIL 8/10
SCALE: NOT TO SCALE



DEFLECTOR PIPE BERM

DETAIL 9/10
SCALE: NOT TO SCALE

4/11/13

REV	DATE	DESCRIPTION	DWN BY	DES BY	CHK BY	APP BY
1	04/11/13	REVISED PER MDNR COMMENTS	TSS	JGW	ASL	BOS

DATE OF ISSUE 03/25/13
DRAWN BY TSS
DESIGNED BY TAB
CHECKED BY JGW
APPROVED BY BOS

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BRIDGETON, MISSOURI

TEMPORARY CAP AND CAP INTEGRITY SYSTEM DETAILS

SHEET NO. 10
PROJECT NO. 130140

File: G:\PROJECTS\BRIDGETON (MO)\130140 - CAPPING SYSTEM\PDU DWGS\CAP INTEGRITY PLANSET\BRIDGDOC4.DWG Layout: DETAILS-10 User: tsteinbronn Apr 11, 2013 - 3:58pm

APPENDIX C

AUGUST 6, 2013 WEEKLY DATA REPORT

Bridgeton Landfill, LLC

Weekly Data Submittals

Required by Section 52.F of Agreed Order, Case No. 13SL-CC01088
Effective May 13, 2013

Contents:

Attachment A – Leachate Levels in Leachate Collection Sumps
Attachment B – Temperature Monitoring Probe Analytical Charts
Attachment C – Gas Interceptor Wellhead Temperature Graphs
Attachment D – Gas Well GEW-54 Wellhead Temperature

Provided Separately:

– Leachate Level in Leachate Collection Sump Raw Data Excel Spreadsheet
– Temperature Monitoring Probe Raw Data Excel Spreadsheet
– Gas Interceptor Well Reading Raw Data Excel Spreadsheet

August 6, 2013

Commentary on Data

Attachment A – Leachate Levels in Leachate Collection Sumps

Bridgeton Landfill has installed replacement sump LCS-3C but is unable to install a pump due to excessive pressures and surging conditions. A replacement for LCS-4B has been drilled but attempts to place well casing and pump in it have been temporarily abandoned until some excess pressure in the LCS is relieved.

The LCS-1 pump failed and it appears that the well is damaged or collapsed at some point; evaluation of restorative or mitigative measures is ongoing. LCS 6B exhibited a transducer controller error during the reading event; this should be addressed by next reading. The other leachate collection sumps appear to be operating properly with measured leachate levels below the required pumping levels.

Attachment B – Temperature Monitoring Probe Analytical Charts

The following TMPs indicated virtually identical or lower temperature profiles than previous week(s): TMP-1, -2, -6, -7, -11,-12, -13, and -14.

TMP-3, -4, -5, and -9 indicated slight to moderate increase from previous weeks.

TMP-10 indicated a relatively significant (about 15° F) increase throughout the string; however, this TMP was equipped with new connectors and wiring modifications as maintenance, and the increased readings may be related to improved connectivity. Readings next week should establish if the increase is a trend.

Attachment C – Gas Interceptor Wellhead Temperature Graphs

The following GIWs indicated virtually identical or slightly trending lower wellhead temperatures as recent previous week(s): GIW-2, -3, -4, -5, -6, -7, -8, -9, -10, -11, -12, and -13. The following GIWs indicated slight to moderate observable increases in wellhead temperatures as recent previous week(s): GIW-1 and -3.

Recent increases in GIW-2, -9, and -12 appear to have been caused by slight increases in vacuum which may have increased the radii of influence for these wells and drawn additional heat. While this is a desired effect, vacuum on these wellheads has been restored to lower levels due to a desire to keep oxygen levels as low as possible while still retaining function of these GIWs.

Attachment D - Gas Well GEW-54 Wellhead Temperature

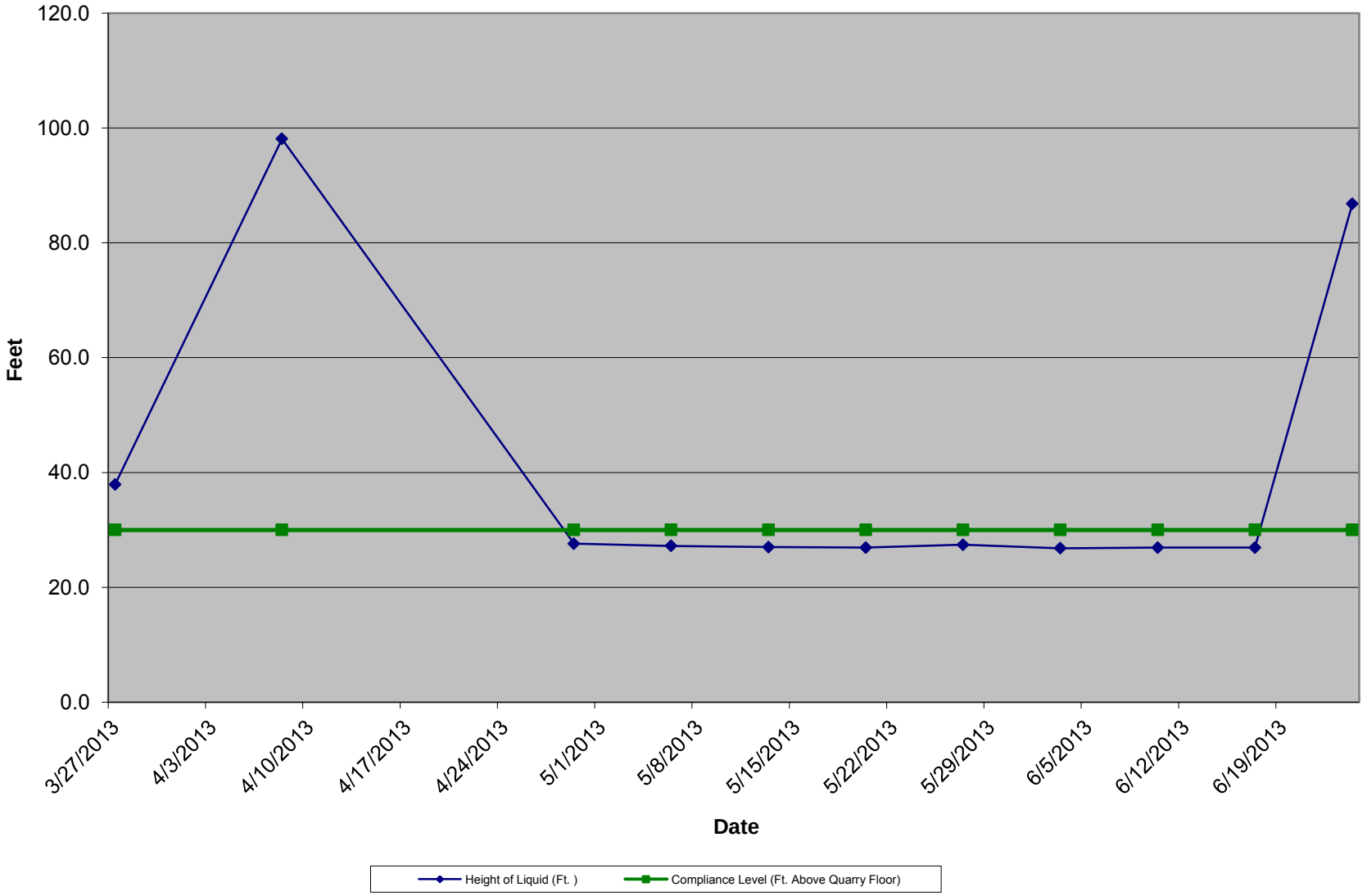
This attachment was first added to the weekly data report on July 23, 2013 to track wellhead temperature in GEW-54 which is located in the North Quarry, has historically exhibited somewhat elevated temperatures, and which, on June 18, 2013, exhibited a wellhead temperature of 155°F.

As seen in Attachment D, the most recent wellhead temperature is 152° F. The past three weekly monitoring events indicate a narrow 148-152° temperature range.

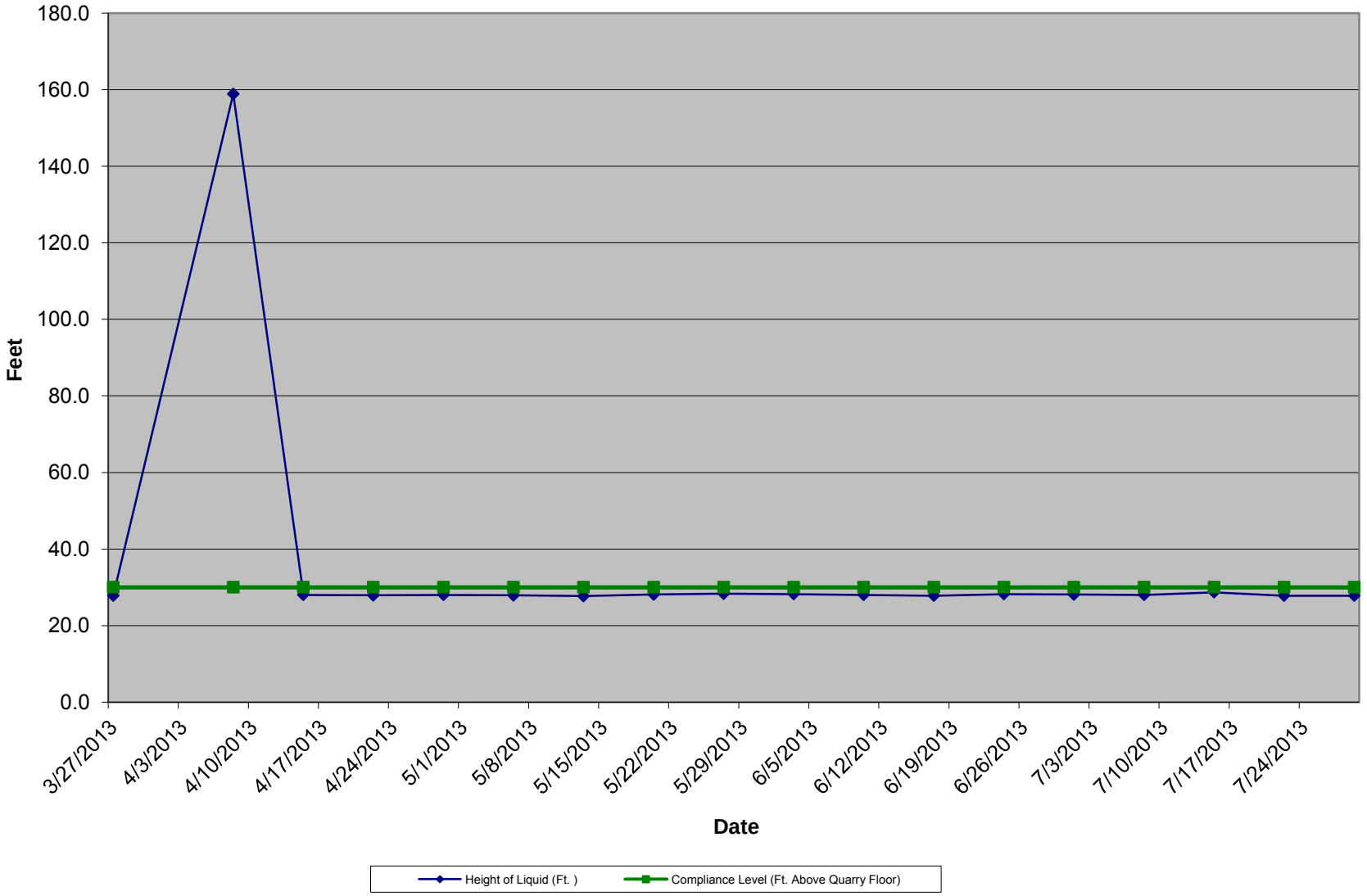
ATTACHMENT A

LEACHATE LEVELS IN LEACHATE COLLECTION SUMPS

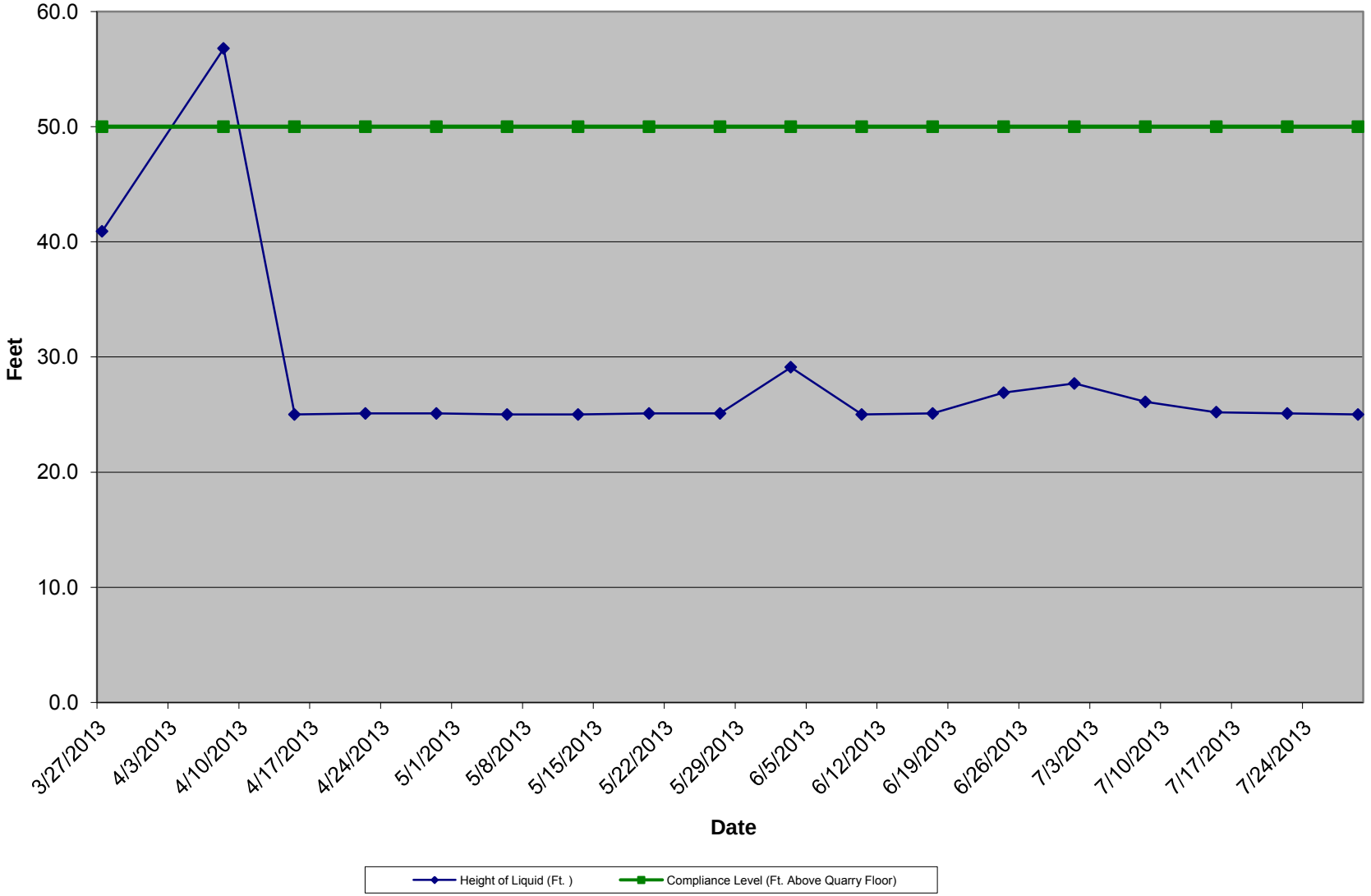
LCS-1D Liquid Level Above Quarry Floor



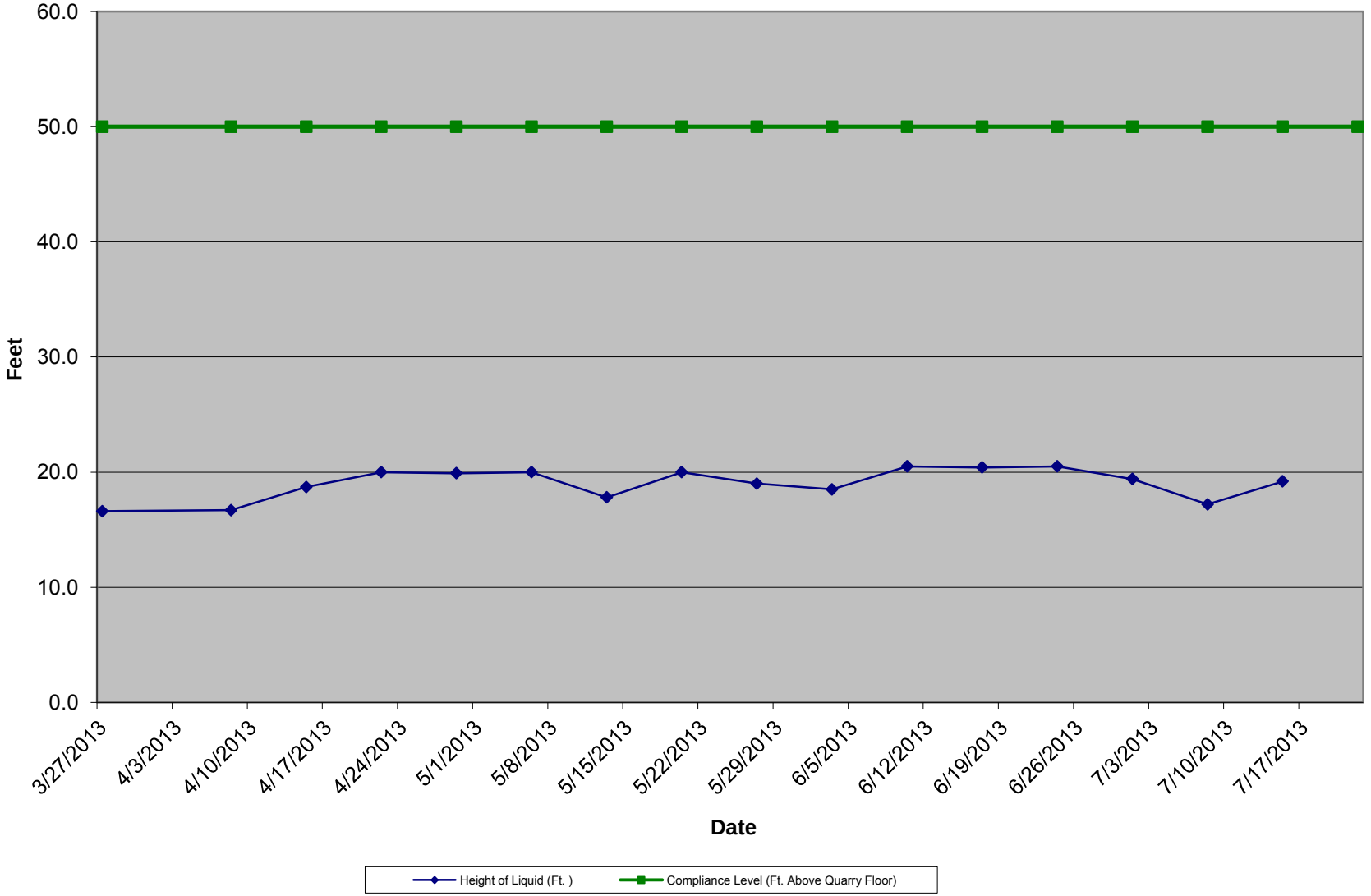
LCS-2D Liquid Level Above Quarry Floor



LCS-5A Liquid Level Above Quarry Floor



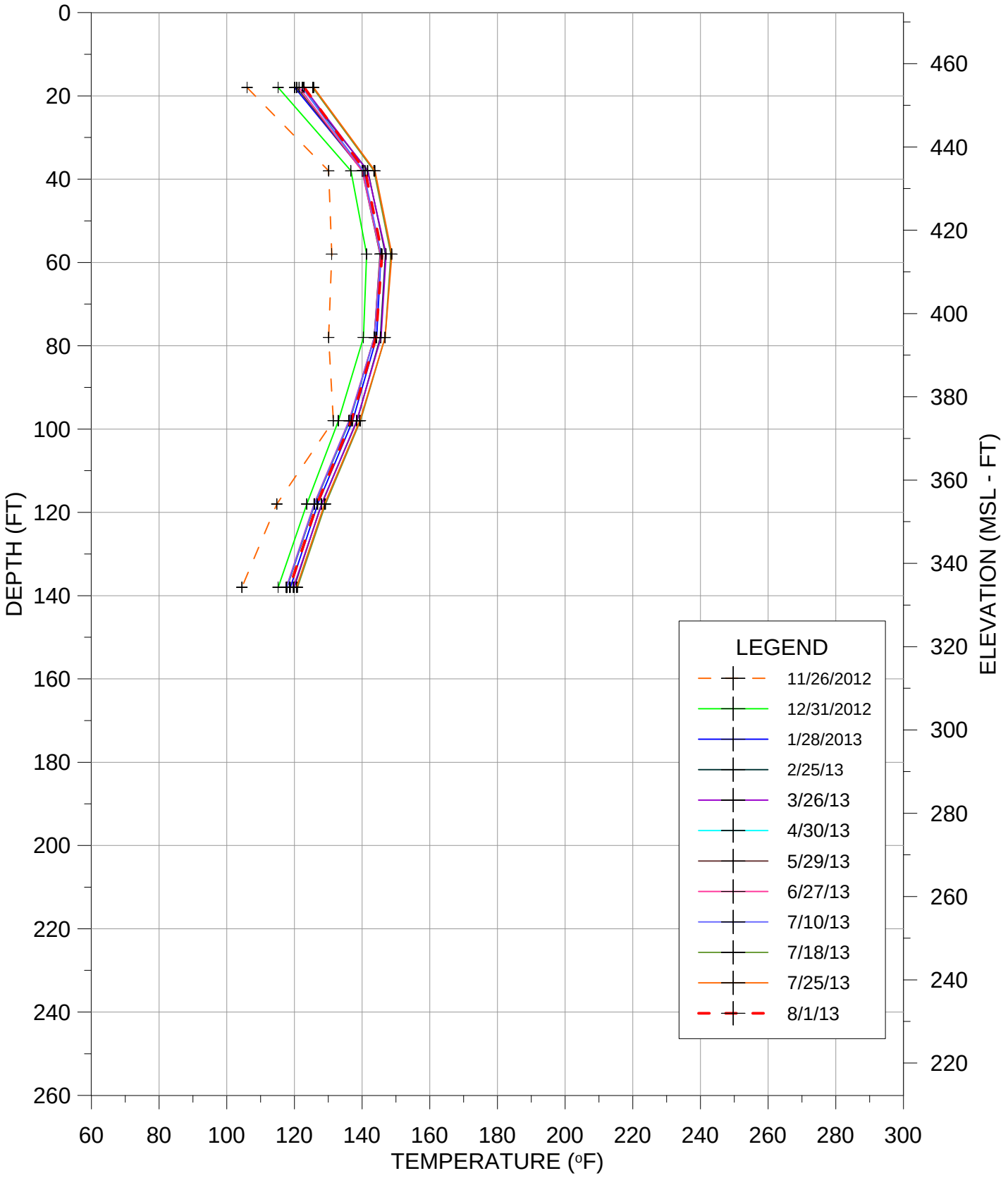
LCS-6B Liquid Level Above Quarry Floor



ATTACHMENT B

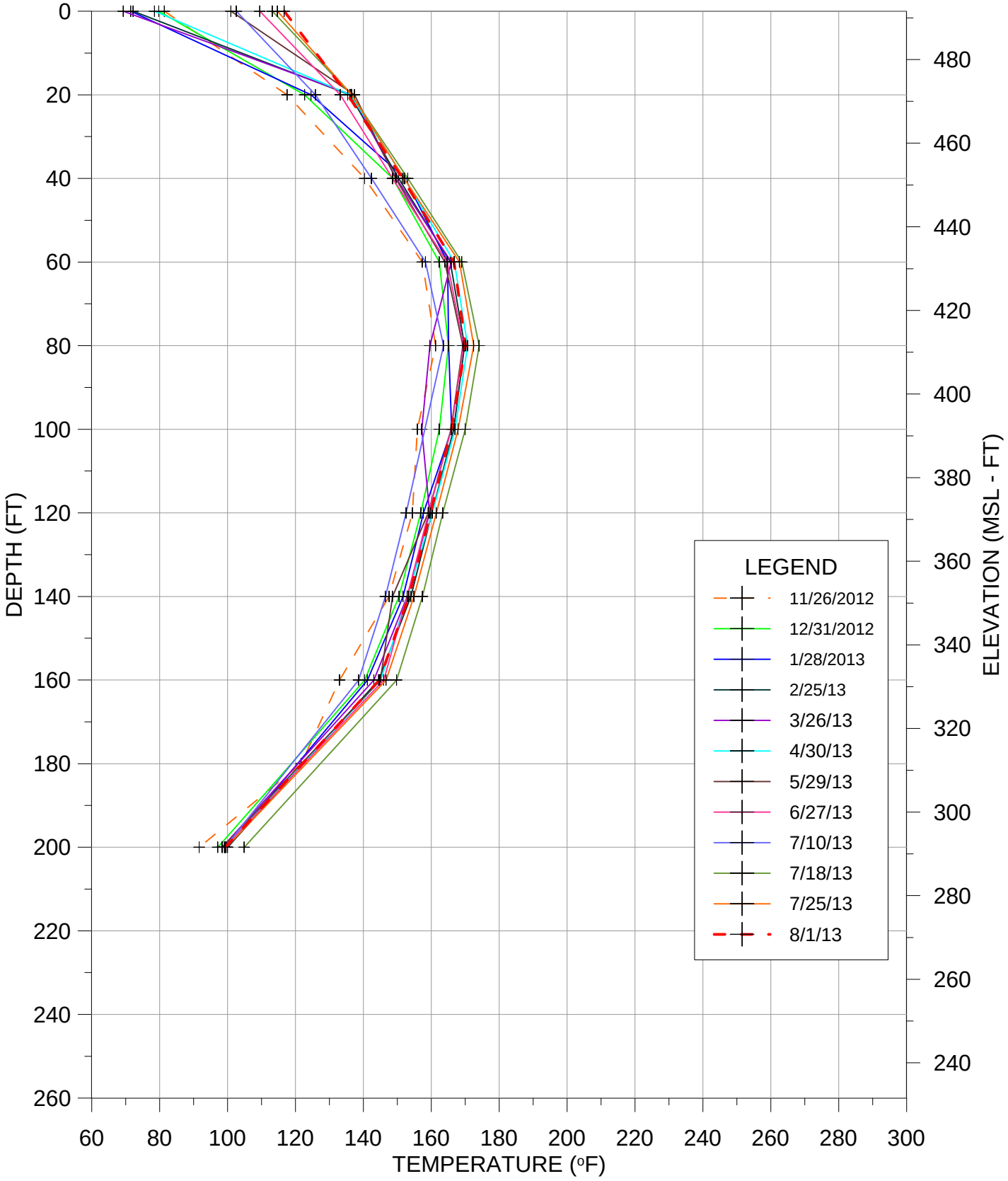
TEMPERATURE MONITORING PROBE ANALYTICAL CHARTS

TMP-1



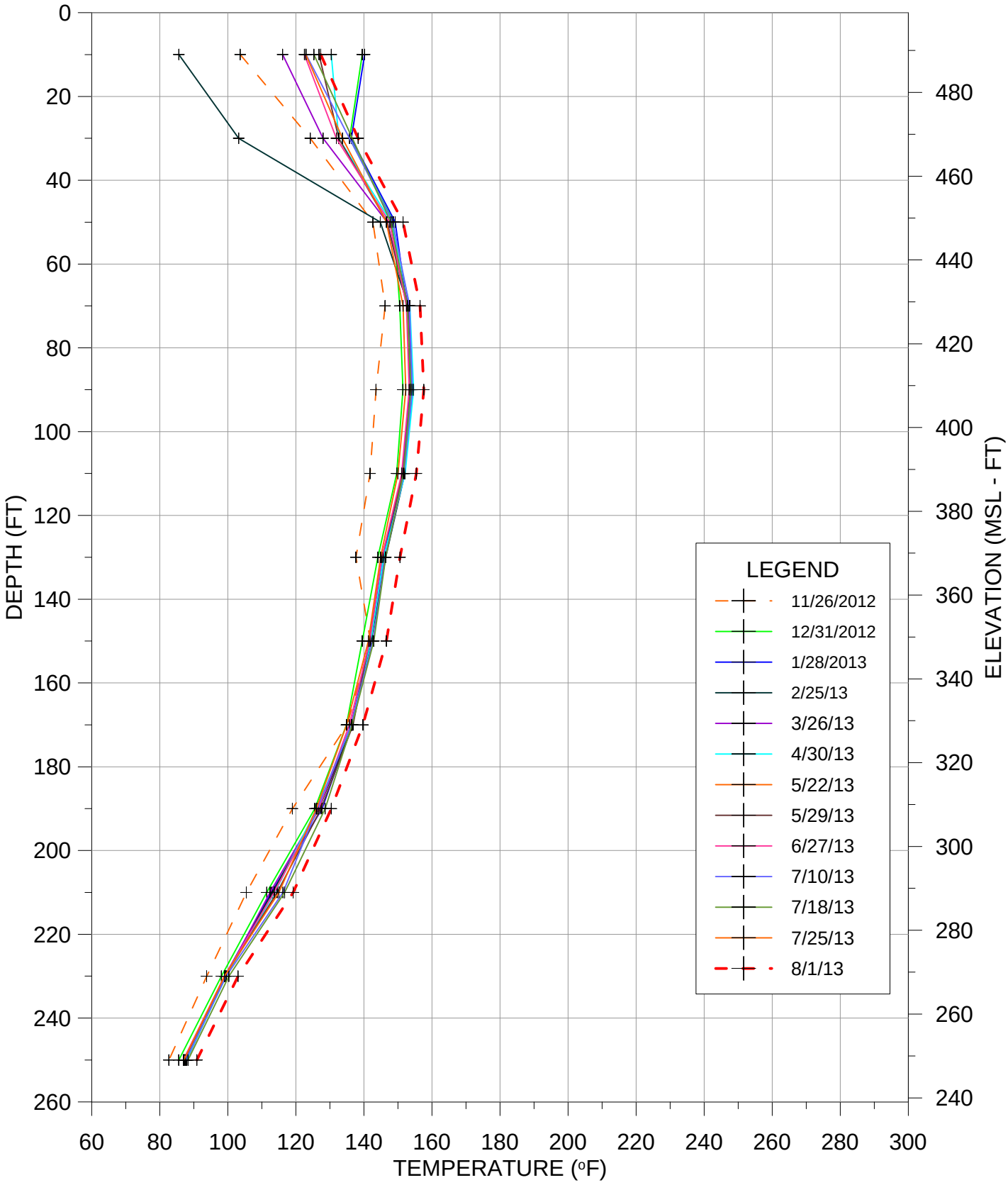
TEMPERATURE VS DEPTH
BRIDGETON LANDFILL

TMP-2



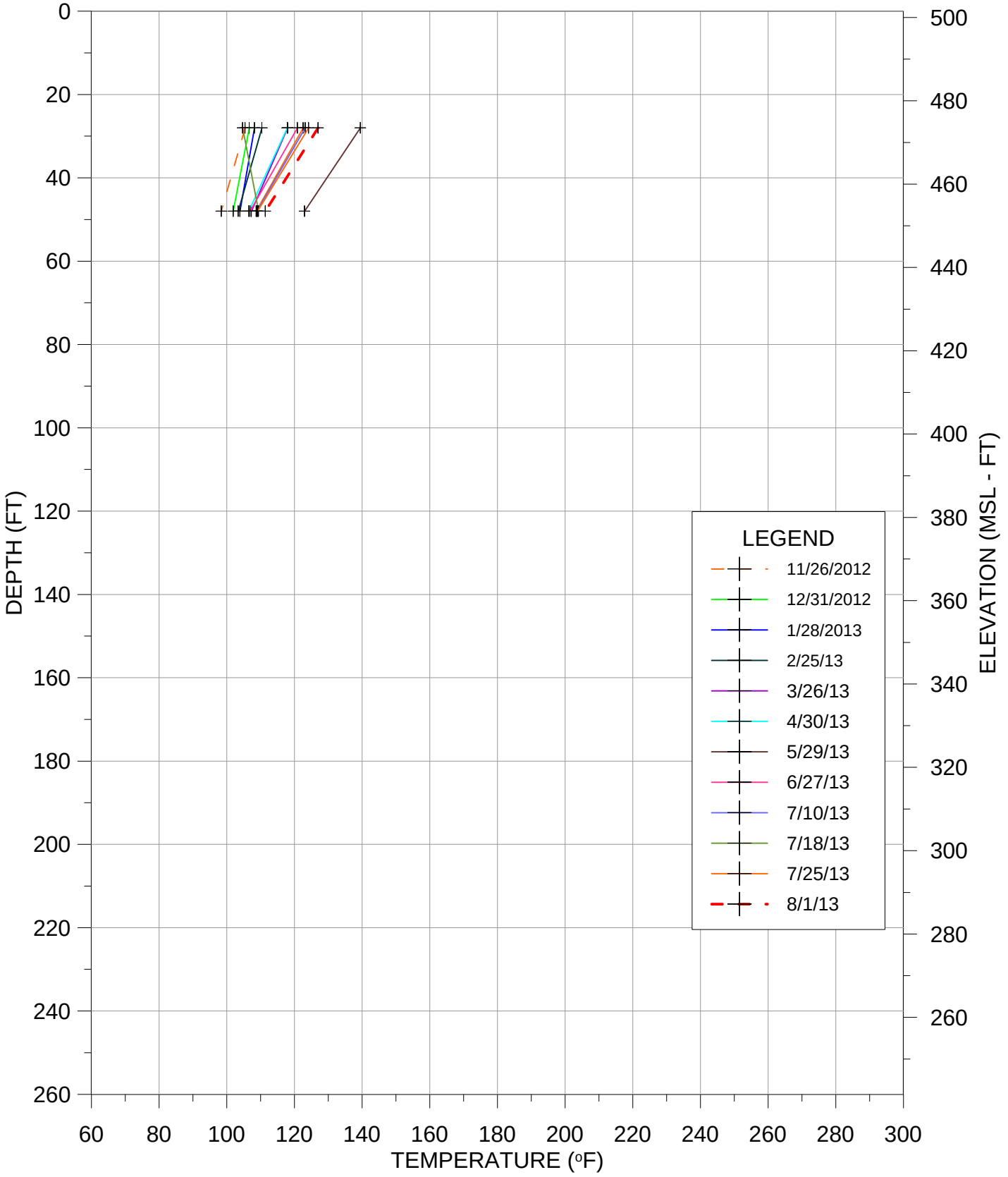
TEMPERATURE VS DEPTH
BRIDGETON LANDFILL

TMP-3



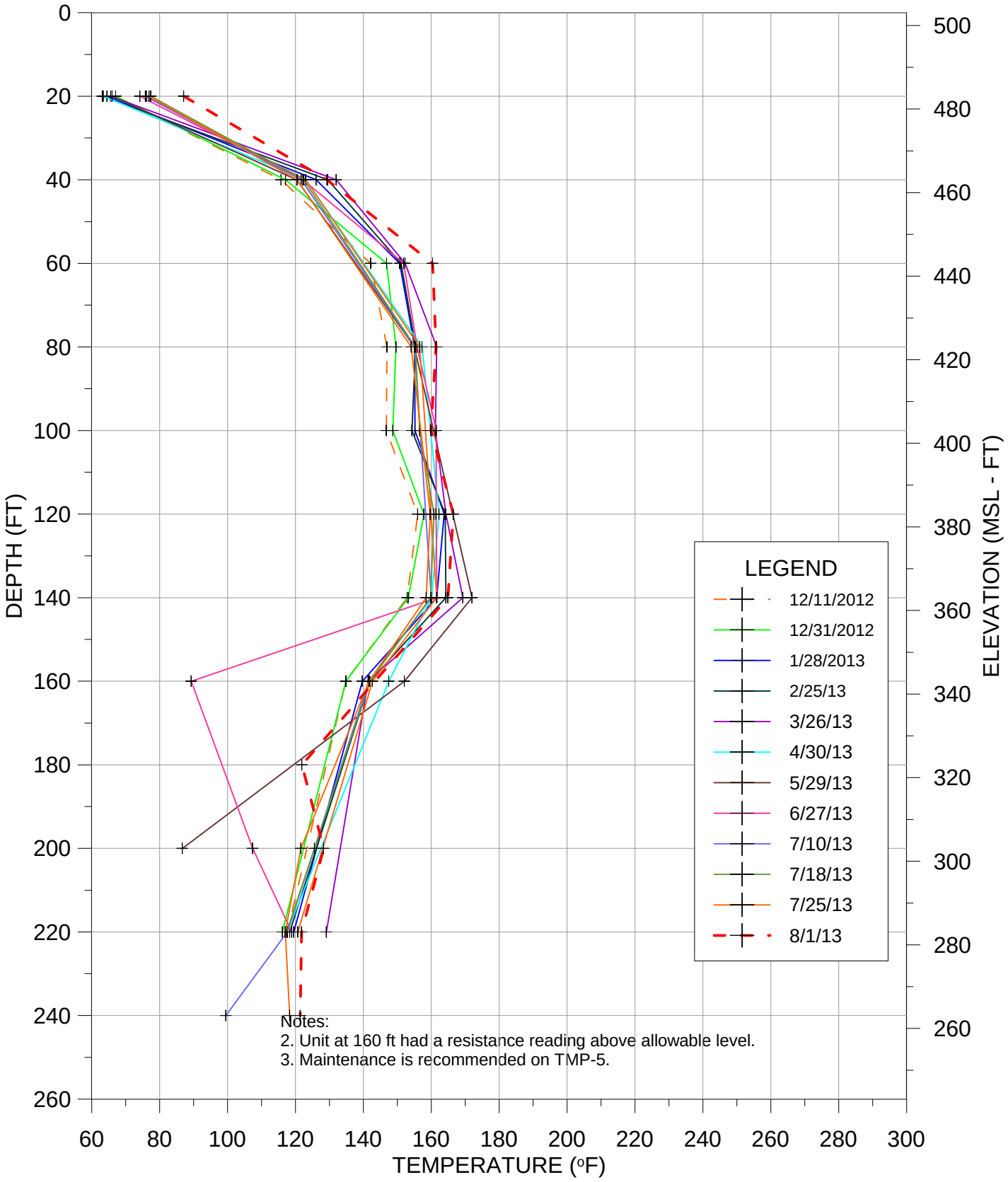
TEMPERATURE VS DEPTH
BRIDGETON LANDFILL

TMP-4



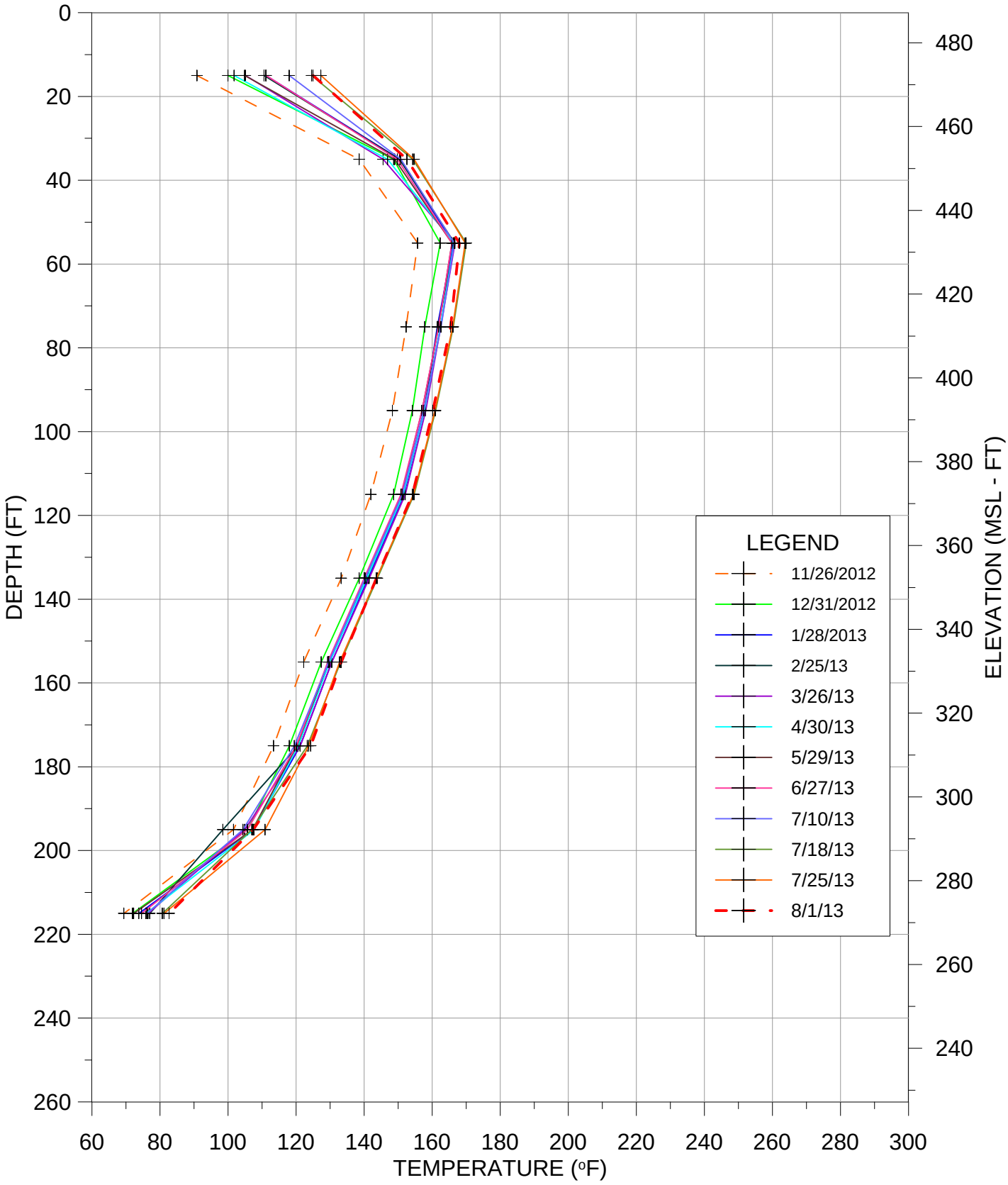
TEMPERATURE VS DEPTH
BRIDGETON LANDFILL

TMP-5



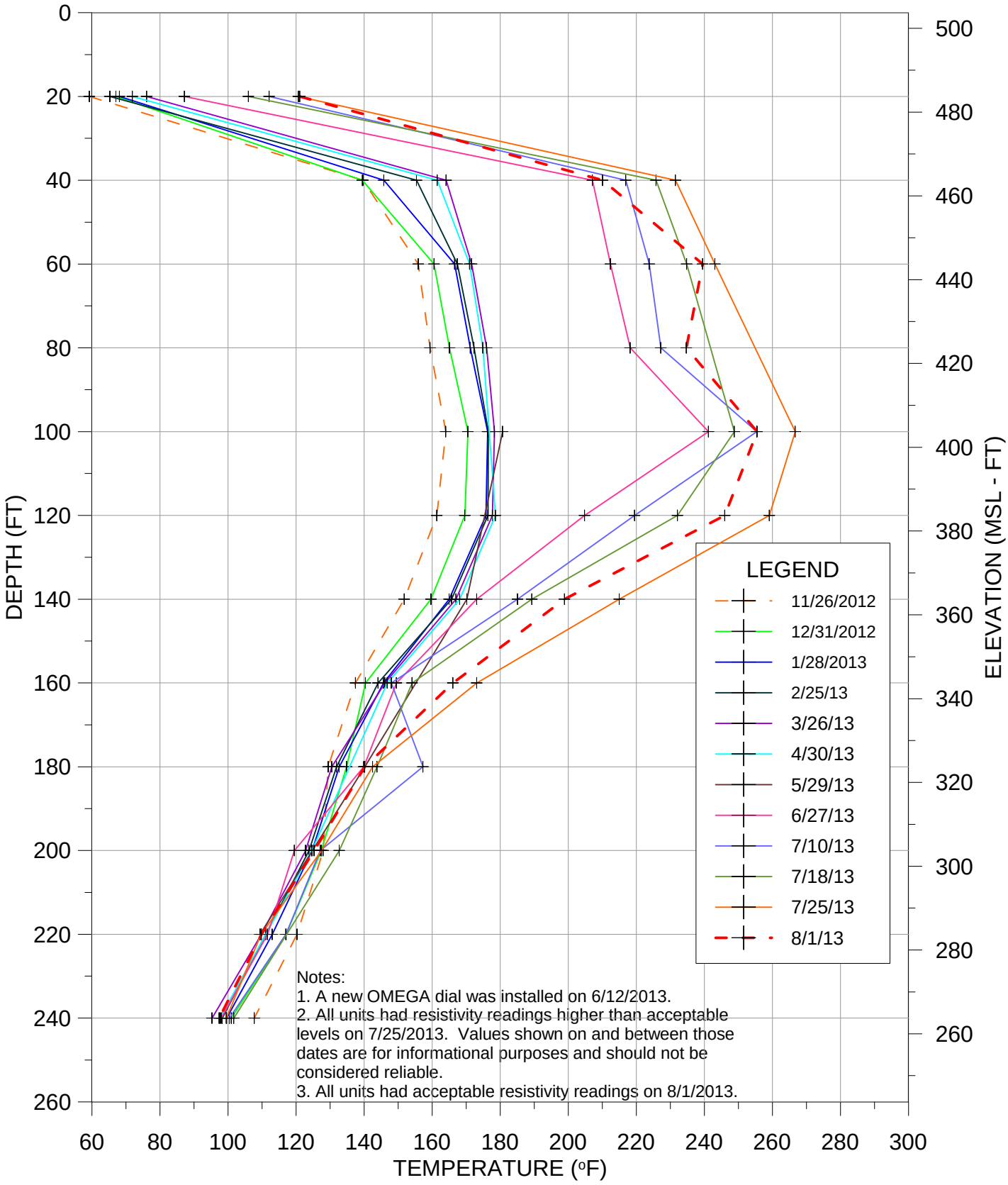
TEMPERATURE VS DEPTH
BRIDGETON LANDFILL

TMP-6



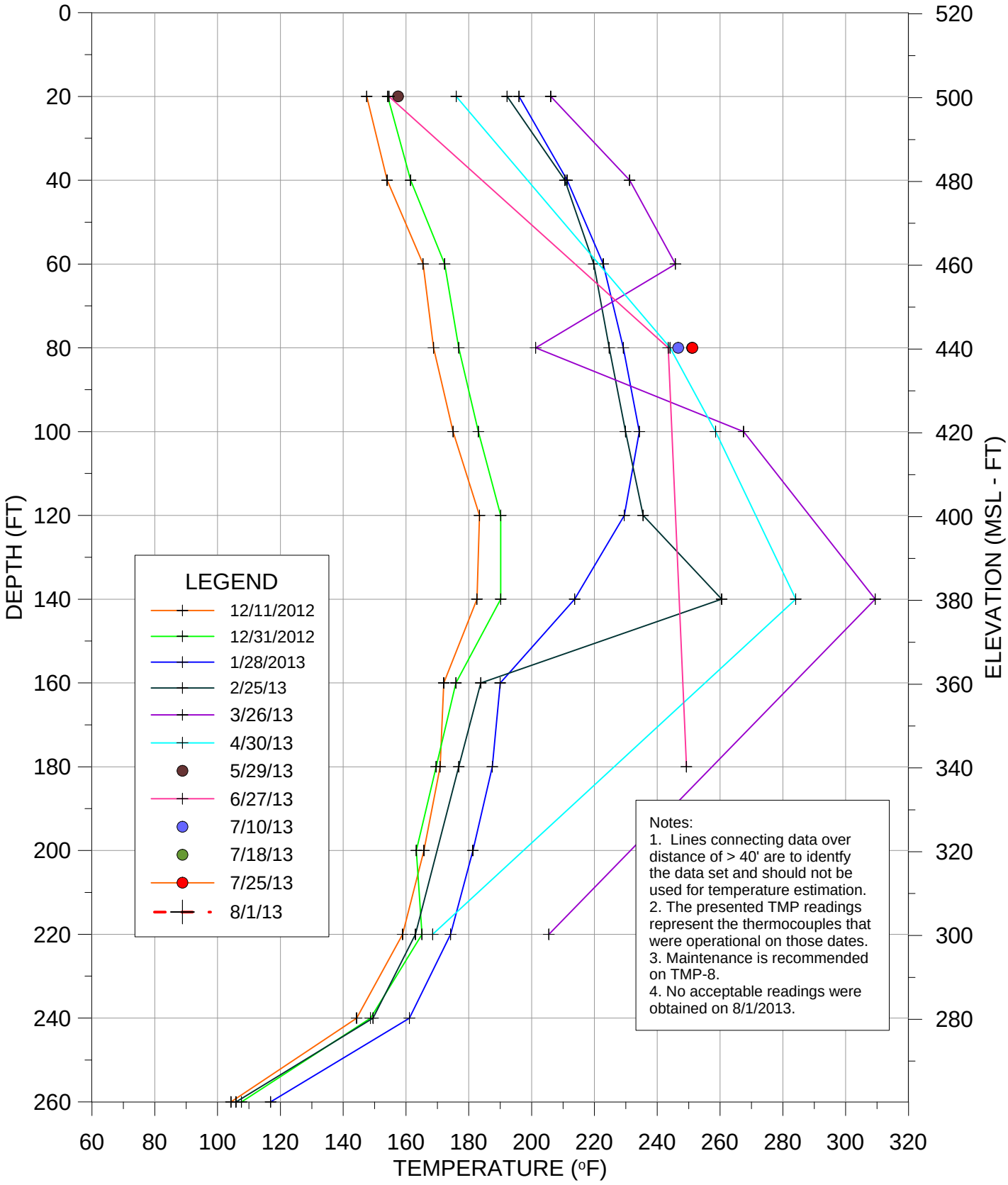
TEMPERATURE VS DEPTH
BRIDGETON LANDFILL

TMP-7R



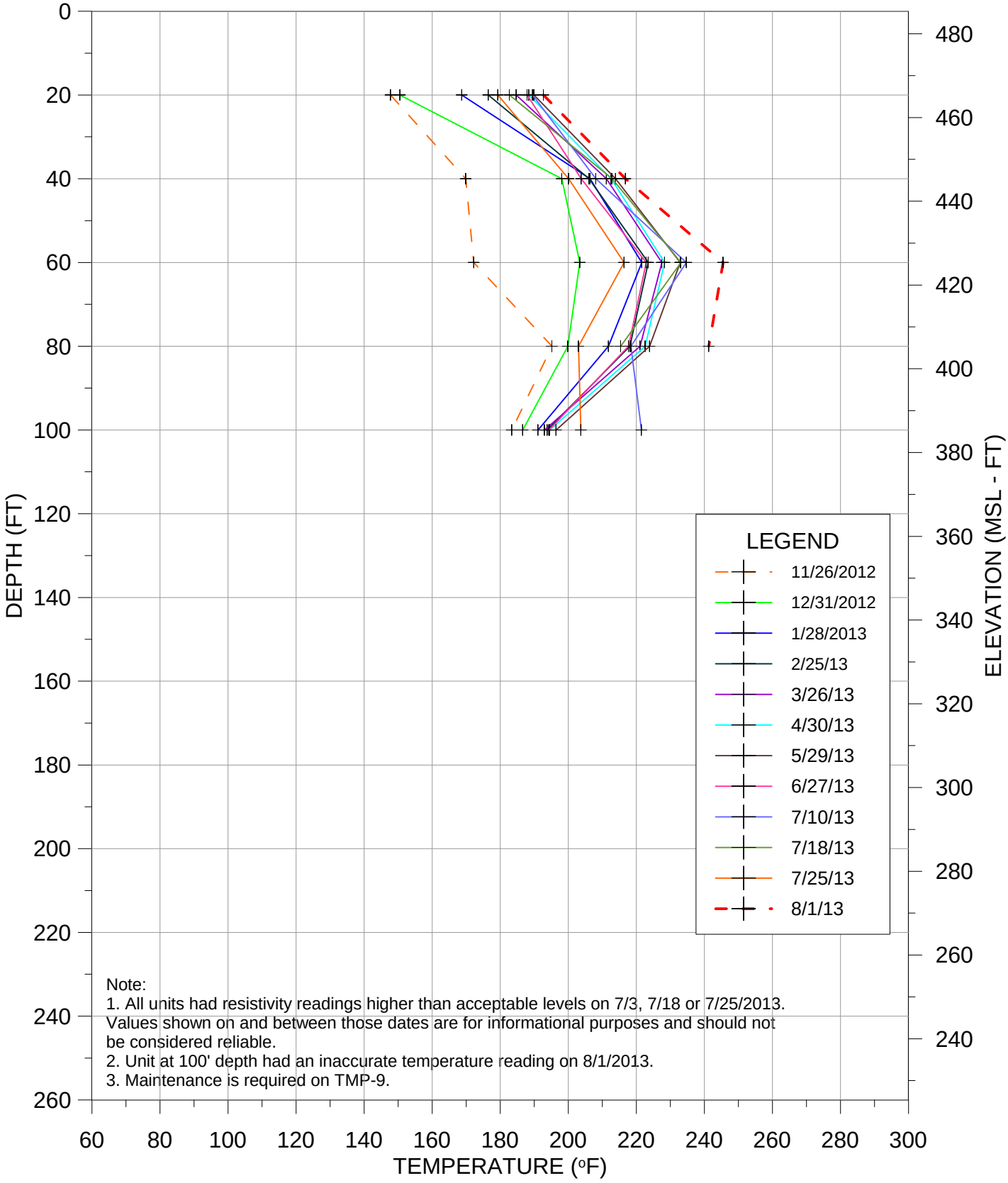
TEMPERATURE VS DEPTH
BRIDGETON LANDFILL

TMP-8



TEMPERATURE VS DEPTH
BRIDGETON LANDFILL

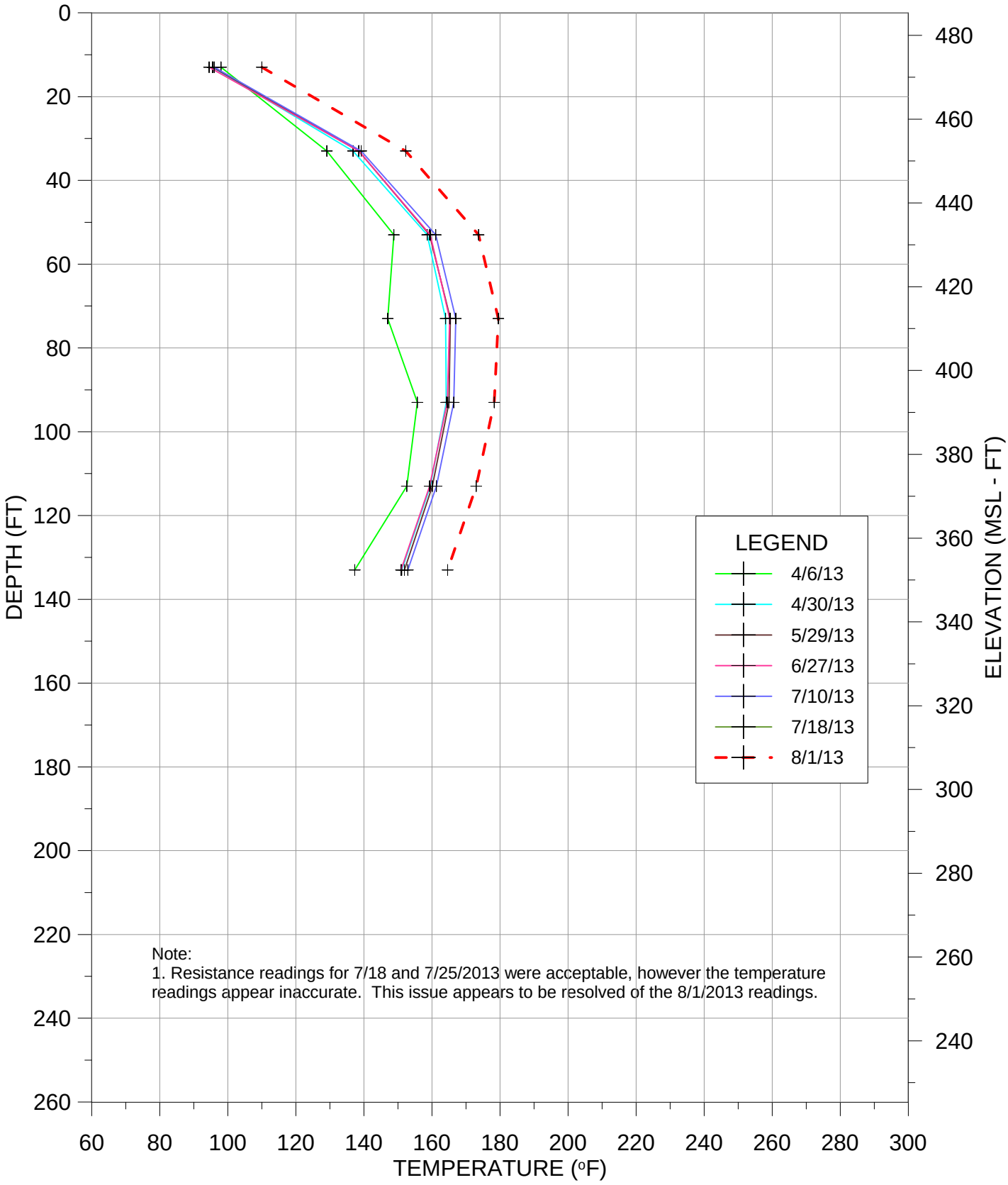
TMP-9



Note:
1. All units had resistivity readings higher than acceptable levels on 7/3, 7/18 or 7/25/2013. Values shown on and between those dates are for informational purposes and should not be considered reliable.
2. Unit at 100' depth had an inaccurate temperature reading on 8/1/2013.
3. Maintenance is required on TMP-9.

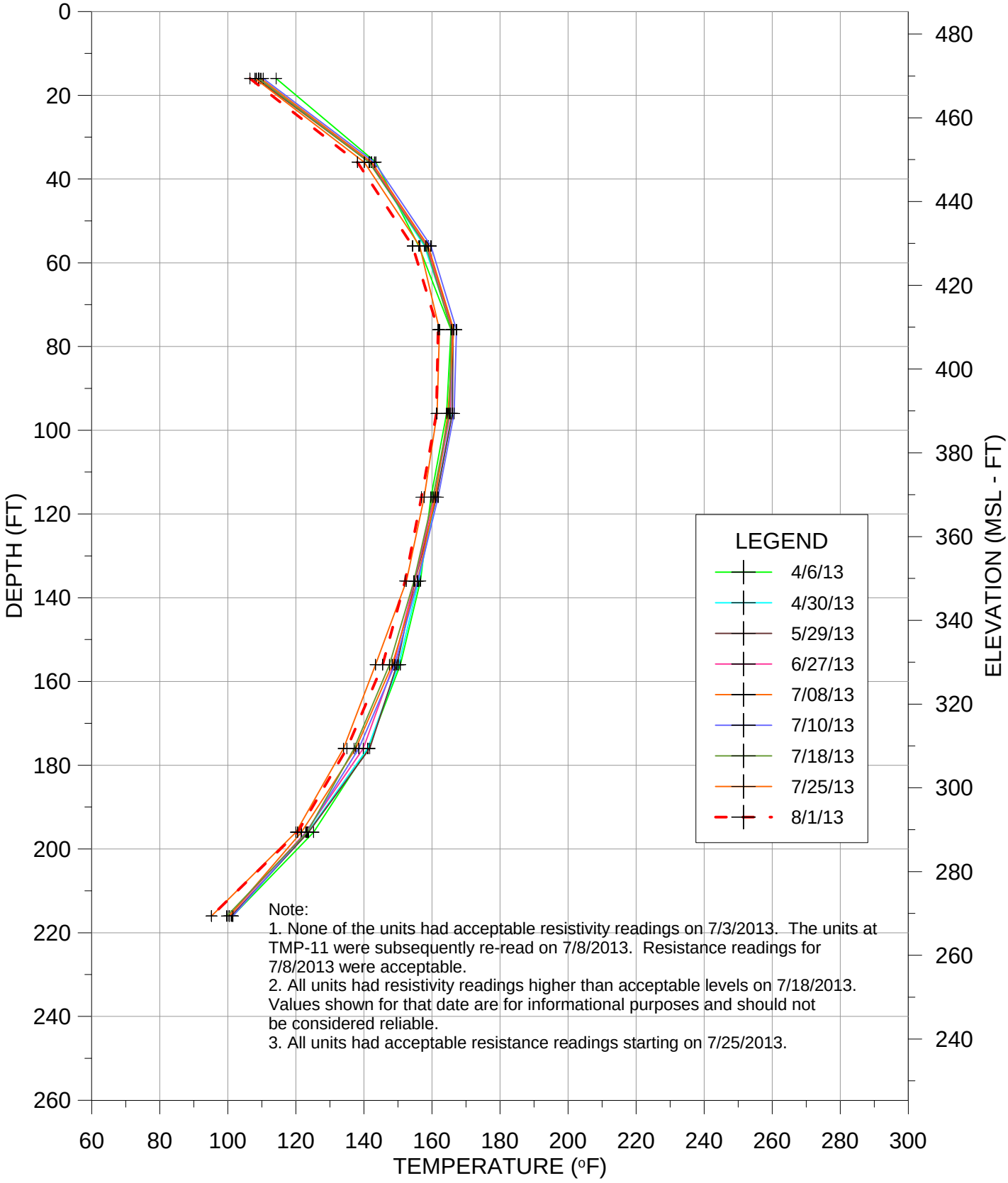
TEMPERATURE VS DEPTH
BRIDGETON LANDFILL

TMP-10



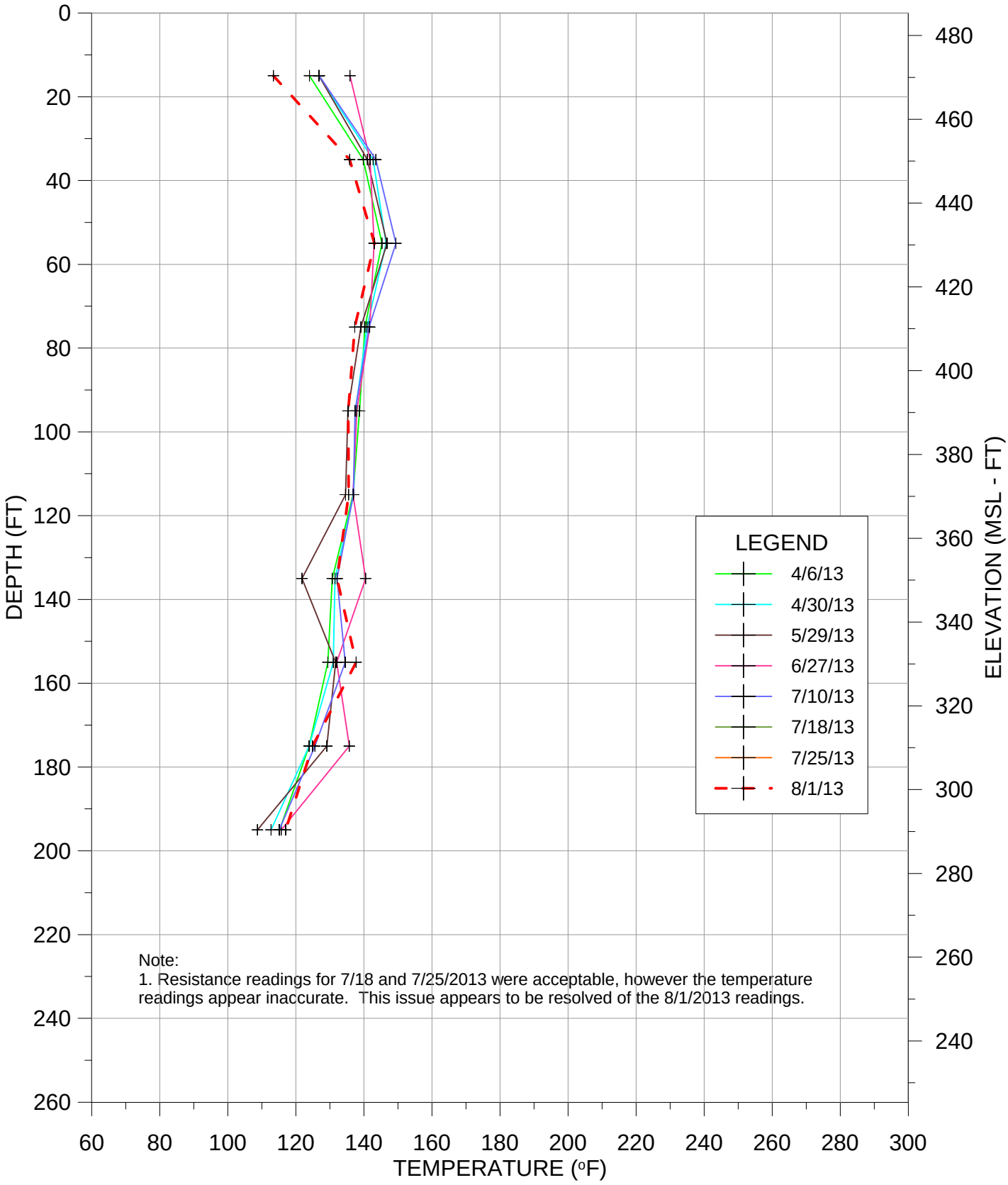
TEMPERATURE VS DEPTH
BRIDGETON LANDFILL

TMP-11



TEMPERATURE VS DEPTH
BRIDGETON LANDFILL

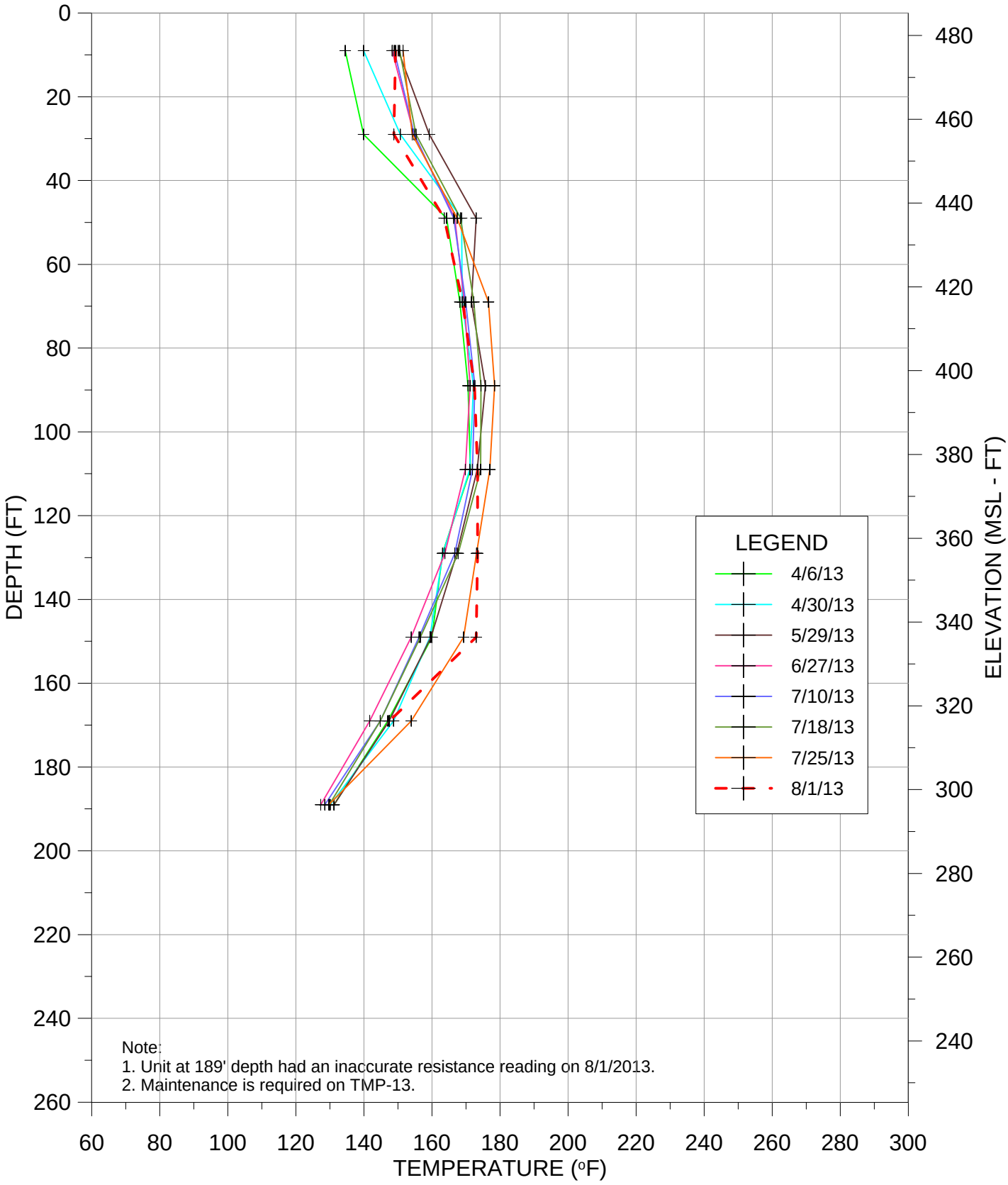
TMP-12



Note:
1. Resistance readings for 7/18 and 7/25/2013 were acceptable, however the temperature readings appear inaccurate. This issue appears to be resolved of the 8/1/2013 readings.

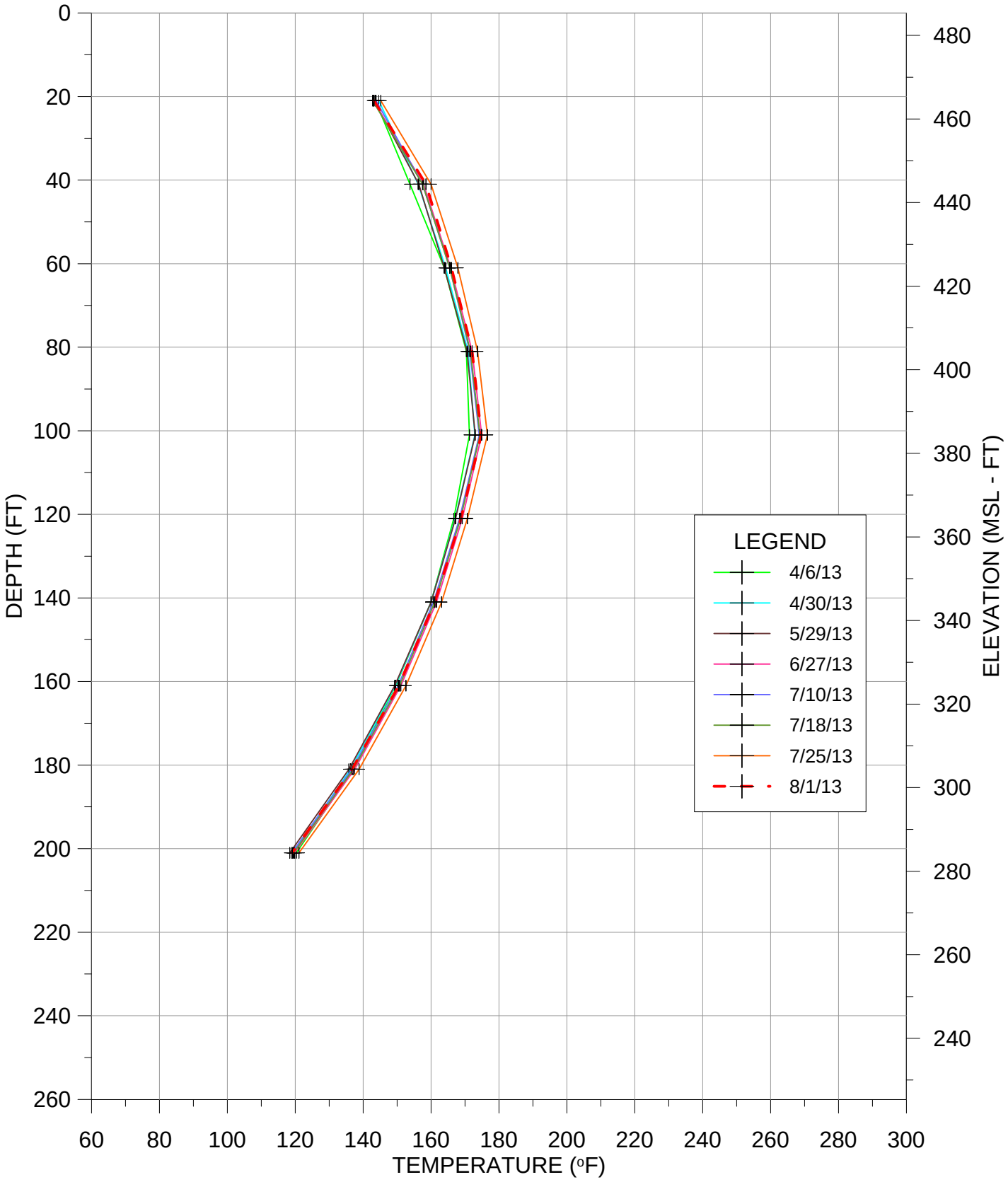
TEMPERATURE VS DEPTH
BRIDGETON LANDFILL

TMP-13



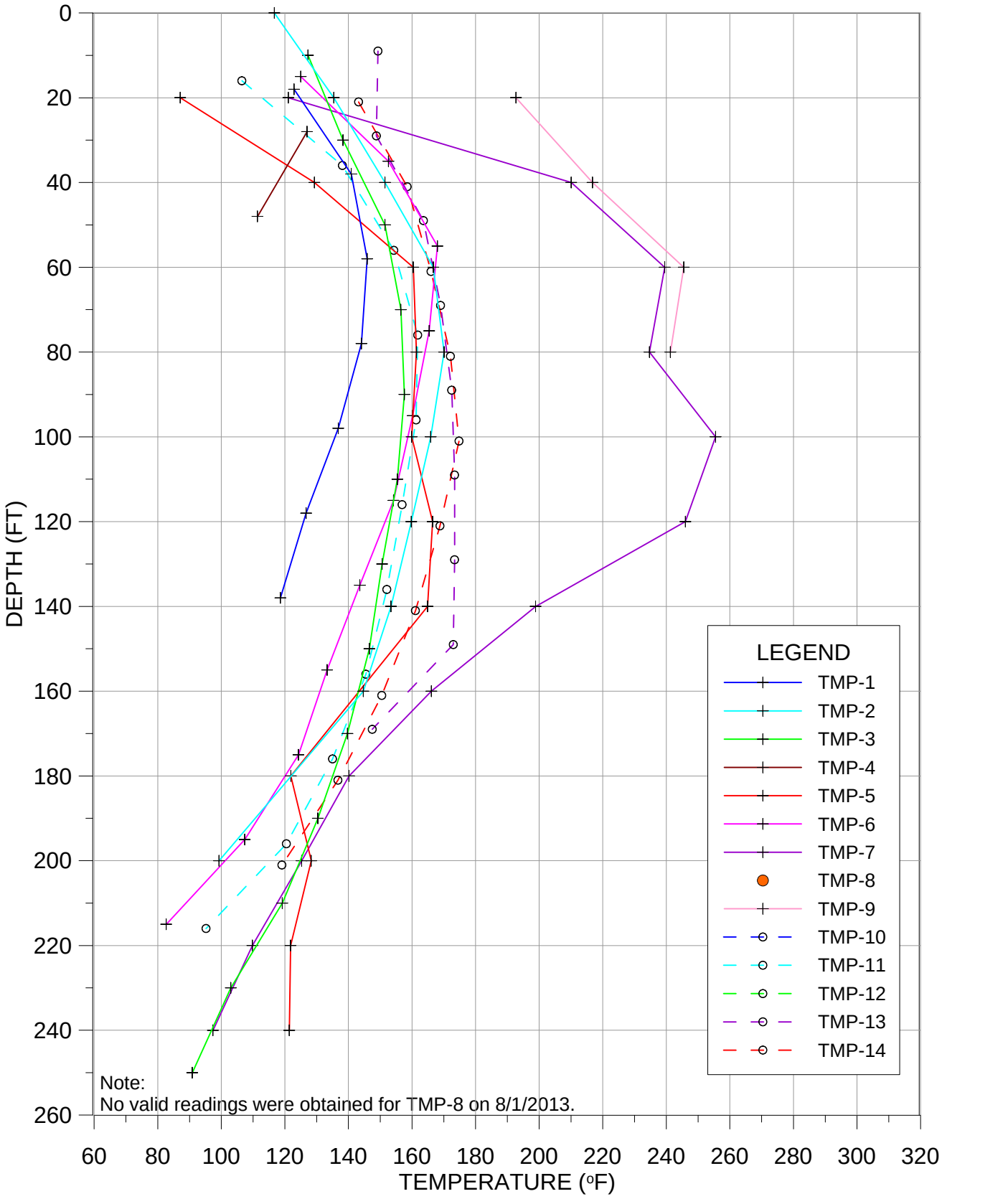
TEMPERATURE VS DEPTH
BRIDGETON LANDFILL

TMP-14



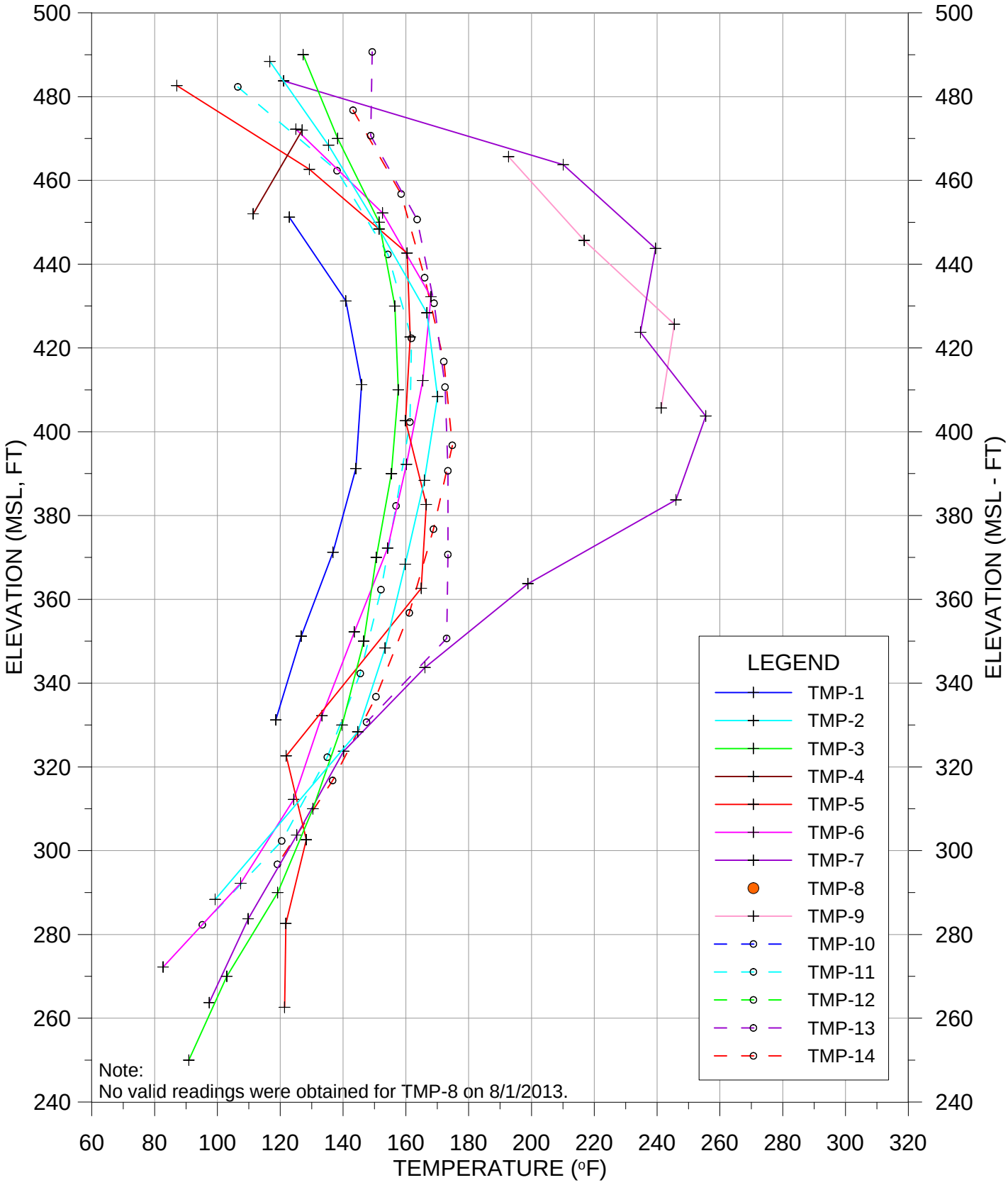
TEMPERATURE VS DEPTH
BRIDGETON LANDFILL

8/1/2013 -DEPTH



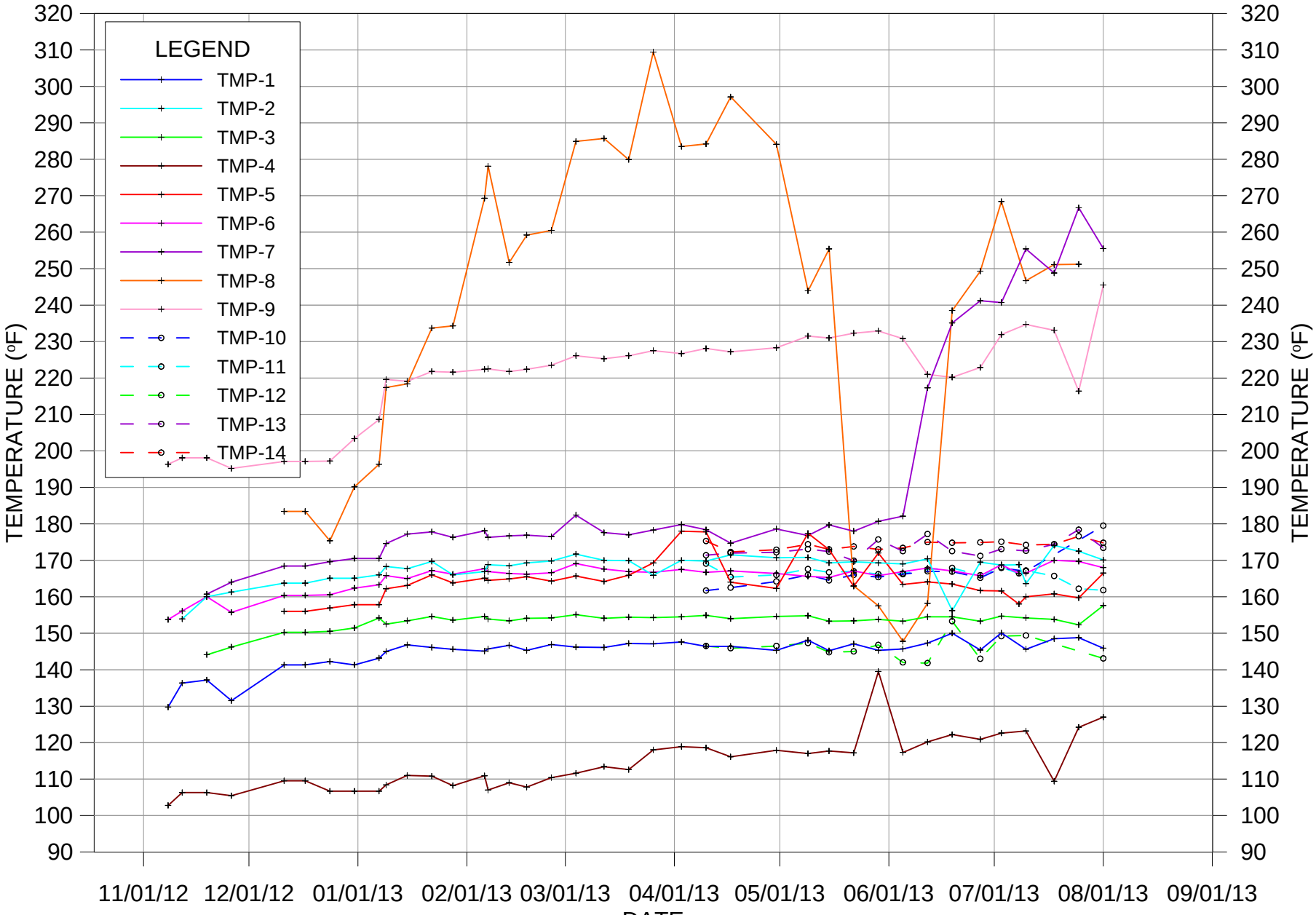
TEMPERATURE VS DEPTH
BRIDGETON LANDFILL

8/1/2013 - ELEVATION



TEMPERATURE VS ELEVATION
BRIDGETON LANDFILL

MAXIMUM TEMPERATURES



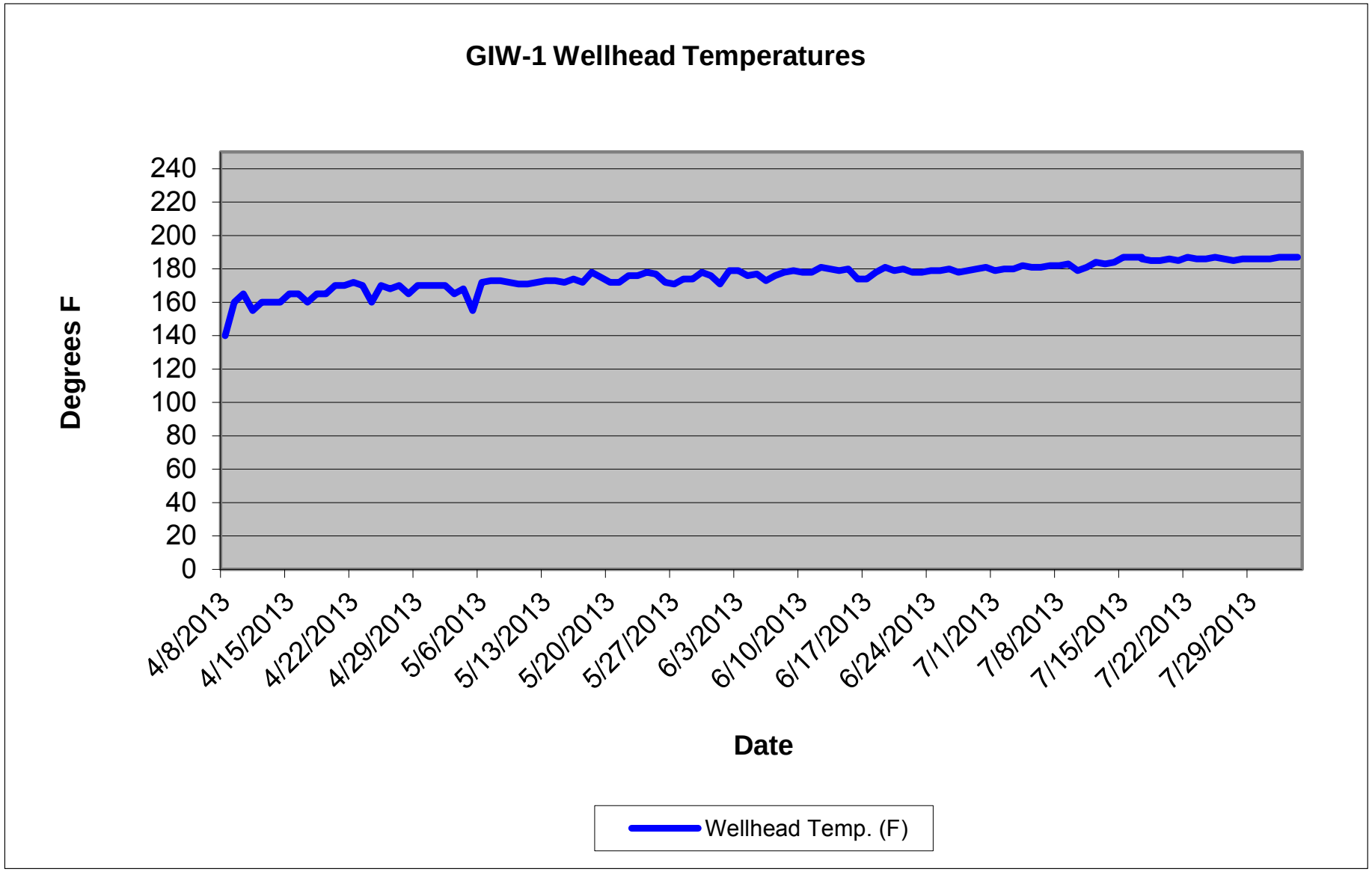
Note:

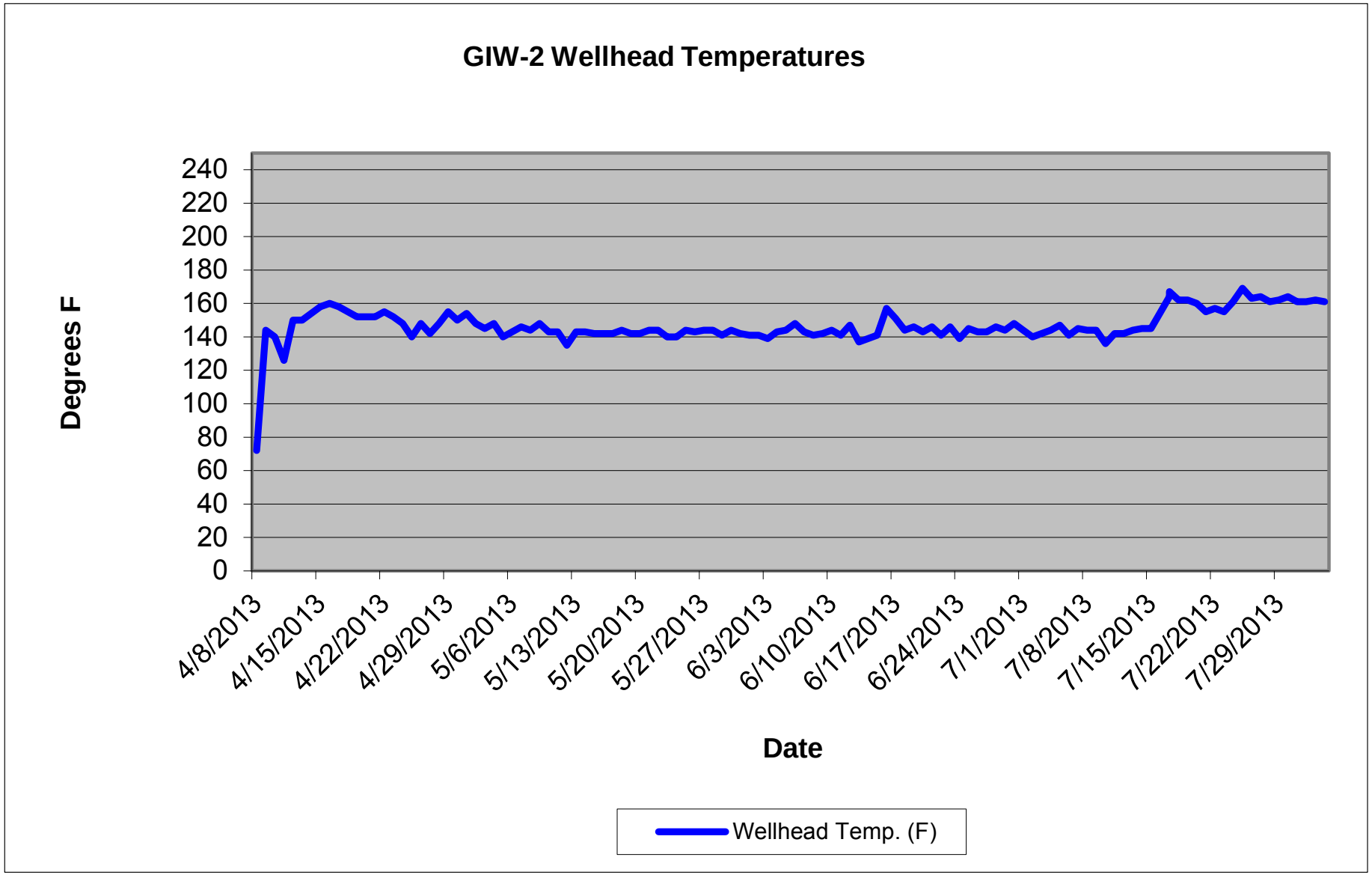
1. From 5/22 - 6/12/13, only the TMP-8 reading at 20' depth was operational. No valid readings were obtained for TMP-8 on 8/3/2013.
2. A new OMEGA dial was installed at TMP-7R on 6/12/2013 enabling more vaild readings.
3. No valid readings were obtained for TMP-10 and TMP-12 on 7/18/2013 or 7/25/2013.

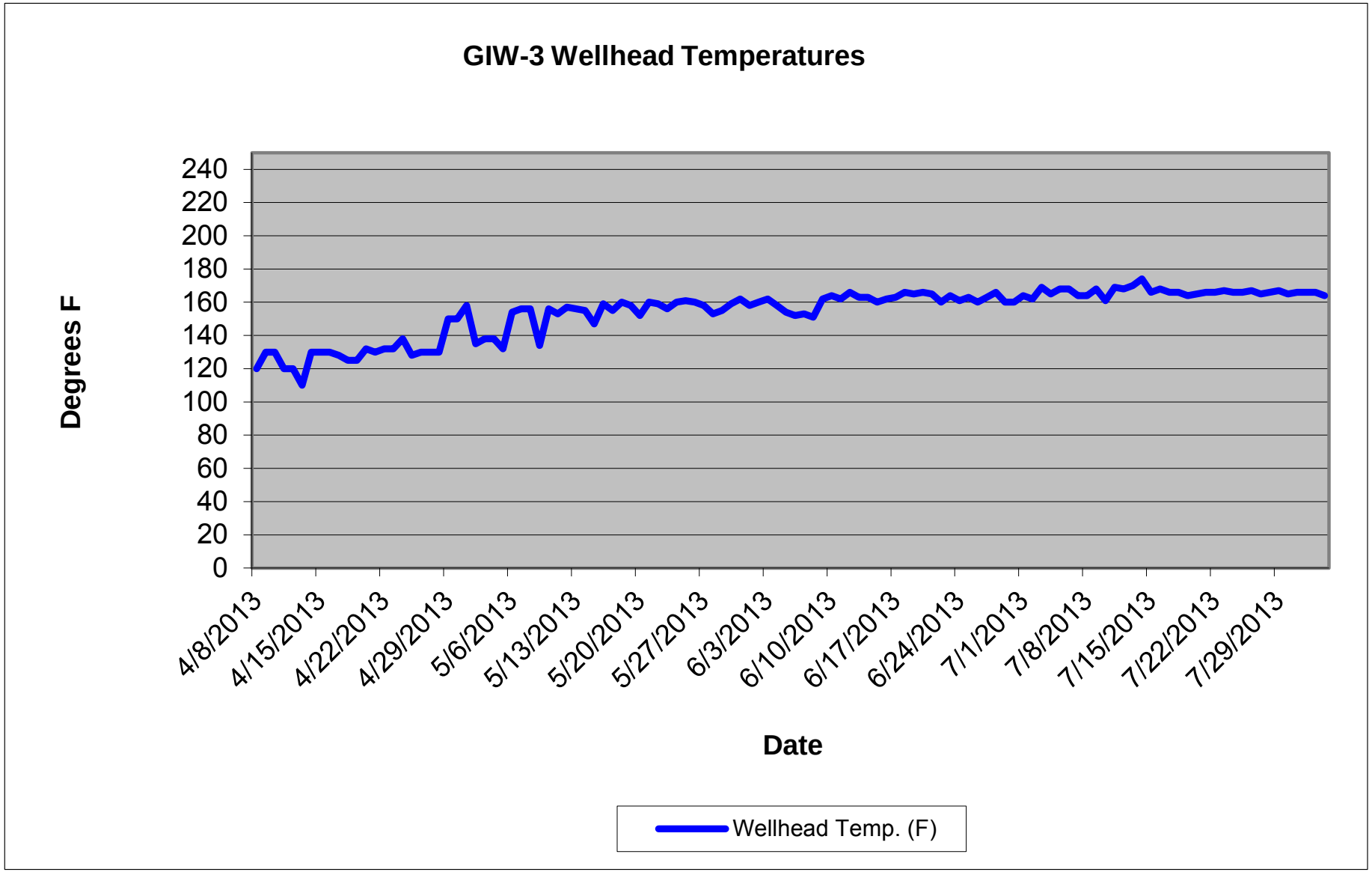
TEMPERATURE VS TIME
BRIDGETON LANDFILL

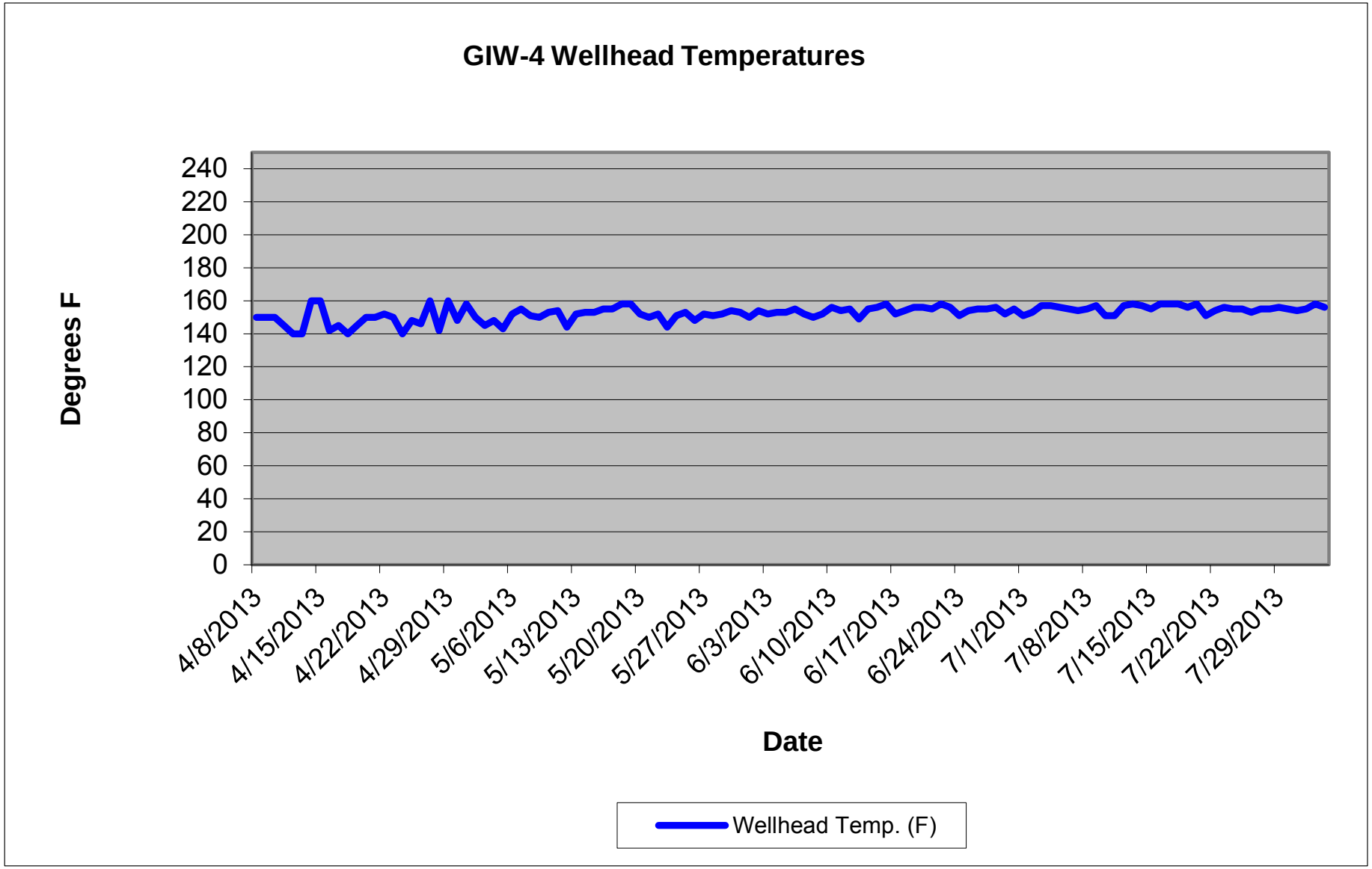
ATTACHMENT C

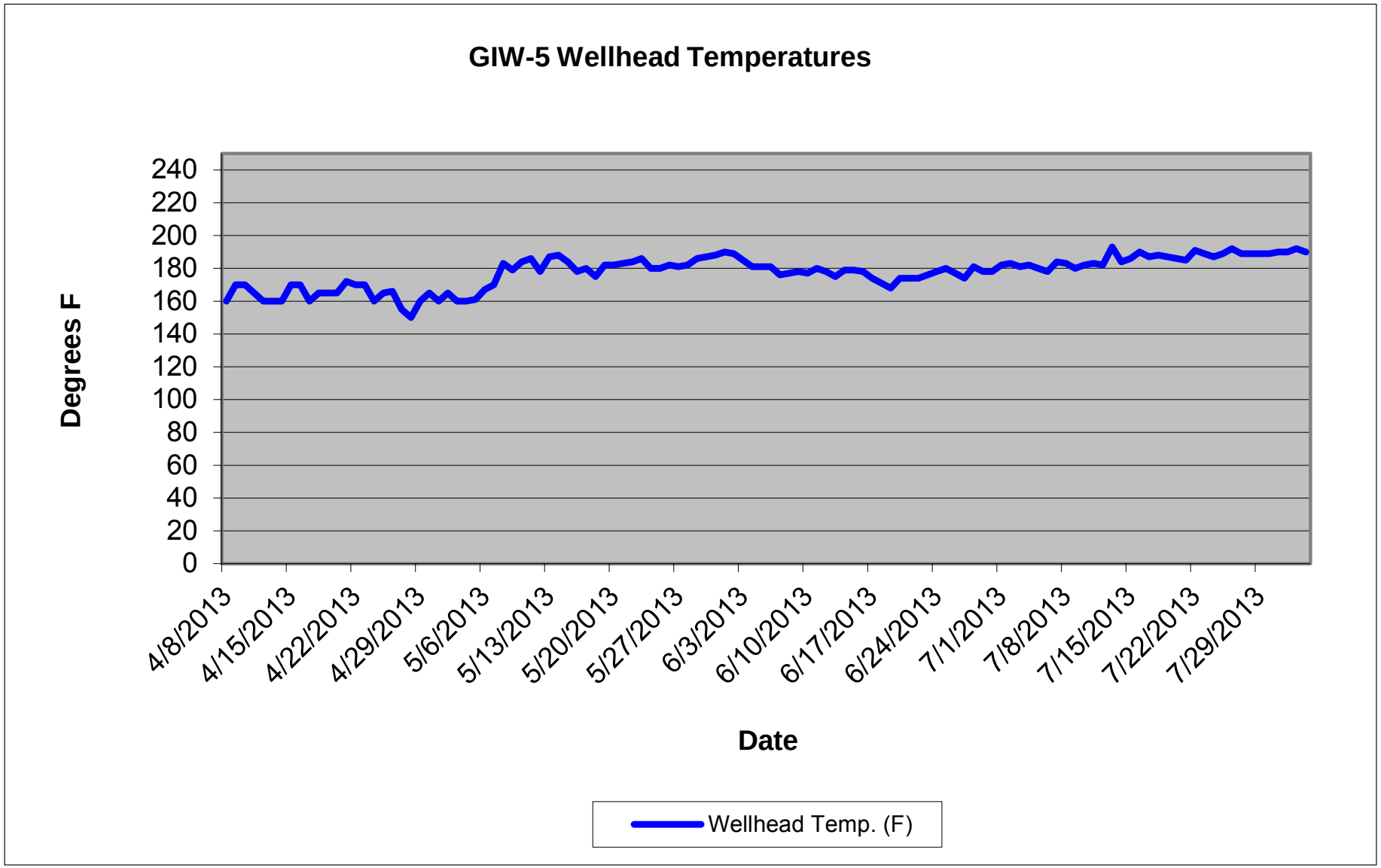
GAS INTERCEPTOR WELLHEAD TEMPERATURE GRAPHS

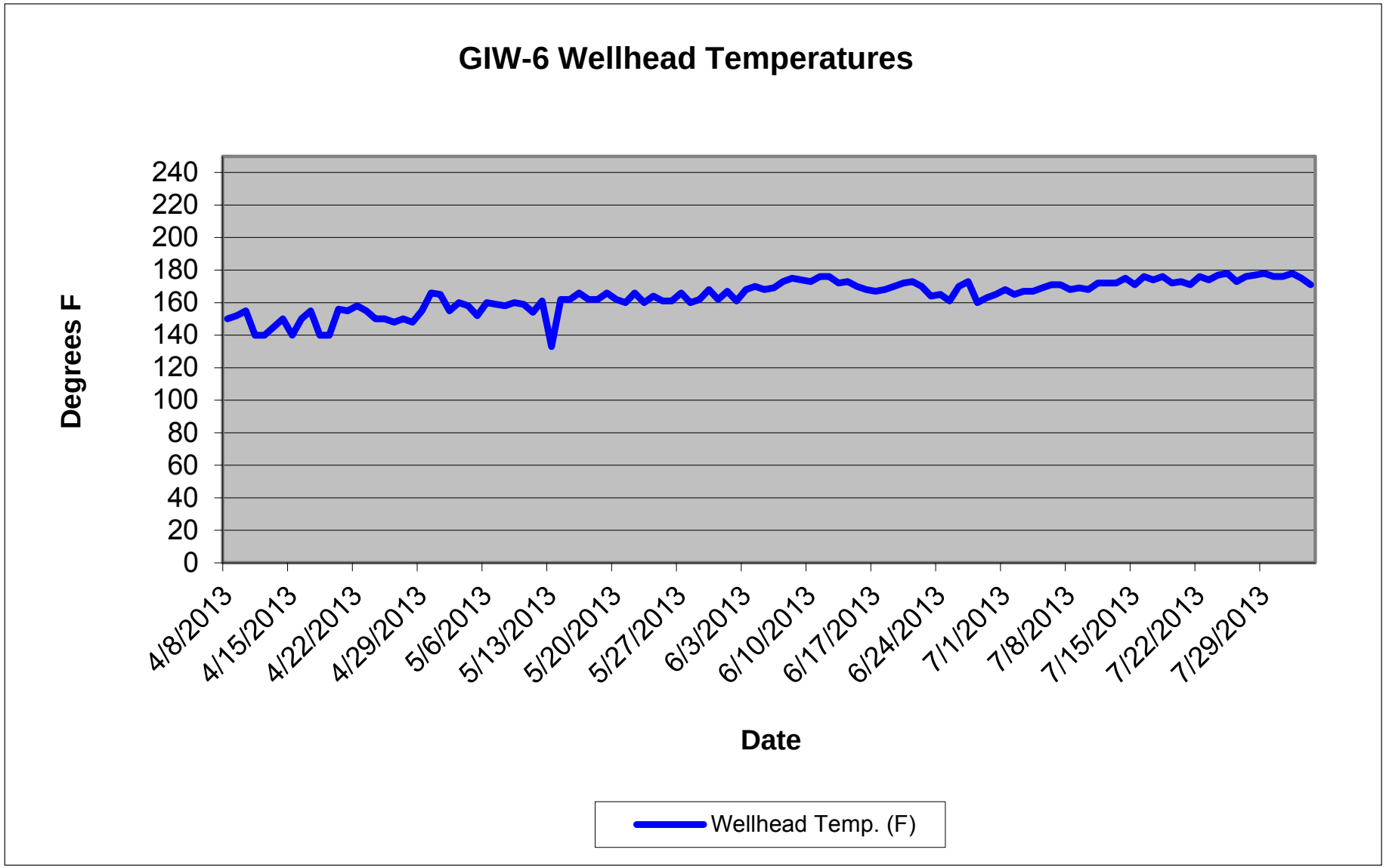

GIW-1 Wellhead Temperatures
Degrees F
240
220
200
180
160
140
120
100
80
60
40
20
0
4/8/2013
4/15/2013
4/22/2013
4/29/2013
5/6/2013
5/13/2013
5/20/2013
5/27/2013
6/3/2013
6/10/2013
6/17/2013
6/24/2013
7/1/2013
7/8/2013
7/15/2013
7/22/2013
7/29/2013
Date
Wellhead Temp. (F)

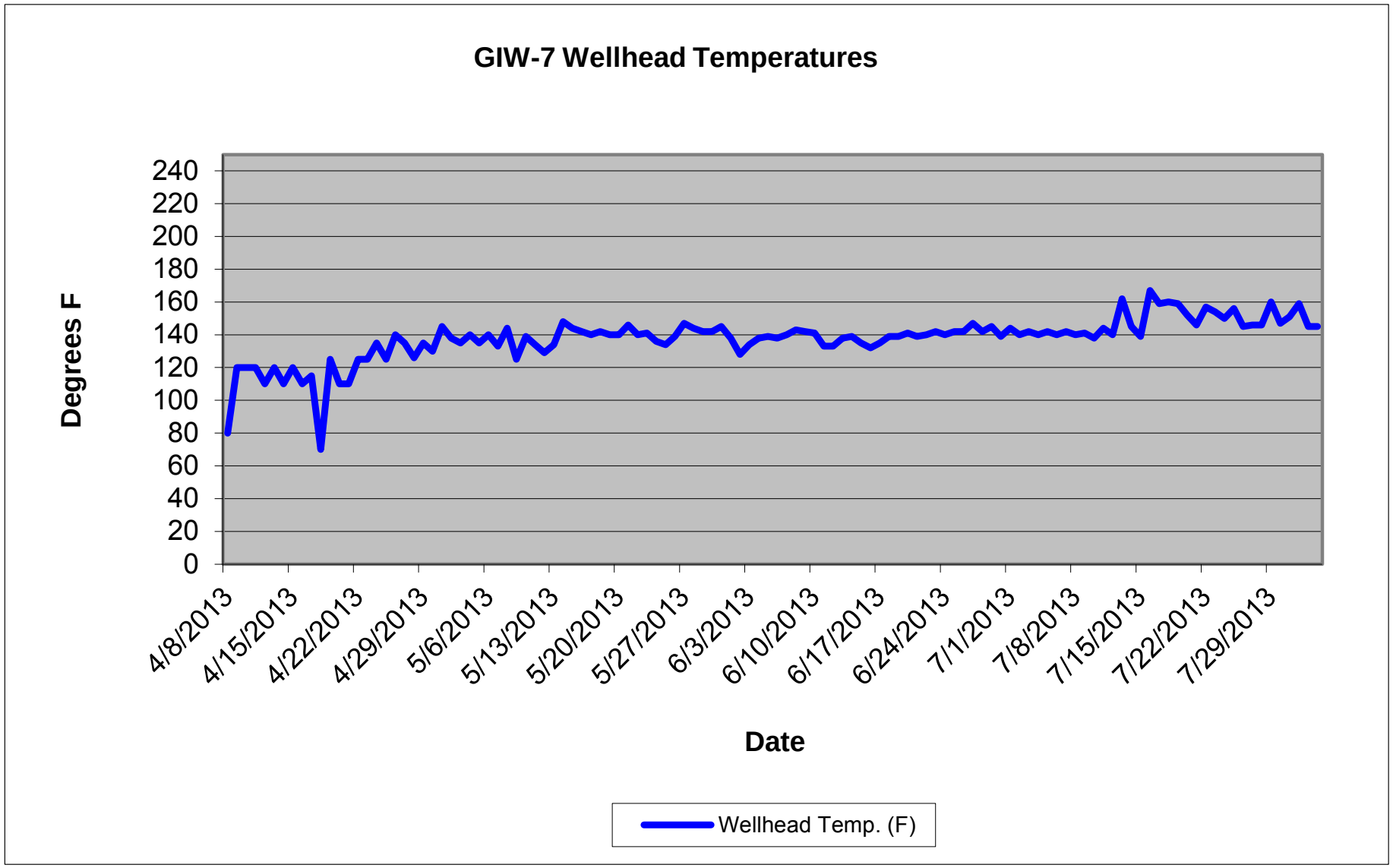

GIW-2 Wellhead Temperatures
Degrees F
240
220
200
180
160
140
120
100
80
60
40
20
0
4/8/2013
4/15/2013
4/22/2013
4/29/2013
5/6/2013
5/13/2013
5/20/2013
5/27/2013
6/3/2013
6/10/2013
6/17/2013
6/24/2013
7/1/2013
7/8/2013
7/15/2013
7/22/2013
7/29/2013
Date
Wellhead Temp. (F)

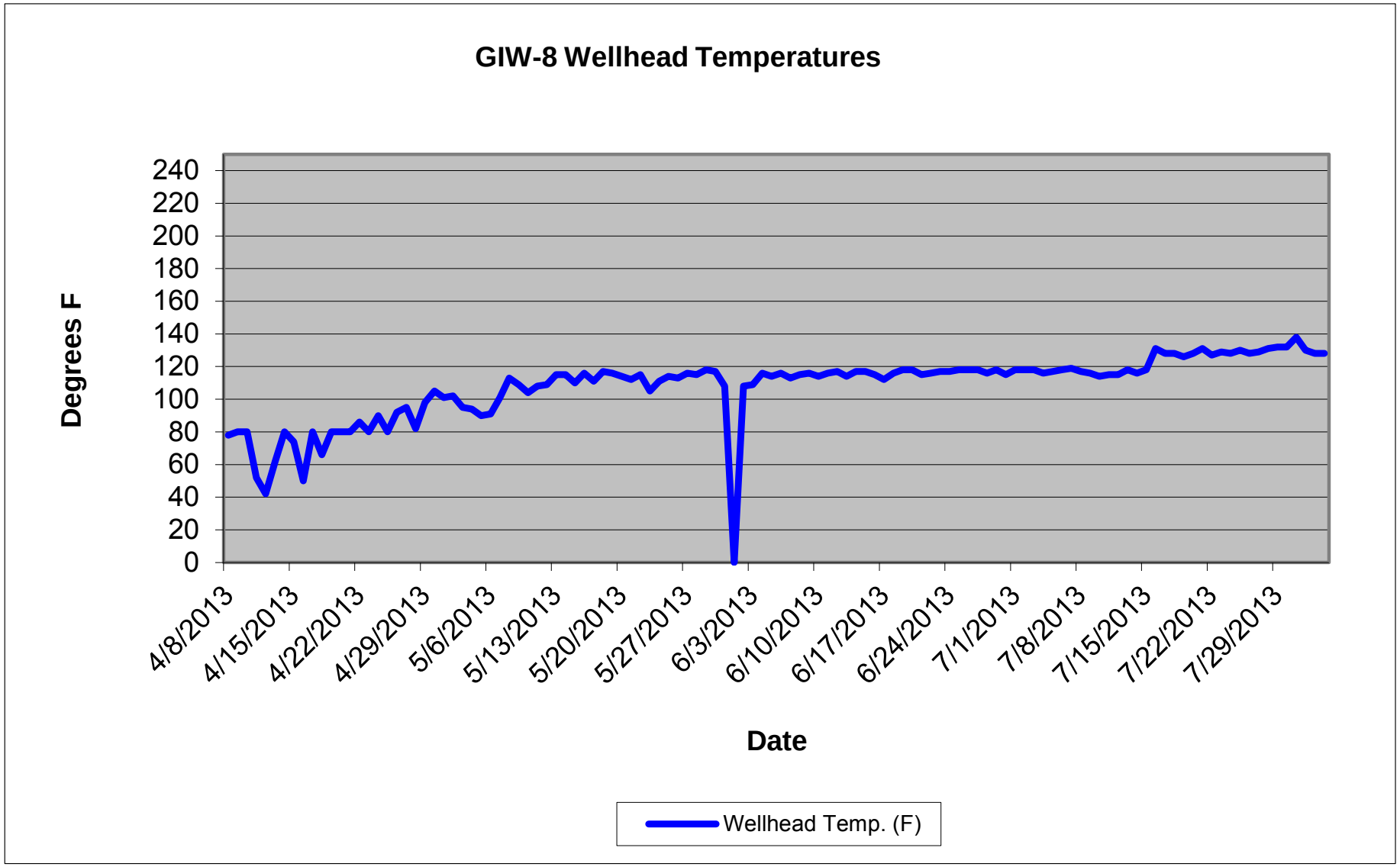

GIW-3 Wellhead Temperatures
Degrees F
240
220
200
180
160
140
120
100
80
60
40
20
0
4/8/2013
4/15/2013
4/22/2013
4/29/2013
5/6/2013
5/13/2013
5/20/2013
5/27/2013
6/3/2013
6/10/2013
6/17/2013
6/24/2013
7/1/2013
7/8/2013
7/15/2013
7/22/2013
7/29/2013
Date
Wellhead Temp. (F)

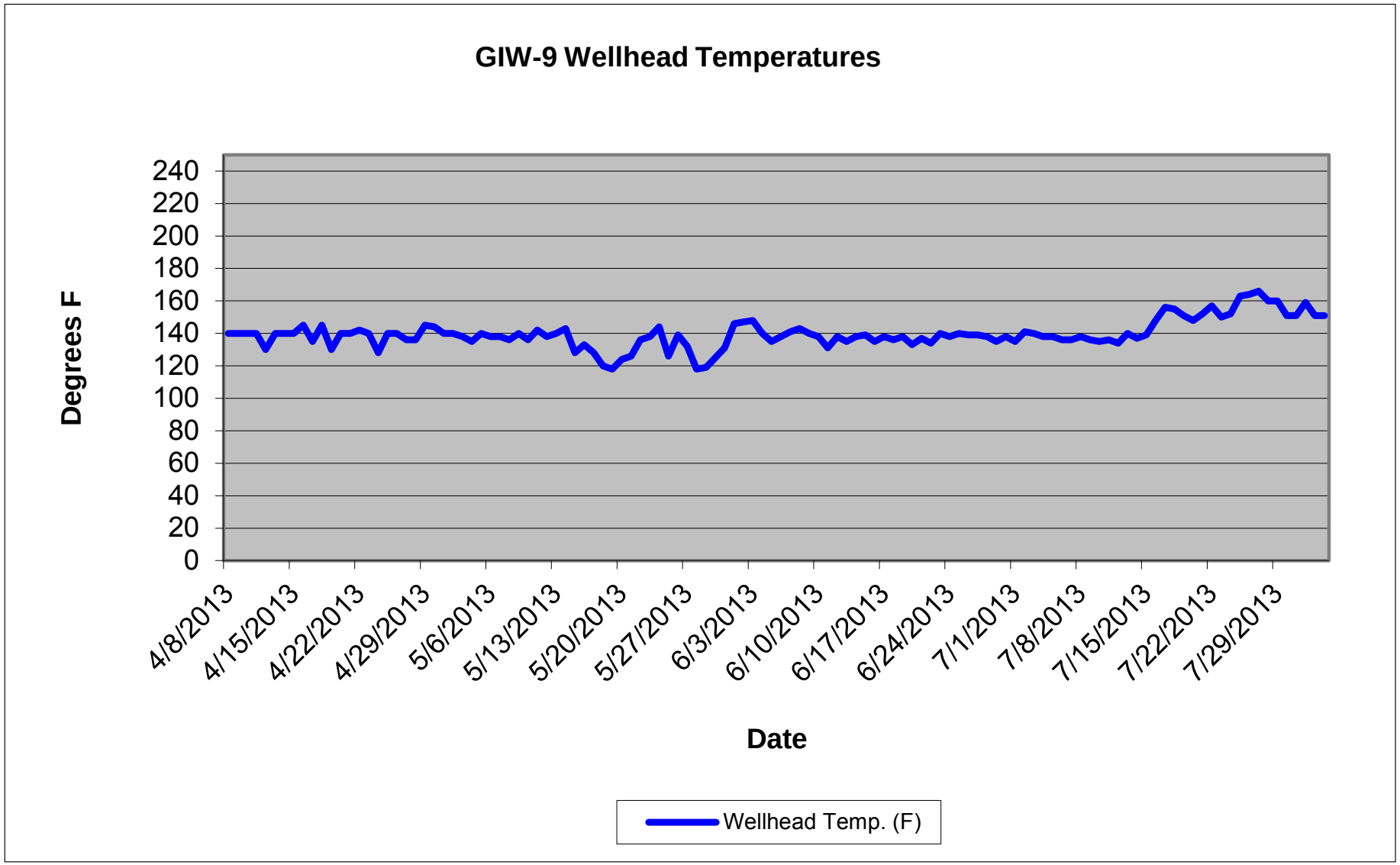

GIW-4 Wellhead Temperatures
Degrees F
240
220
200
180
160
140
120
100
80
60
40
20
0
4/8/2013
4/15/2013
4/22/2013
4/29/2013
5/6/2013
5/13/2013
5/20/2013
5/27/2013
6/3/2013
6/10/2013
6/17/2013
6/24/2013
7/1/2013
7/8/2013
7/15/2013
7/22/2013
7/29/2013
Date
Wellhead Temp. (F)

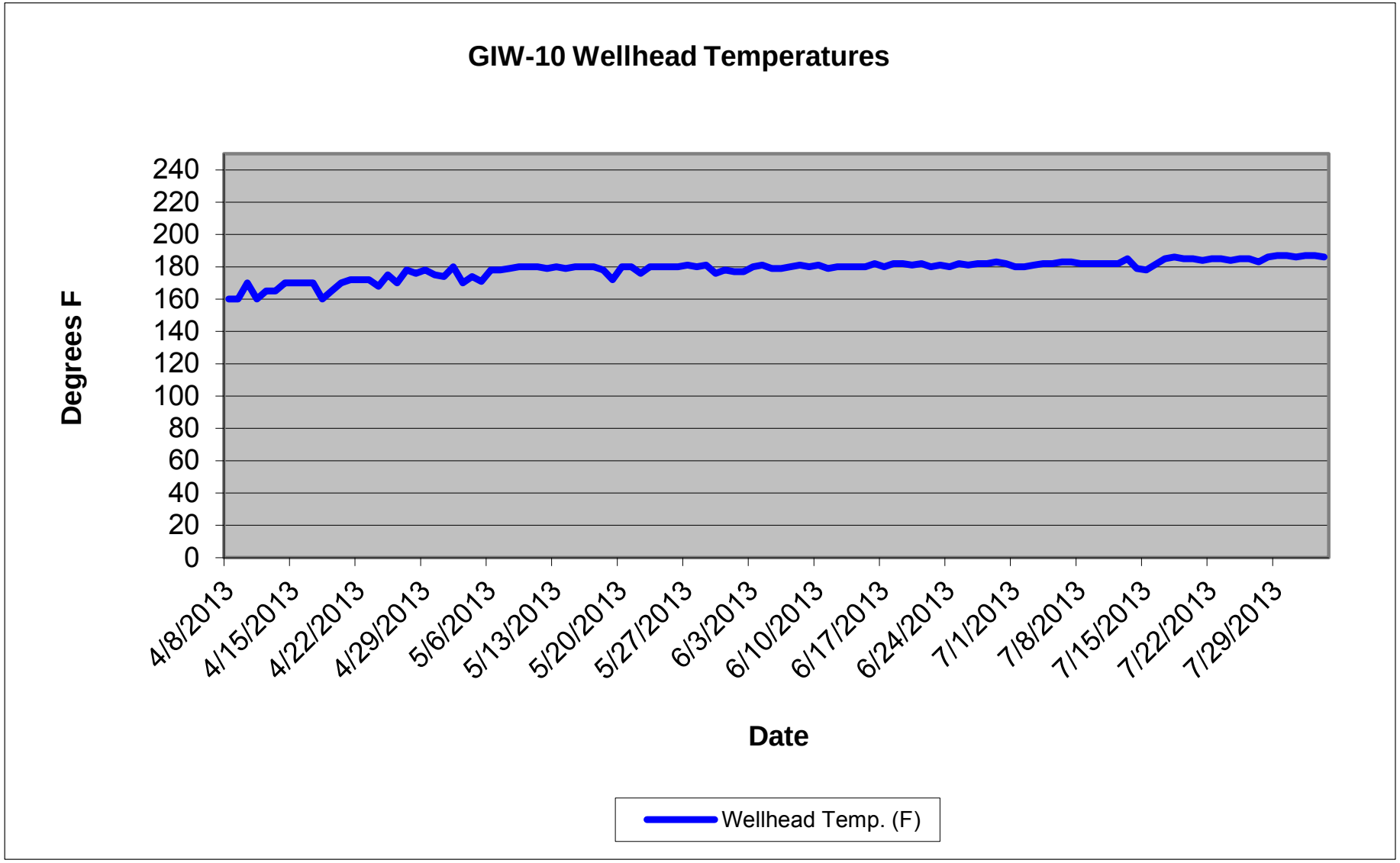

GIW-5 Wellhead Temperatures
Degrees F
240
220
200
180
160
140
120
100
80
60
40
20
0
4/8/2013
4/15/2013
4/22/2013
4/29/2013
5/6/2013
5/13/2013
5/20/2013
5/27/2013
6/3/2013
6/10/2013
6/17/2013
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7/1/2013
7/8/2013
7/15/2013
7/22/2013
7/29/2013
Date
Wellhead Temp. (F)

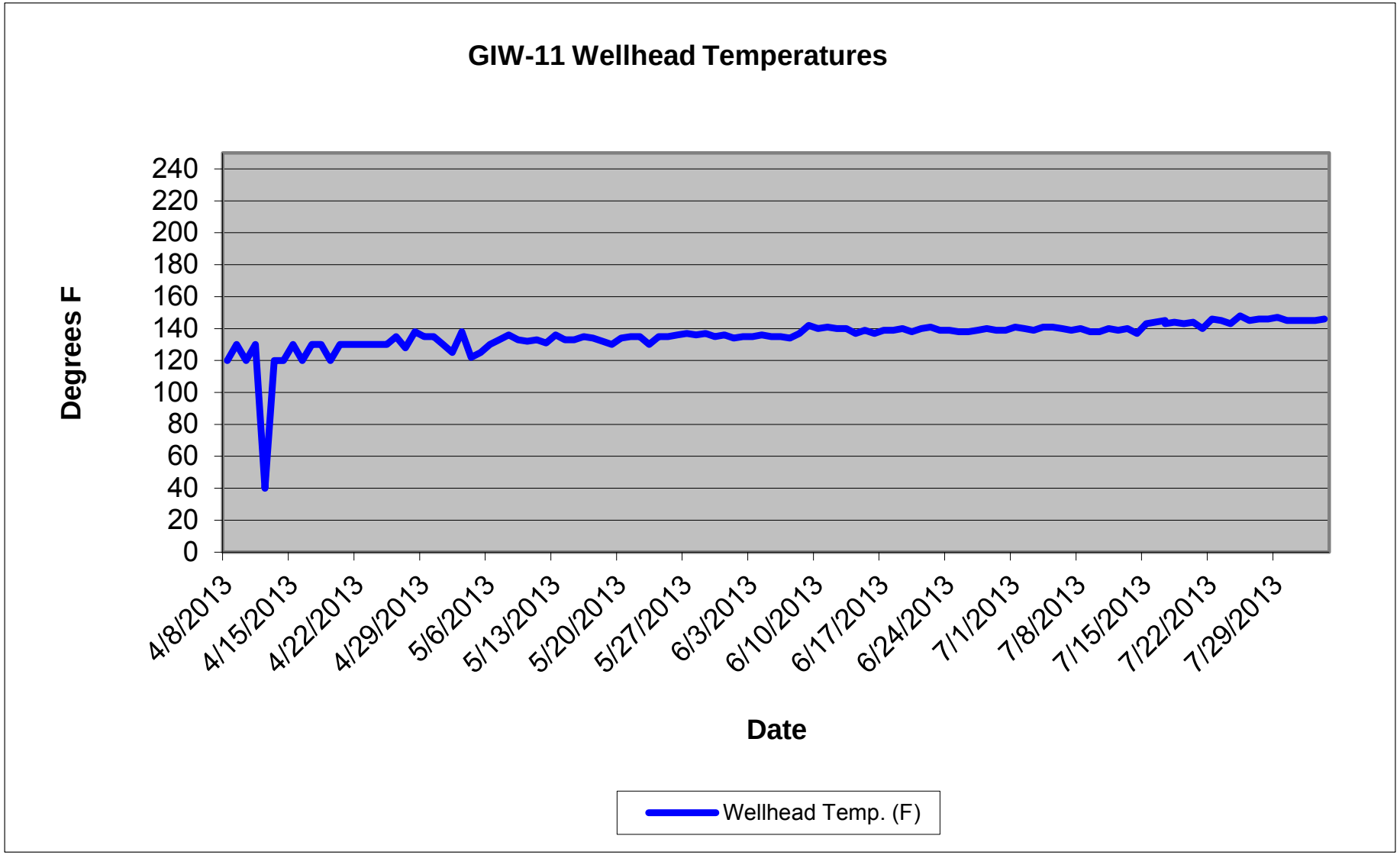

GIW-6 Wellhead Temperatures
Degrees F
240
220
200
180
160
140
120
100
80
60
40
20
0
4/8/2013
4/15/2013
4/22/2013
4/29/2013
5/6/2013
5/13/2013
5/20/2013
5/27/2013
6/3/2013
6/10/2013
6/17/2013
6/24/2013
7/1/2013
7/8/2013
7/15/2013
7/22/2013
7/29/2013
Date
Wellhead Temp. (F)

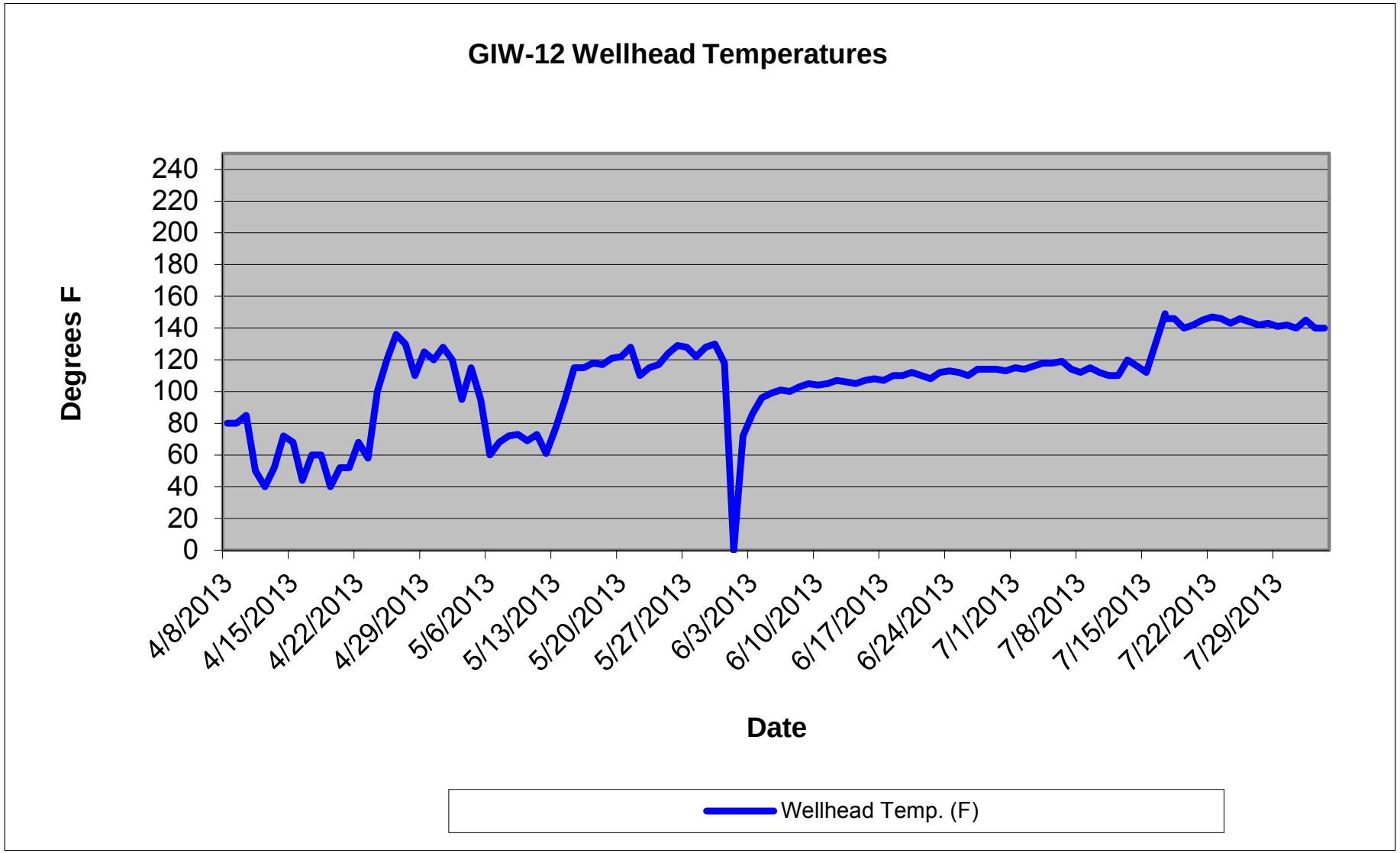

GIW-7 Wellhead Temperatures
Degrees F
240
220
200
180
160
140
120
100
80
60
40
20
0
4/8/2013
4/15/2013
4/22/2013
4/29/2013
5/6/2013
5/13/2013
5/20/2013
5/27/2013
6/3/2013
6/10/2013
6/17/2013
6/24/2013
7/1/2013
7/8/2013
7/15/2013
7/22/2013
7/29/2013
Date
Wellhead Temp. (F)

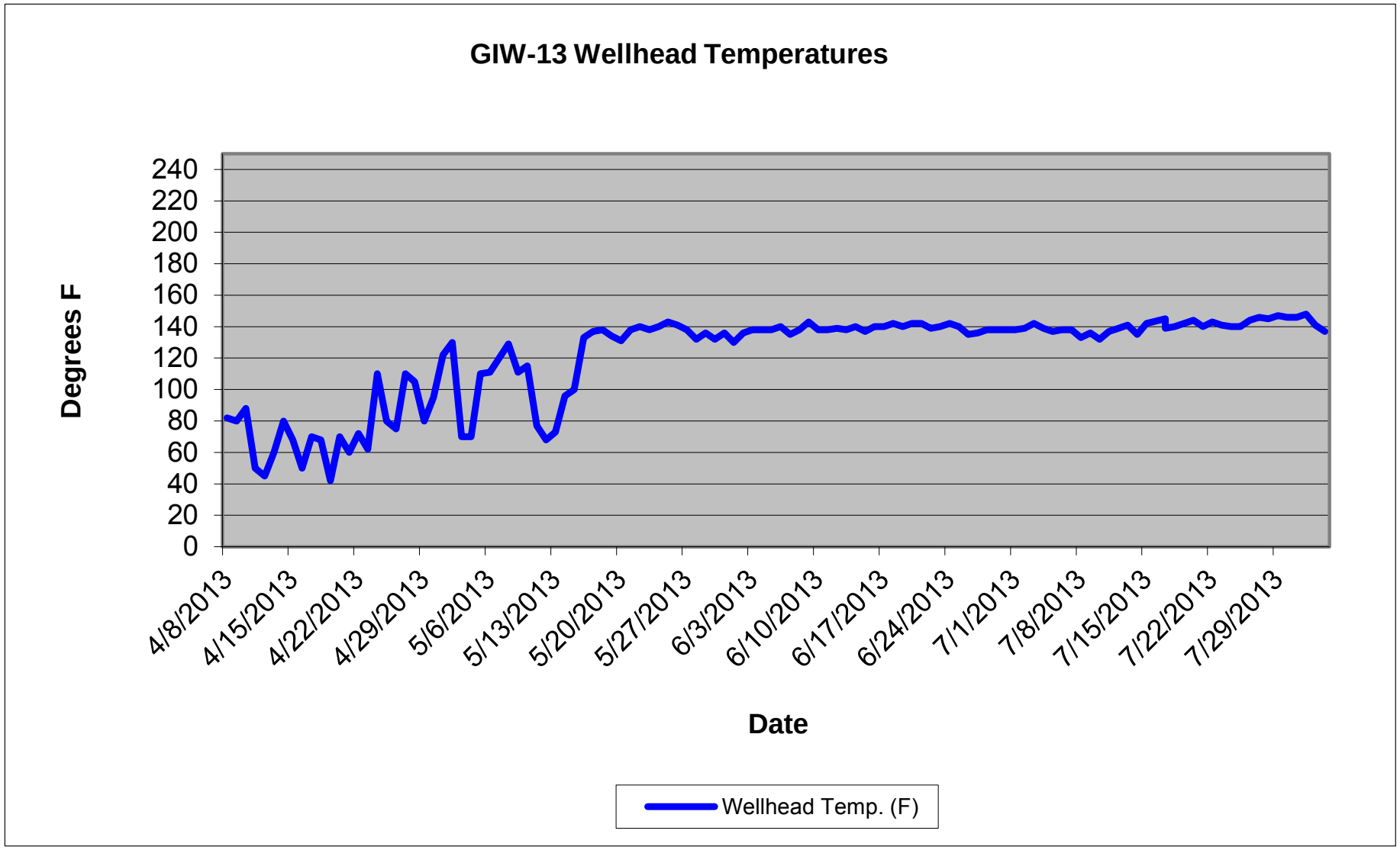

GIW-8 Wellhead Temperatures
Degrees F
240
220
200
180
160
140
120
100
80
60
40
20
0
4/8/2013
4/15/2013
4/22/2013
4/29/2013
5/6/2013
5/13/2013
5/20/2013
5/27/2013
6/3/2013
6/10/2013
6/17/2013
6/24/2013
7/1/2013
7/8/2013
7/15/2013
7/22/2013
7/29/2013
Date
Wellhead Temp. (F)


GIW-9 Wellhead Temperatures
Degrees F
240
220
200
180
160
140
120
100
80
60
40
20
0
4/8/2013
4/15/2013
4/22/2013
4/29/2013
5/6/2013
5/13/2013
5/20/2013
5/27/2013
6/3/2013
6/10/2013
6/17/2013
6/24/2013
7/1/2013
7/8/2013
7/15/2013
7/22/2013
7/29/2013
Date
Wellhead Temp. (F)


GIW-10 Wellhead Temperatures
Degrees F
240
220
200
180
160
140
120
100
80
60
40
20
0
4/8/2013
4/15/2013
4/22/2013
4/29/2013
5/6/2013
5/13/2013
5/20/2013
5/27/2013
6/3/2013
6/10/2013
6/17/2013
6/24/2013
7/1/2013
7/8/2013
7/15/2013
7/22/2013
7/29/2013
Date
Wellhead Temp. (F)


GIW-11 Wellhead Temperatures
Degrees F
240
220
200
180
160
140
120
100
80
60
40
20
0
4/8/2013
4/15/2013
4/22/2013
4/29/2013
5/6/2013
5/13/2013
5/20/2013
5/27/2013
6/3/2013
6/10/2013
6/17/2013
6/24/2013
7/1/2013
7/8/2013
7/15/2013
7/22/2013
7/29/2013
Date
Wellhead Temp. (F)


GIW-12 Wellhead Temperatures
Degrees F
240
220
200
180
160
140
120
100
80
60
40
20
0
4/8/2013
4/15/2013
4/22/2013
4/29/2013
5/6/2013
5/13/2013
5/20/2013
5/27/2013
6/3/2013
6/10/2013
6/17/2013
6/24/2013
7/1/2013
7/8/2013
7/15/2013
7/22/2013
7/29/2013
Date
Wellhead Temp. (F)


GIW-13 Wellhead Temperatures
Degrees F
240
220
200
180
160
140
120
100
80
60
40
20
0
4/8/2013
4/15/2013
4/22/2013
4/29/2013
5/6/2013
5/13/2013
5/20/2013
5/27/2013
6/3/2013
6/10/2013
6/17/2013
6/24/2013
7/1/2013
7/8/2013
7/15/2013
7/22/2013
7/29/2013
Date
Wellhead Temp. (F)

ATTACHMENT D

GAS WELL GEW-54 WELLHEAD TEMPERATURE

Weekly Wellhead Temperature Monitoring of GEW-54 (North Quarry)

Date	Time	Temperature Reading
7/22/13	5:11 PM	149° F
7/30/13	9:30 AM	148° F
8/05/13	8:51 PM	152° F

APPENDIX D

JULY 20, 2013 MONTHLY DATA REPORT

Bridgeton Landfill, LLC

Monthly Data Submittals

Required by Section 52.E of Agreed Order, Case No. 13SL-CC01088
Effective May 13, 2013

Contents:

Commentary on Data
Attachment A **Daily Flare Monitoring Data**
- **A-1** **Data Spreadsheet**
- **A-2** **Data Graphs**

Attachment B **Work Completed and Planned**
Attachment C **Carbon Monoxide Maps**
Attachment D **Hydrogen Maps**
Attachment E **Settlement Front Map**
Attachment F **Gas Wellfield Data**
- **F-1** **GEM Data Spreadsheet**
- **F-2** **Maximum Temperature Spreadsheet**
- **F-3** **Lab Analyses Spreadsheet**

Attachment G **Wellhead Temperature Maps**
Attachment H **Summary of Odor Complaints**
Attachment I **Liquid Characterization Data**
Attachment J **Liquid Transport Manifest Logs**

Provided Separately:

– Flare Raw Data Excel Spreadsheet
– Gas Wellfield Raw Data Excel Spreadsheet

July 20, 2013

Commentary on Data, July 20, 2013

The following observations and comments are offered for the June 2013 data:

Gas Volume

- As seen in Attachment A-2, gas collection volume continued to increase (from about 5,500 CFM in February 2013 to about 8,000 CFM in June 2013) as the GIWs were put into service and overall vacuum distribution to the GCCS was improved. Flare inlet temperature had gradually increased in April and May but achieved a stable level in June 2013.

Gas Quality

- Attachment F-2 and G indicate an overall trend to higher gas wellhead temperatures in the South Quarry area. This is attributable to higher ambient temperature, improved gas collection efficiency, and capture of more generated heat.
- Five wells in the North Quarry area have historically run at or over 131° F at times and currently exhibit somewhat elevated temperatures as indicated on the June map in Attachment F-2; review of weekly gas quality in Attachment F-1 reveals that all of these gas wells have no oxygen and have normal methane and carbon dioxide levels suggesting healthy wellfield conditions at those locations. In order to determine if these changes are attributable to higher ambient temperature, Bridgeton Landfill will monitor GEW-54 (maximum June temperature of 155 degrees Fahrenheit) for temperature on a weekly basis until such time the temperature falls below 140 degrees Fahrenheit.
- Review of the maps in Attachment C shows that carbon monoxide levels in gas extraction wells in the "neck" area (GEW-10, -39, and -109) indicate moderately increasing levels. This may be the effect of the Gas Interceptor Wells (GIWs); however, to better understand these detections, Bridgeton Landfill will conduct carbon monoxide monitoring of GEW-54 on a monthly basis until the temperature falls below 140 degrees Fahrenheit. In addition, we will collect one round of monitoring for carbon monoxide at the surrounding wells, GEW-40, -41R, -43R, -53, and -55.
- Review of the maps in Attachment D shows that hydrogen levels in two of the gas extraction wells in the "neck" area (GEW-39, and -109) indicate moderately increasing levels. This may be the effect of the Gas Interceptor Wells (GIWs); however, to better understand these detections, Bridgeton Landfill will conduct one round of hydrogen monitoring at GEW-40, -41R, -43R, -53, -54, and -55.
- Attachment F-1 includes data that shows that six vertical gas extraction wells had oxygen levels over 5% at one or more weekly monitoring events in June. Four of these (GEW-18R, -33R, -34, and -110) were addressed with final June readings below 5%, and the other two (GEW-1, and -14A) are undergoing evaluation.

Further, Bridgeton Landfill will coordinate with MDNR to enroll the procedures for collecting weekly temperatures and monthly CO measurements at wells that exhibit temperatures over 145 degrees Fahrenheit into the on-going operating procedures at the site. The weekly

collection of temperatures and monthly collection of CO measurements will cease after the well temperatures are recorded below 140 degrees Fahrenheit.

Settlement

- The June settlement data results in Appendix E are not meaningful for the southern portion of the South Quarry due to extensive re-grading efforts required for the capping work in that area. However, the northern area, including the "neck" area was not disturbed in June, so the settlement front in that area was observable. Comparison of the June settlement front on Attachment E to the May settlement front map indicate little to no advancement of settlement front toward the neck area in the NE or N directions and a movement of about one foot per day toward the NE. The past several months continue to show an overall slowing of advancement toward the neck area with data since February 2013 indicating an average movement in the northern directions of 0.49 feet per day.

Complaints

- As seen in Attachment H, there were 43 complaints in June (compared to 76 complaints in May).

ATTACHMENT A

DAILY FLARE MONITORING DATA

ATTACHMENT A-1

DATA SPREADSHEET

Daily Flare Monitoring Data - Bridgeton Landfill
1/1/2013 - 6/30/2013

Date	Device Flow (scfm)				Total Flow (scfm)
	Enclosed Flare	Callidus Flare	Candlestick Flare	E. Aux. Candlestick Flare	
1/1/2013	2,011	1,822	1,418		**5,251**
1/2/2013	1,974	1,977	1,378		**5,329**
1/3/2013	2,130	1,980	1,468		**5,578**
1/4/2013	1,878	1,838	1,393		**5,109**
1/5/2013	1,908	1,860	1,321		**5,089**
1/6/2013	1,712	1,782	1,358		**4,852**
1/7/2013	1,734	1,761	1,265	1,211	**5,971**
1/8/2013	1,410	2,009	1,247	1,247	**5,913**
1/9/2013	1,902	2,090	1,203	1,234	**6,429**
1/10/2013	2,367	2,060	1,243	1,301	**6,971**
1/11/2013	1,765	1,646	1,302		**4,713**
1/12/2013	4,388				**4,388**
1/13/2013	1,569	2,672	1,221	1,474	**6,936**
1/14/2013		2,904	1,394	1,434	**5,732**
1/15/2013		3,245	1,401	1,422	**6,068**
1/16/2013		3,122	1,316	1,388	**5,826**
1/17/2013	4,639	3,163	1,514	1,484	**10,800**
1/18/2013		2,782	1,413	1,389	**5,584**
1/19/2013		4,064			**4,064**
1/20/2013		1,888			**1,888**
1/21/2013	752		1,411	1,282	**3,445**
1/22/2013	4,660	2,735	1,894		**9,289**
1/23/2013	730	2,870	730		**4,330**
1/24/2013	671	2,735	1,271		**4,677**
1/25/2013	710	2,759	3,900		**7,369**
1/26/2013	625	2,875	3,901		**7,401**
1/27/2013	591	2,751	3,901		**7,243**
1/28/2013	971	2,843	3,900		**7,714**
1/29/2013	697		1,074		**1,771**
1/30/2013	697	2,862	806		**4,365**
1/31/2013	2,100	2,220	820		**5,140**

Daily Flare Monitoring Data - Bridgeton Landfill
1/1/2013 - 6/30/2013

Date	Device Flow (scfm)				Total Flow (scfm)
	Enclosed Flare	Callidus Flare	Candlestick Flare	E. Aux. Candlestick Flare	
2/1/2013	1,573	2,399	1,452		**5,424**
2/2/2013	2,633	1,618	1,483		**5,734**
2/3/2013	2,880	2,130	868		**5,878**
2/4/2013	3,450	2,358	814		**6,622**
2/5/2013	2,960	2,220	820		**6,000**
2/6/2013	3,204	2,473	981		**6,658**
2/7/2013	2,856	2,258	1,089		**6,203**
2/8/2013	2,641	2,124	832		**5,597**
2/9/2013	2,794	2,366	994		**6,154**
2/10/2013	2,719	2,210	1,080		**6,009**
2/11/2013	3,404	2,216	920		**6,540**
2/12/2013	2,990	2,200	950		**6,140**
2/13/2013	2,915	2,141	965		**6,021**
2/14/2013	2,938	1,995	1,035		**5,968**
2/15/2013	2,824	2,130	941		**5,895**
2/16/2013	2,589	2,064	1,026		**5,679**
2/17/2013	2,760	2,048	1,090		**5,898**
2/18/2013	2,767	2,490	1,060		**6,317**
2/19/2013	2,450	2,233	950		**5,633**
2/20/2013	2,324	2,094	951		**5,369**
2/21/2013	2,435	2,092	1,021		**5,548**
2/22/2013	2,555	2,108	1,150		**5,813**
2/23/2013	2,461	2,024	1,011		**5,496**
2/24/2013	2,694	2,119	1,015		**5,828**
2/25/2013	2,650	1,987	1,080		**5,717**
2/26/2013	2,398	2,293	935		**5,626**
2/27/2013	1,811	1,804	818		**4,433**
2/28/2013	2,112	1,975	908		**4,995**

Daily Flare Monitoring Data - Bridgeton Landfill
1/1/2013 - 6/30/2013

Date	Device Flow (scfm)				Total Flow (scfm)
	Enclosed Flare	Callidus Flare	Candlestick Flare	E. Aux. Candlestick Flare	
3/1/2013	2,192	1,926	848		**4,966**
3/2/2013	2,293	2,202	906		**5,401**
3/3/2013	2,533	2,357	874		**5,764**
3/4/2013	2,659	2,365	913		**5,937**
3/5/2013	2,709	2,313	976		**5,998**
3/6/2013	2,414	2,283	1,012		**5,709**
3/7/2013	2,542	2,340	879		**5,761**
3/8/2013	2,526	2,380	957		**5,863**
3/9/2013	2,711	2,389	915		**6,015**
3/10/2013	2,726	2,266	1,073		**6,065**
3/11/2013	3,134	2,027	1,178		**6,339**
3/12/2013	2,933	2,373	1,202		**6,508**
3/13/2013	2,873	2,207	1,332		**6,412**
3/14/2013	3,615	1,549	768		**5,932**
3/15/2013	3,321	2,237	1,284		**6,842**
3/16/2013	2,762	1,948	1,381		**6,091**
3/17/2013	2,690	1,836	1,842		**6,368**
3/18/2013	2,316	2,171	2,009		**6,496**
3/19/2013	2,252	2,307	1,578		**6,137**
3/20/2013	2,883	2,251	1,167		**6,301**
3/21/2013	2,080	2,106	1,383		**5,569**
3/22/2013	2,216	2,664	1,339		**6,219**
3/23/2013	3,474	2,345	1,247		**7,066**
3/24/2013	2,869	2,248	1,099		**6,216**
3/25/2013	2,946	2,165	1,177		**6,288**
3/26/2013	3,255	2,243	1,112		**6,610**
3/27/2013	3,188	2,249	1,167		**6,604**
3/28/2013	3,237	2,314	1,322		**6,873**
3/29/2013	3,055	2,293	1,898		**7,246**
3/30/2013	2,975	2,349	1,238		**6,562**
3/31/2013	2,826	2,041	1970		**6,837**

Daily Flare Monitoring Data - Bridgeton Landfill
1/1/2013 - 6/30/2013

Date	Device Flow (scfm)				Total Flow (scfm)
	Enclosed Flare	Callidus Flare	Candlestick Flare	E. Aux. Candlestick Flare	
4/1/2013	2,755	2,284	1,994		**7,033**
4/2/2013	2,982	2,109	1,655		**6,746**
4/3/2013	3,138	2,246	1,728		**7,112**
4/4/2013	3,320	2,173	2,008		**7,501**
4/5/2013	3,001	2,034	2,196		**7,231**
4/6/2013	2,976	1,776	1,889		**6,641**
4/7/2013					
4/8/2013	3,122	2,154	1,877		**7,153**
4/9/2013	2,849	2,001	2,156		**7,006**
4/10/2013	3,001	1,614	1,279		**5,894**
4/11/2013	2,719	1,561	1,335		**5,615**
4/12/2013	2,645	1,417	1,441		**5,503**
4/13/2013	3,344	1,504	1,259		**6,107**
4/14/2013	2,369	1,617	2,558		**6,544**
4/15/2013	2,225	1,654	2,135		**6,014**
4/16/2013	1,874	1,472	2,005		**5,351**
4/17/2013	1,889	1,454	2,413		**5,756**
4/18/2013	2,536	1,610	1,808		**5,954**
4/19/2013	2,741	1,558	2,032		**6,331**
4/20/2013	2,963	1,613	1,753		**6,329**
4/21/2013	3,109	1,614	1,773		**6,496**
4/22/2013	3,630	1,564	2,011		**7,205**
4/23/2013	3,202	1,600	1,660		**6,462**
4/24/2013	3,049	1,610	1,675		**6,334**
4/25/2013	3,014	1,585	1,687		**6,286**
4/26/2013	2,832	1,590	1,620		**6,042**
4/27/2013	3,526	1,590	1,029		**6,145**
4/28/2013	3,628	1,615	1,345		**6,588**
4/29/2013	3,506	1,562	1,982		**7,050**
4/30/2013	3,550	1,604	2,124		**7,278**

Daily Flare Monitoring Data - Bridgeton Landfill
1/1/2013 - 6/30/2013

Date	Device Flow (scfm)				Total Flow (scfm)
	Enclosed Flare	Callidus Flare	Candlestick Flare	E. Aux. Candlestick Flare	
5/1/2013	1,693	1,516	2,168		**5,377**
5/2/2013	1,562	1,583	1,752		**4,897**
5/3/2013	1,697	1,620	1,779		**5,096**
5/4/2013	1,540	1,606	1,810		**4,956**
5/5/2013	1,740	1,548	1,707		**4,995**
5/6/2013	1,755	1,603	1,730		**5,088**
5/7/2013	1,720	1,687	2,235		**5,642**
5/8/2013	1,656	1,620	2,176		**5,452**
5/9/2013	1,611	1,374	2,110		**5,095**
5/10/2013	1,648	1,582	1,527		**4,757**
5/11/2013	1,663	1,546	1,642		**4,851**
5/12/2013	1,621	1,607	1,900		**5,128**
5/13/2013	1,643	1,564	1,810		**5,017**
5/14/2013	1,626	1,611	2,121		**5,358**
5/15/2013	1,640	1,598	1,920		**5,158**
5/16/2013	1,654	1,404	2,242		**5,300**
5/17/2013	1,648	1,582	2,121		**5,351**
5/18/2013	1,639	1,560	2,141		**5,340**
5/19/2013	1,666	1,595	2,375		**5,636**
5/20/2013	1,667	1,605	1,881		**5,153**
5/21/2013	1,649	1,596	2,112		**5,357**
5/22/2013	1,629	1,574	2,337		**5,540**
5/23/2013	1,662	1,577	2,214		**5,453**
5/24/2013	1,658	1,477	1,873		**5,008**
5/25/2013	1,673	1,539	2,007		**5,219**
5/26/2013	1,669	1,519	2,488		**5,676**
5/27/2013	1,676	1,510	2,601		**5,787**
5/28/2013	1,651	1,612	2,034		**5,297**
5/29/2013	1,614	1,610	2,321		**5,545**
5/30/2013	1,670	1,601	2,828		**6,099**
5/31/2013	1,591	1,596	2,741		**5,928**

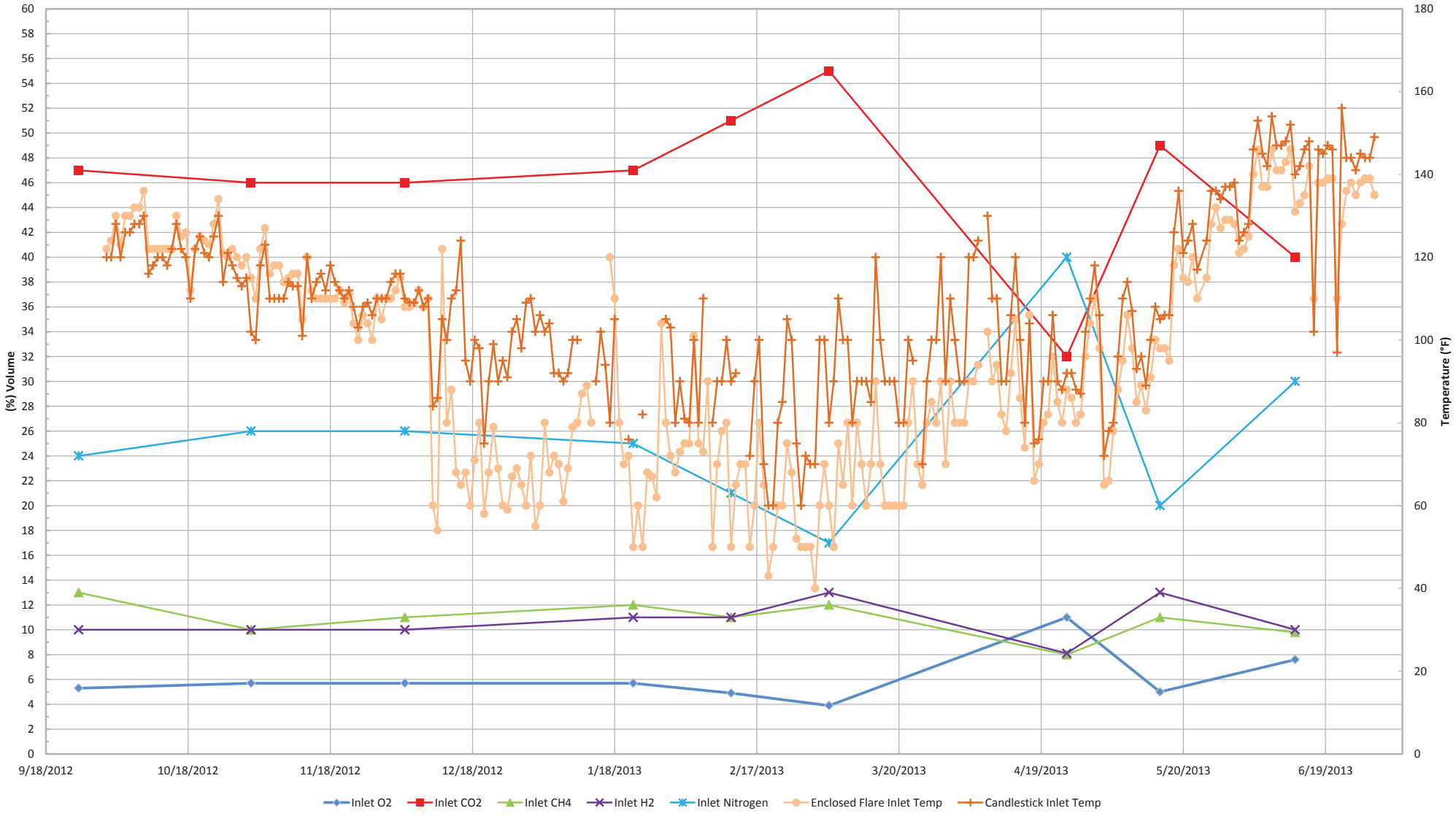
Daily Flare Monitoring Data - Bridgeton Landfill
1/1/2013 - 6/30/2013

Date	Device Flow (scfm)				Total Flow (scfm)
	Enclosed Flare	Callidus Flare	Candlestick Flare	E. Aux. Candlestick Flare	
6/1/2013	3,161	1,467	2,873		**7,501**
6/2/2013	3,642	1,544	2,245		**7,431**
6/3/2013	3,664	1,581	2,364		**7,609**
6/4/2013	3,451	1,490	2,713		**7,654**
6/5/2013	3,722	1,591	1,922	586	**7,821**
6/6/2013	3,696	1,592	1,918	529	**7,735**
6/7/2013	3,405	1,571	1,809	734	**7,519**
6/8/2013	3,544	1,553	2,592	596	**8,285**
6/9/2013	3,352	1,581	2,038	864	**7,835**
6/10/2013	3,691	1,623	1,589	1,079	**7,982**
6/11/2013	3,665	1,580	1,457	1,028	**7,730**
6/12/2013	3,651	1,546	2,110	1,056	**8,363**
6/13/2013	3,698	1,596	1,653	488	**7,435**
6/14/2013	3,558	1,620	1,214	1,119	**7,511**
6/15/2013	3,691	1,562	1,269	872	**7,394**
6/16/2013	3,502	1,608	2,105	745	**7,960**
6/17/2013	2,604	1,558	1,664	1,051	**6,877**
6/18/2013	3,401	1,605	1,496	1,141	**7,643**
6/19/2013	3,691	1,587	1,004	1,409	**7,691**
6/20/2013	3,769	1,608	1,196	1,184	**7,757**
6/21/2013	3,519	1,588	1,891	1,177	**8,175**
6/22/2013	3,864		2,301	1,380	**7,545**
6/23/2013	3,809		2,987	1,293	**8,089**
6/24/2013	3,497		3,046	1,443	**7,986**
6/25/2013	3,889		3,046	1,382	**8,317**
6/26/2013	3,803		2,725	1,391	**7,919**
6/27/2013	3,629		2,605	1,334	**7,568**
6/28/2013	3,853		2,817	1,326	**7,996**
6/29/2013	3,694		2,566	1,386	**7,646**
6/30/2013	3,694		2,911	1,432	**8,037**

ATTACHMENT A-2

DATA GRAPHS

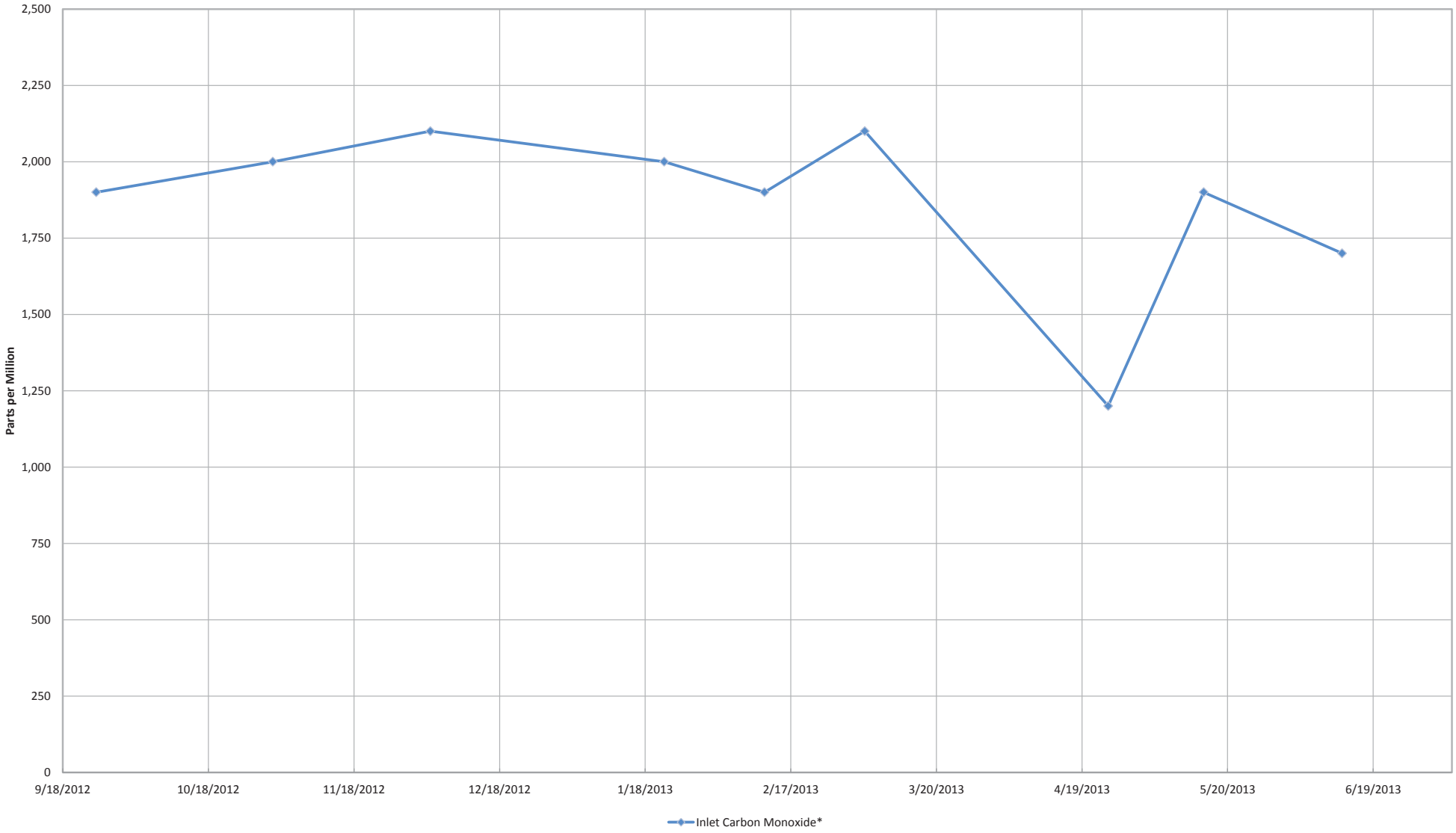
Inlet Gas and Temperature*



*Gas data collected from Laboratory Reports. Temperature data collected from GEM 2000 field readings.

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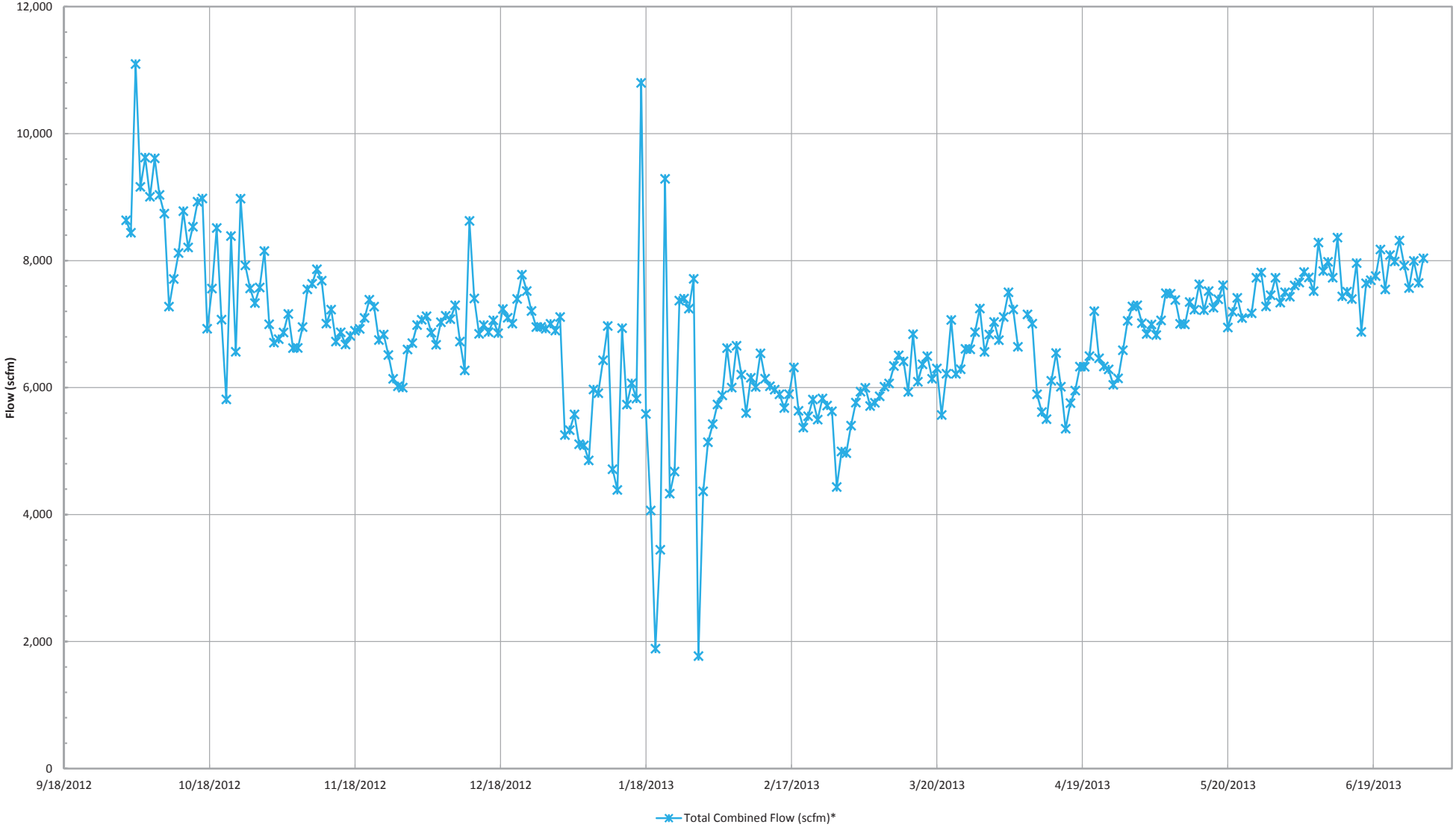
Inlet Carbon Monoxide*



*Data collected from Laboratory Reports.

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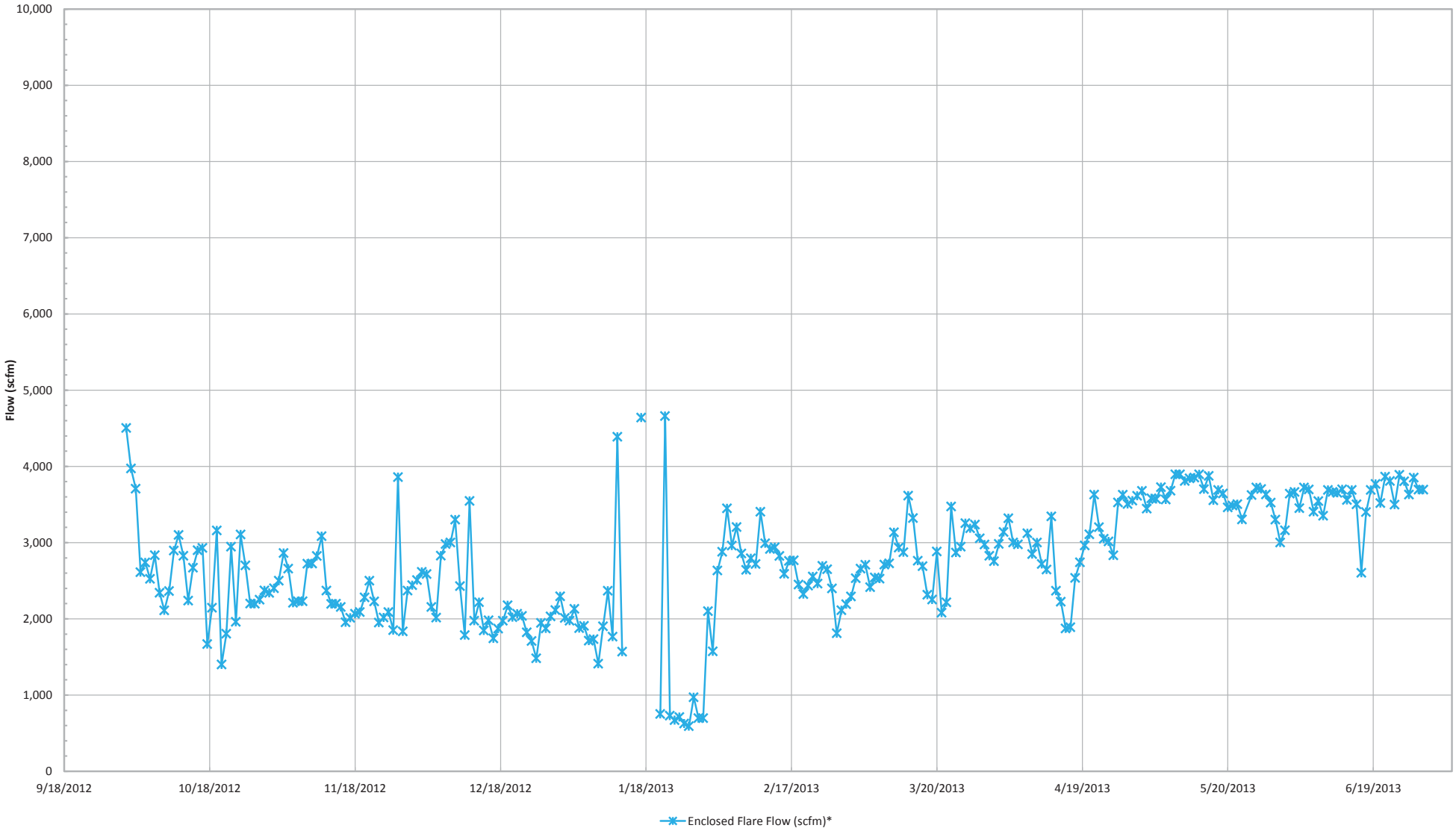
Total Combined Flow (scfm)*



*Combined flow is based on tabulated flow data collected daily from each device.

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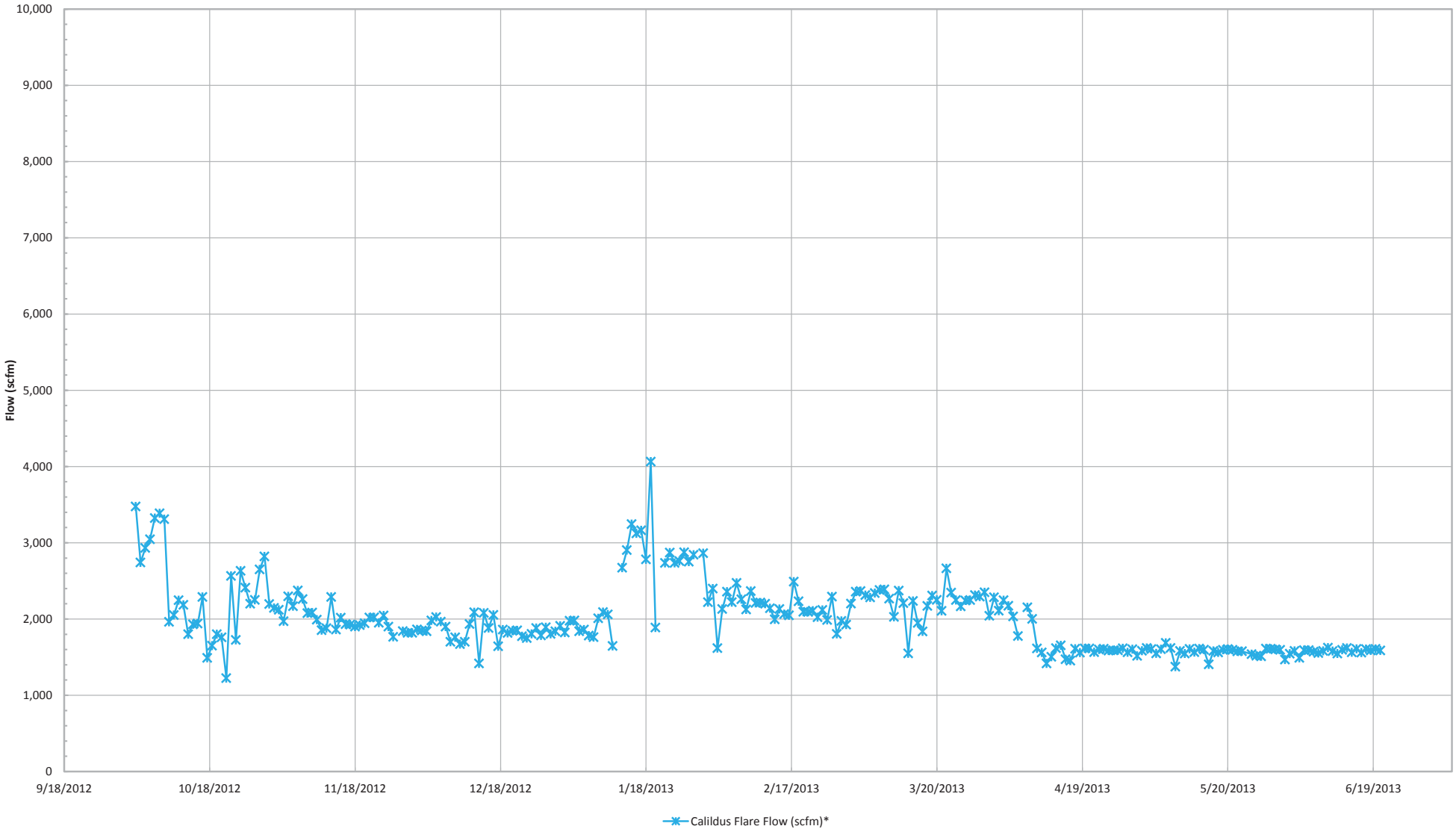
Enclosed Flare Flow (scfm)*



*Flow is based on tabulated flow data collected daily.

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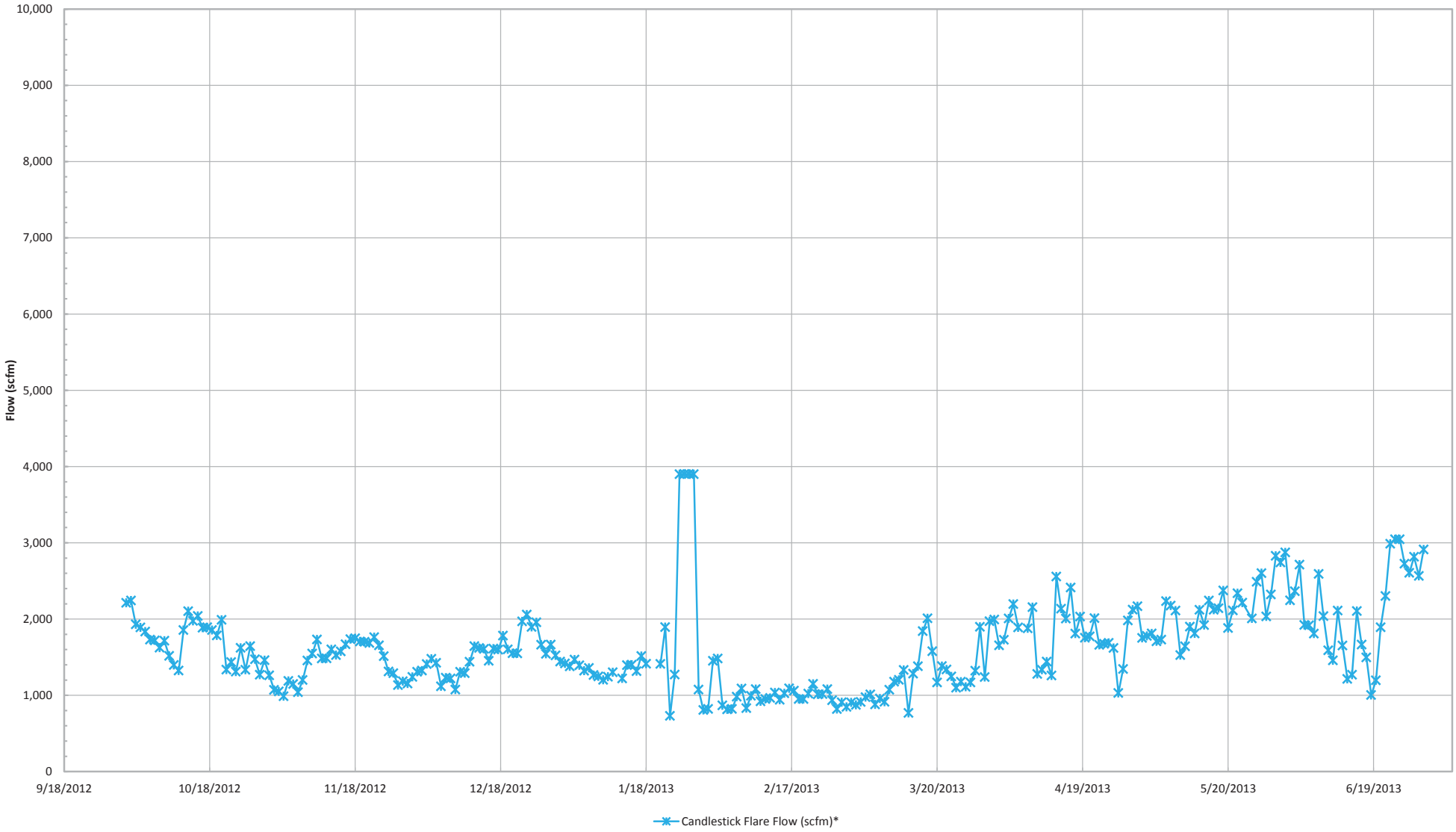
Callidus Flare Flow (scfm)*



*Flow is based on tabulated flow data collected daily.

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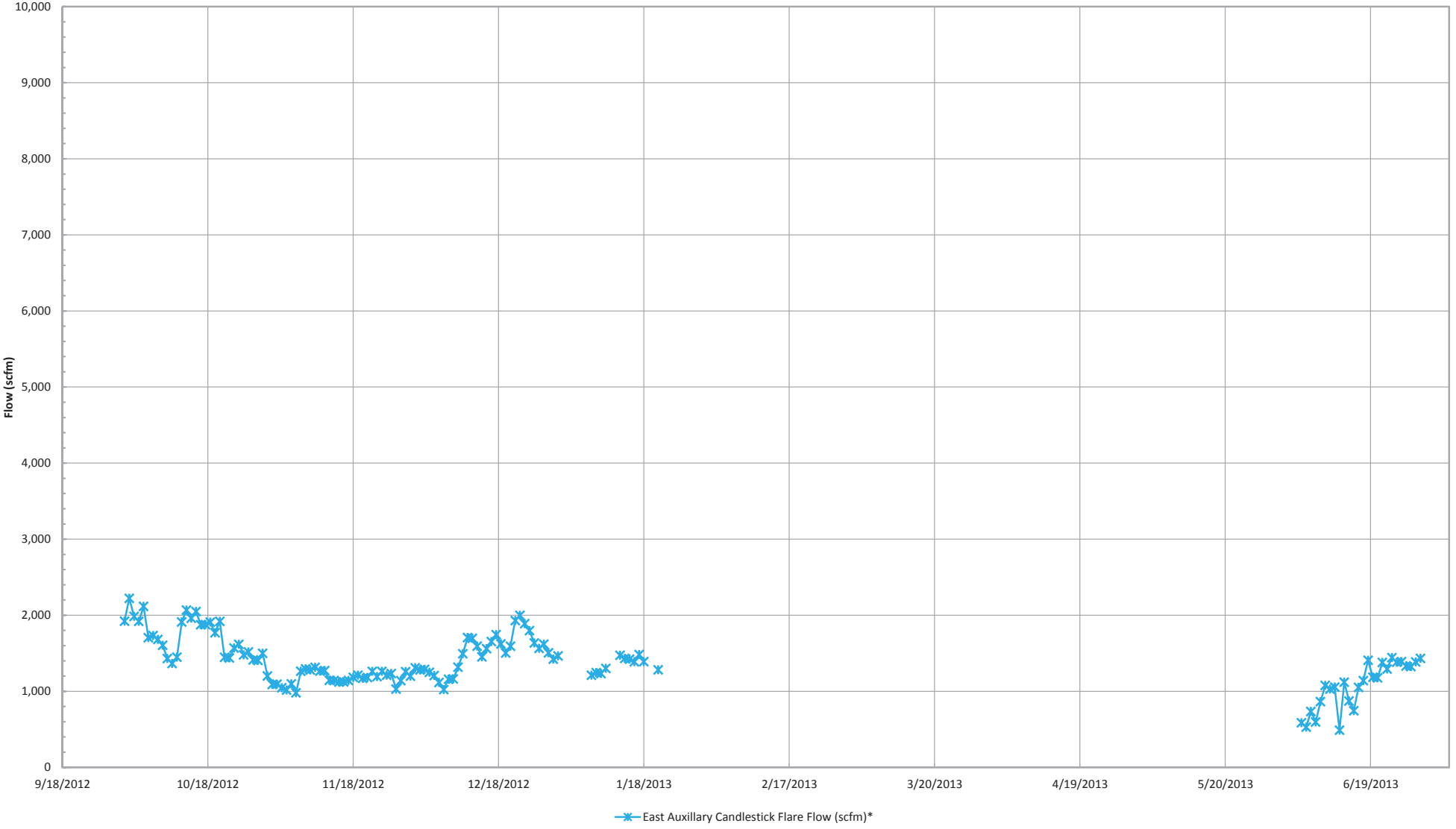
Candlestick Flare Flow (scfm)*



*Flow is based on tabulated flow data collected daily.

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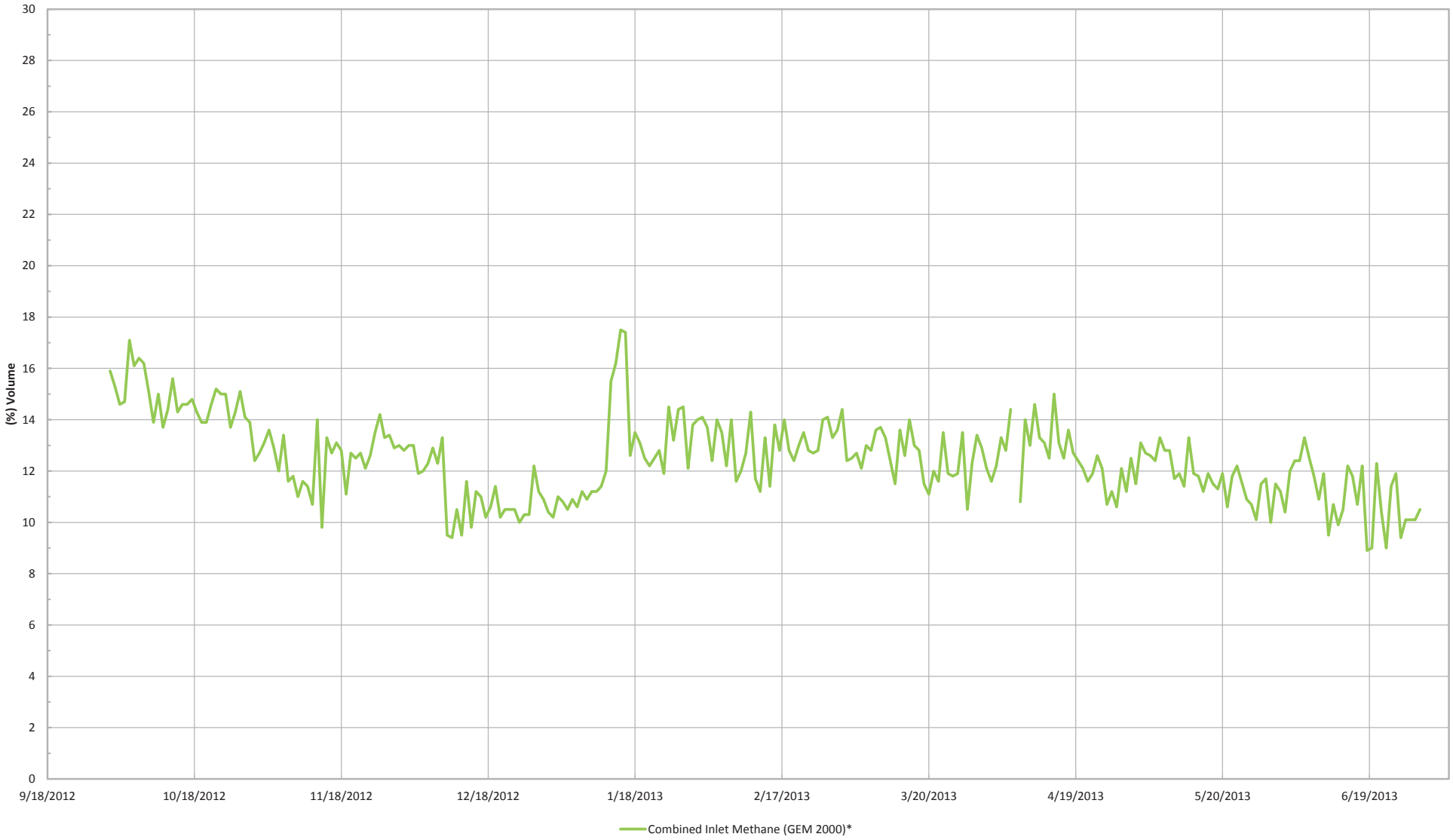
East Auxillary Candlestick Flare Flow (scfm)*



*Flow is based on tabulated flow data collected daily.

SCS ENGINEERS

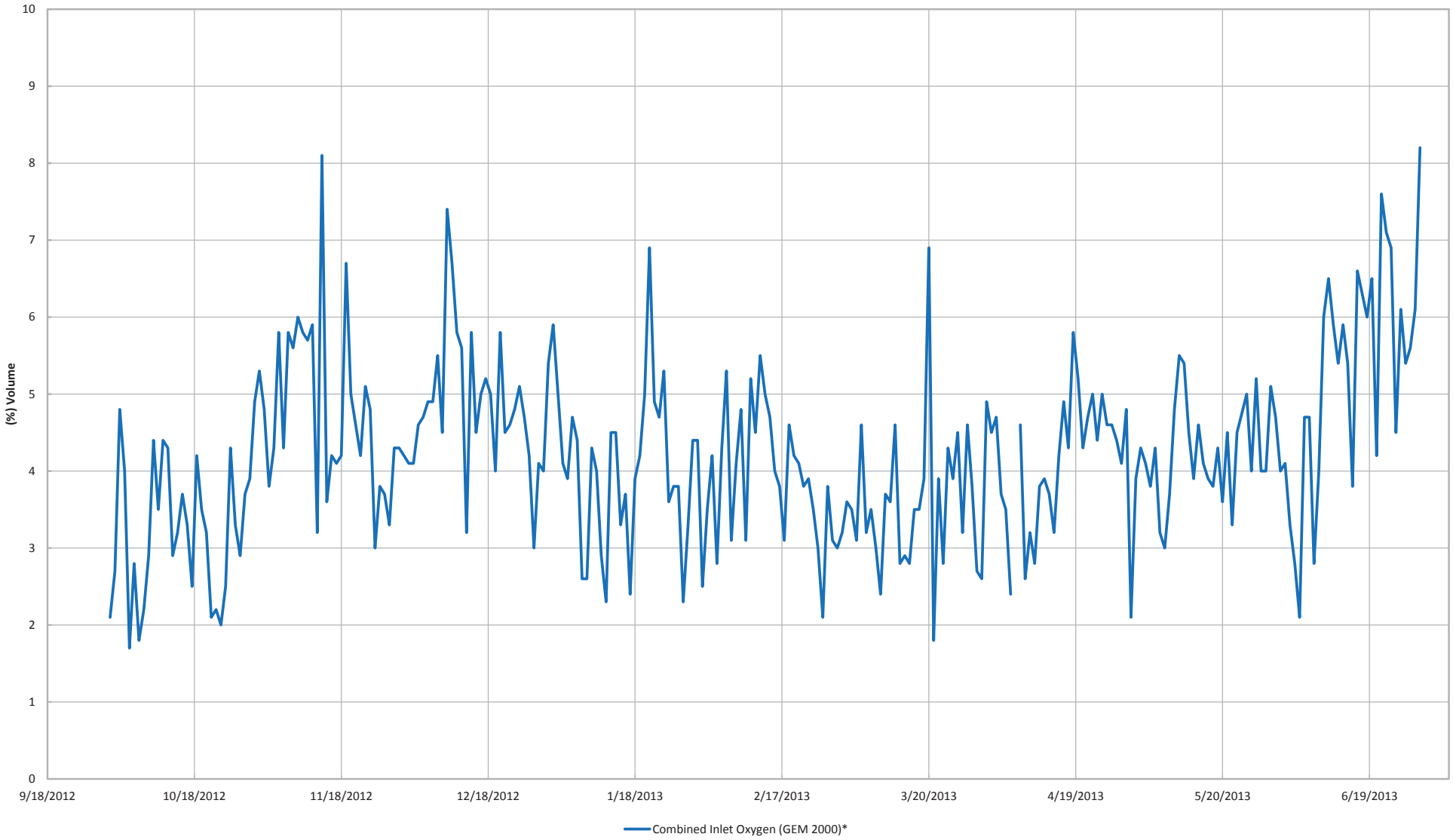
Combined Inlet Methane (GEM 2000)*



*Gas data collected from GEM 2000 field monitoring instrument.

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Combined Inlet Oxygen (GEM 2000)*



*Gas data collected from GEM 2000 field monitoring instrument.

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ATTACHMENT B

WORK COMPLETED AND PLANNED

Bridgeton Landfill, LLC

Monthly Summary of Work Completed and Planned

Work Completed in June 2013

Gas Collection and Control System

- Started operation of 2,500 CFM auxiliary flare to improve vacuum in South Quarry
- Augmented 18" header line in "amphitheater" area
- Installed 12" header from 2,500 CFM auxiliary flare to west side for better vacuum distribution
- Lifted laterals and headers above cap as necessary

Leachate Management System

- Completed drilling LCS-4 replacement to final depth, but unable to install well materials until pressures subside. Hooked drill stem to collection tank for removal of gas, steam and liquid
- Started operation of 316,000 gallon storage and aeration tank
- Removed substantial volume of leachate backlog and frac tanks
- Started trial operation of clarifier

Gas Interceptor Wells/Temperature Monitoring Probes

- Continued routine operation of previously installed features

Cap Related

- Installed 15.4 acres of cap and subcap features on South Quarry
- Connected temporary vacuum to near surface collectors and subcap features

Other Work Items

- All sedimentation and erosion control features completed
- Installed and stubbed up natural gas supply line to flare compound

Work Planned for July 2013

Gas Collection and Control System

- Continue modification required for capping

Leachate Management System

- If conditions allow, install well and pump in LCS 3 and LCS 4
- Begin construction on two of four planned one-million gallon leachate storage tanks
- Begin construction of force main system upgrades and improvements
- Continue to reduce on-site backlog of leachate and remove frac tanks
- Continue or begin pilot studies on: clarifier, reverse osmosis, and biological reactor treatment processes
- Begin pilot study of filter press

Gas Interceptor Wells/Temperature Monitoring Probes

- Continue routine operation and maintenance

Cap Related

- Install 10-15 acres of cap and subcap features on South Quarry

ATTACHMENT C

CARBON MONOXIDE MAPS

LEGEND

= Well Location

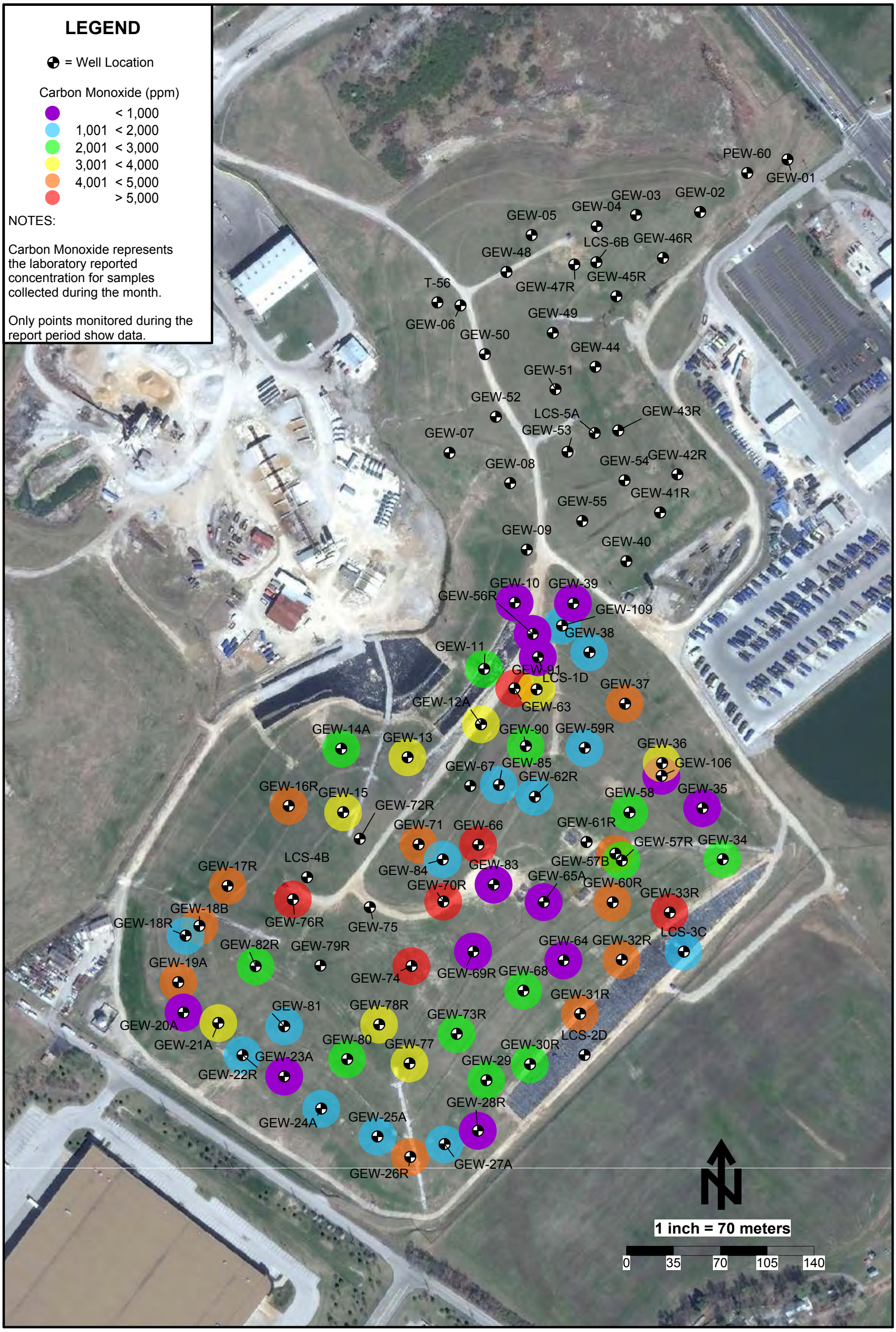
Carbon Monoxide (ppm)

	< 1,000
1,001	< 2,000
2,001	< 3,000
3,001	< 4,000
4,001	< 5,000
	> 5,000

NOTES:

Carbon Monoxide represents the laboratory reported concentration for samples collected during the month.

Only points monitored during the report period show data.



Carbon Monoxide Data Map - March 2013 - Bridgeton Landfill

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LEGEND

= Well Location

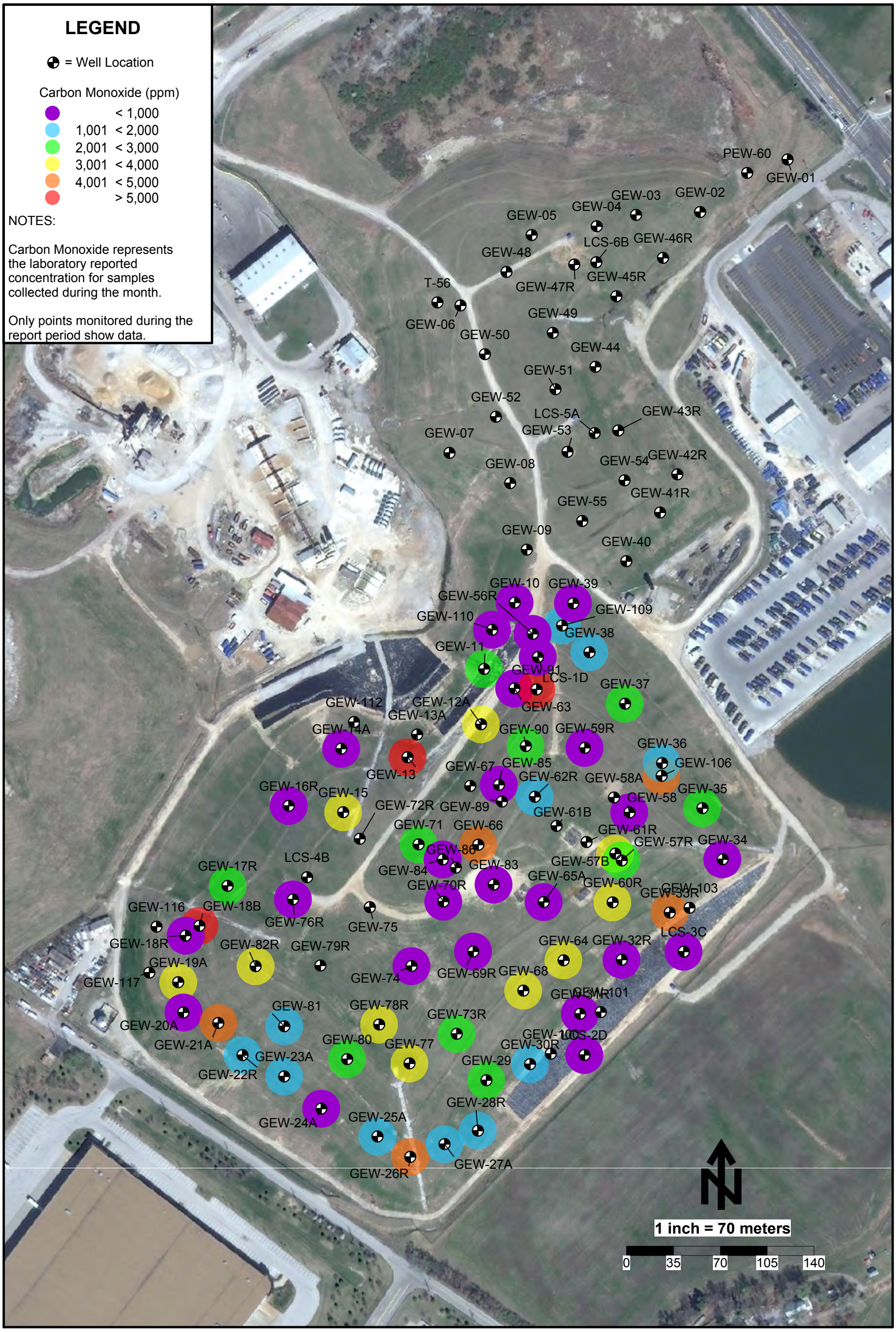
Carbon Monoxide (ppm)

	< 1,000
1,001	< 2,000
2,001	< 3,000
3,001	< 4,000
4,001	< 5,000
	> 5,000

NOTES:

Carbon Monoxide represents the laboratory reported concentration for samples collected during the month.

Only points monitored during the report period show data.



Carbon Monoxide Data Map - April 2013 - Bridgeton Landfill

SCS ENGINEERS

LEGEND

= Well Location

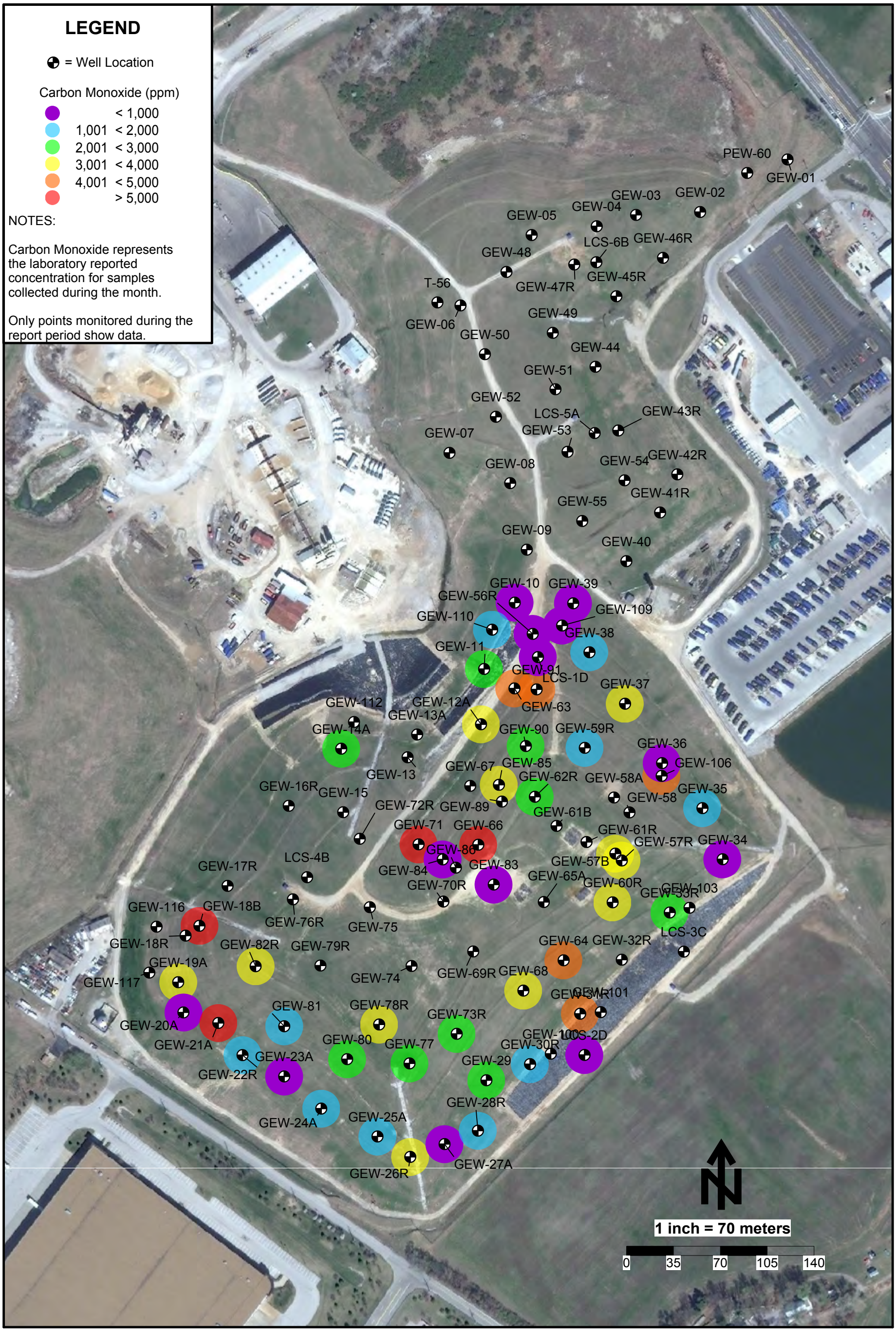
Carbon Monoxide (ppm)

	< 1,000
1,001	< 2,000
2,001	< 3,000
3,001	< 4,000
4,001	< 5,000
	> 5,000

NOTES:

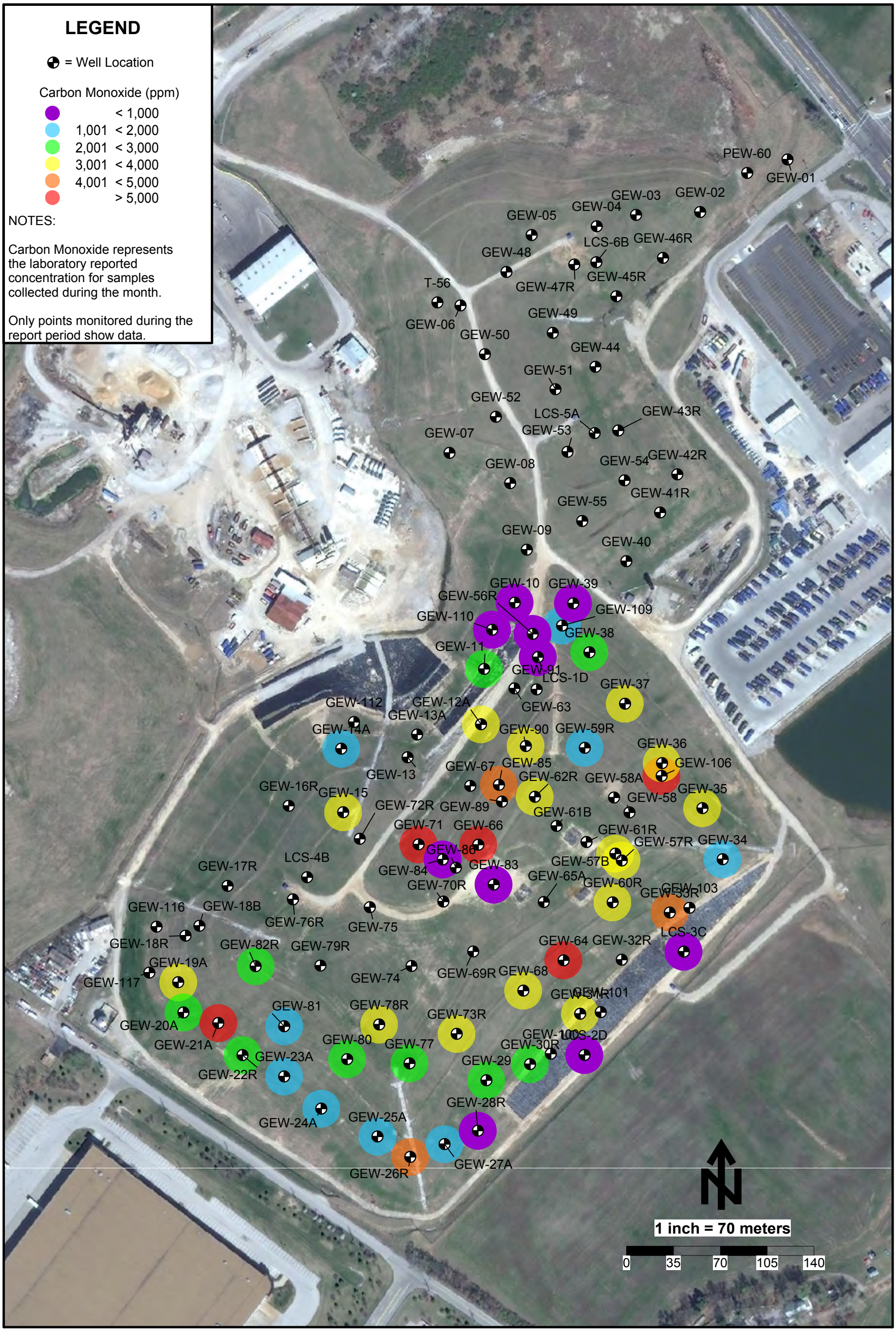
Carbon Monoxide represents the laboratory reported concentration for samples collected during the month.

Only points monitored during the report period show data.



Carbon Monoxide Data Map - May 2013 - Bridgeton Landfill

SCS ENGINEERS



Carbon Monoxide Data Map - June 2013 - Bridgeton Landfill

SCS ENGINEERS

LEGEND

= Well Location

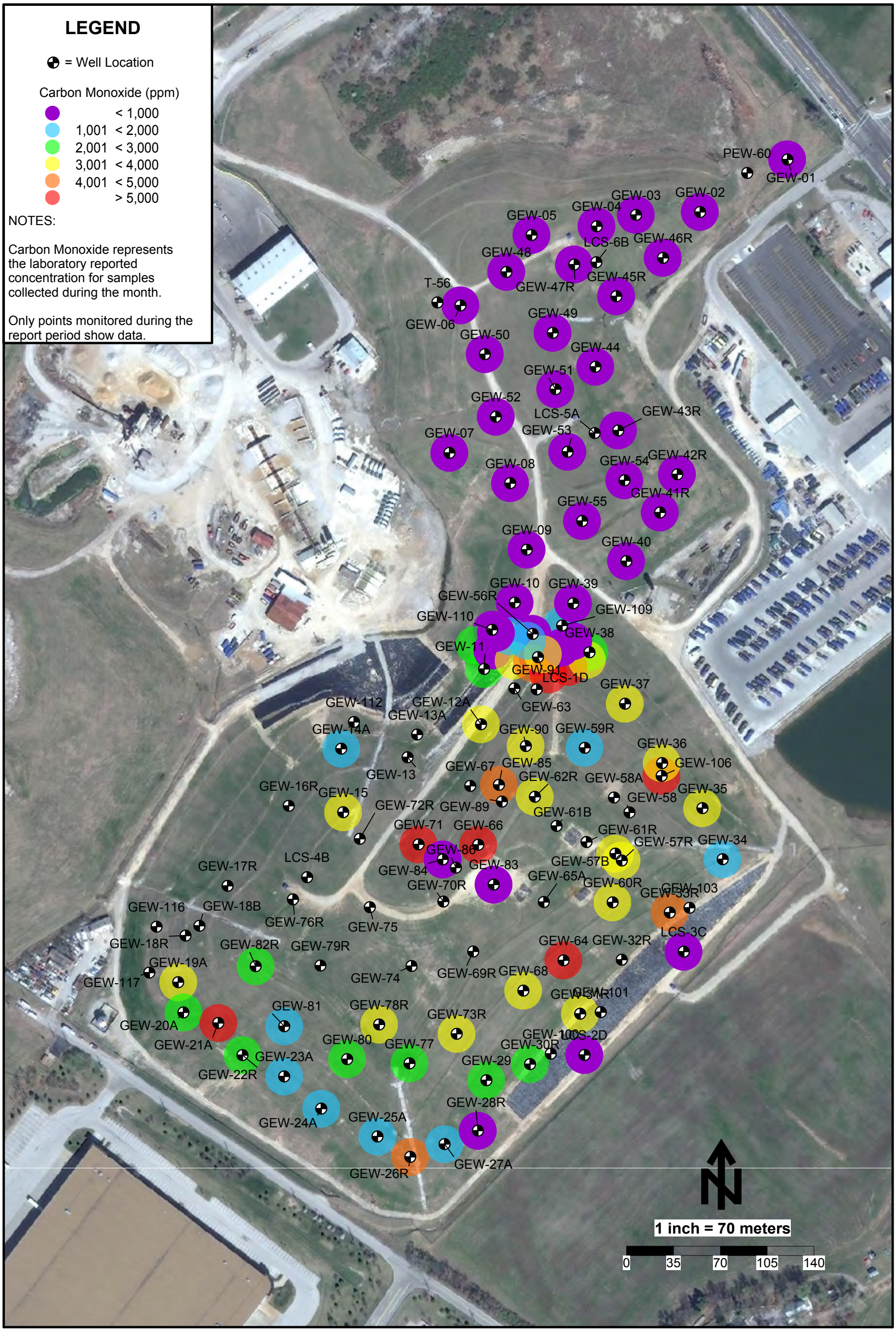
Carbon Monoxide (ppm)

	< 1,000
1,001	< 2,000
2,001	< 3,000
3,001	< 4,000
4,001	< 5,000
	> 5,000

NOTES:

Carbon Monoxide represents the laboratory reported concentration for samples collected during the month.

Only points monitored during the report period show data.



Carbon Monoxide Data Map - June 2013 - Bridgeton Landfill

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ATTACHMENT D

HYDROGEN MAPS

LEGEND

= Well Location

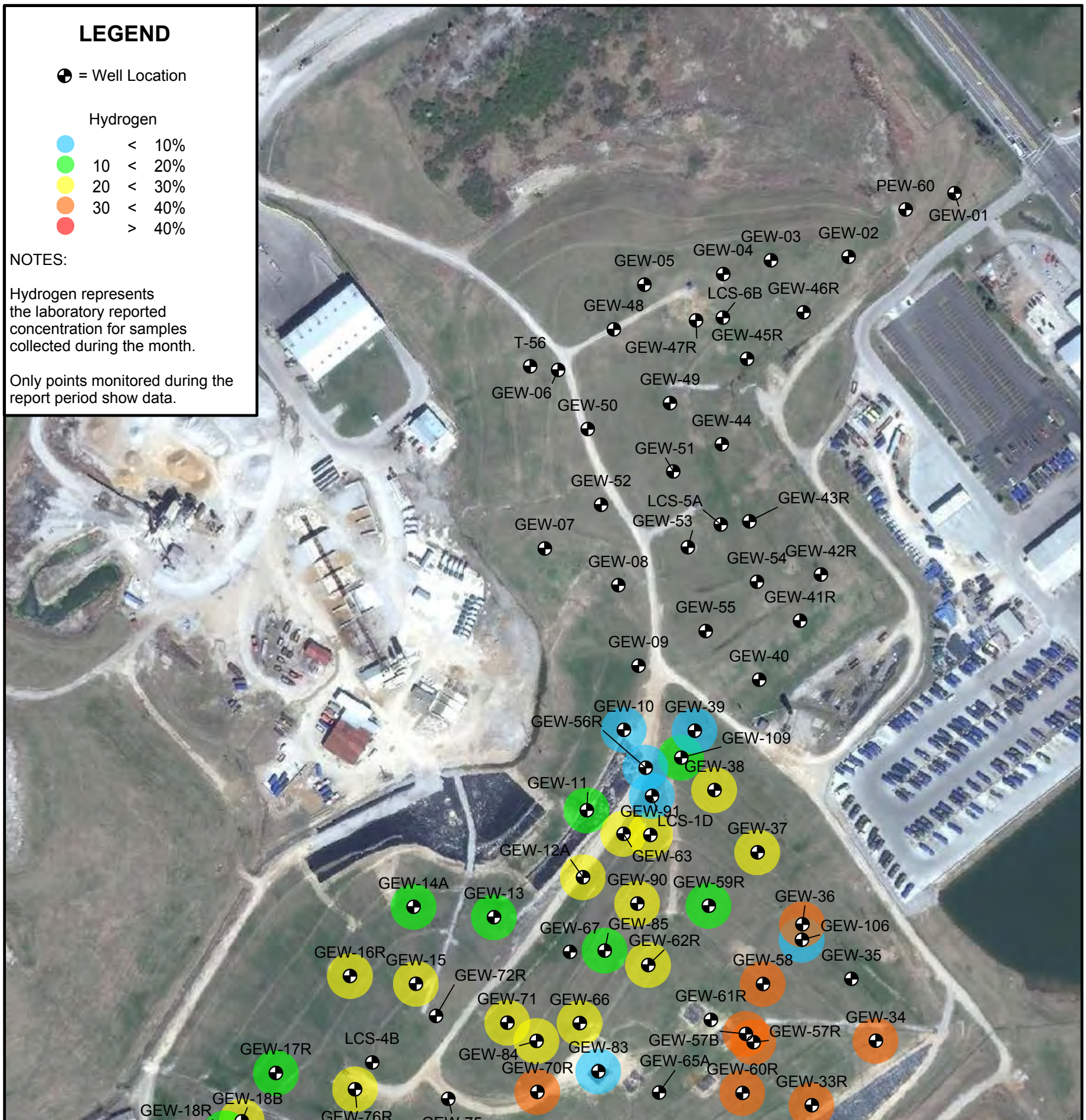
Hydrogen

	<	10%
10	<	20%
20	<	30%
30	<	40%
	>	40%

NOTES:

Hydrogen represents the laboratory reported concentration for samples collected during the month.

Only points monitored during the report period show data.



Hydrogen Data Map - March 2013 - Bridgeton Landfill

SCS ENGINEERS

LEGEND

= Well Location

Hydrogen

		<	10%
	10	<	20%
	20	<	30%
	30	<	40%
		>	40%

NOTES:

Hydrogen represents the laboratory reported concentration for samples collected during the month.

Only points monitored during the report period show data.

PEW-60
GEW-01
GEW-03
GEW-02
GEW-04
GEW-05
LCS-6B
GEW-46R
GEW-48
GEW-47R
GEW-45R
T-56
GEW-06
GEW-49
GEW-50
GEW-44
GEW-51
GEW-52
LCS-5A
GEW-43R
GEW-53
GEW-07
GEW-54
GEW-42R
GEW-08
GEW-41R
GEW-55
GEW-09
GEW-40
GEW-10
GEW-39
GEW-56R
GEW-109
GEW-110
GEW-38
GEW-11
GEW-91
LCS-1D
GEW-37
GEW-63
GEW-112
GEW-12A
GEW-13A
GEW-90
GEW-59R
GEW-14A
GEW-36
GEW-106
GEW-85
GEW-67
GEW-62R
GEW-58A
GEW-13
GEW-16R
GEW-15
GEW-89
GEW-35
GEW-72R
GEW-61B
GEW-71
GEW-66
GEW-58
GEW-61R
GEW-34
GEW-57R
GEW-57B
LCS-4B
GEW-84
GEW-83
GEW-17R
GEW-70R
GEW-65A
GEW-60R
GEW-33R
GEW-103
GEW-116
GEW-18B
GEW-76R
GEW-75
LCS-3C
GEW-18R
GEW-82R
GEW-79R
GEW-64
GEW-32R
GEW-19A
GEW-74
GEW-69R
GEW-68
GEW-117
GEW-101
GEW-81
GEW-78R
GEW-73R
GEW-20A
GEW-21A
GEW-80
GEW-77
GEW-30R
LCS-2D
GEW-23A
GEW-29
GEW-22R
GEW-28R
GEW-24A
GEW-25A
GEW-27A
GEW-26R

N

1 inch = 70 meters

0 35 70 105 140

Hydrogen Data Map - April 2013 - Bridgeton Landfill

SCS ENGINEERS

LEGEND

= Well Location

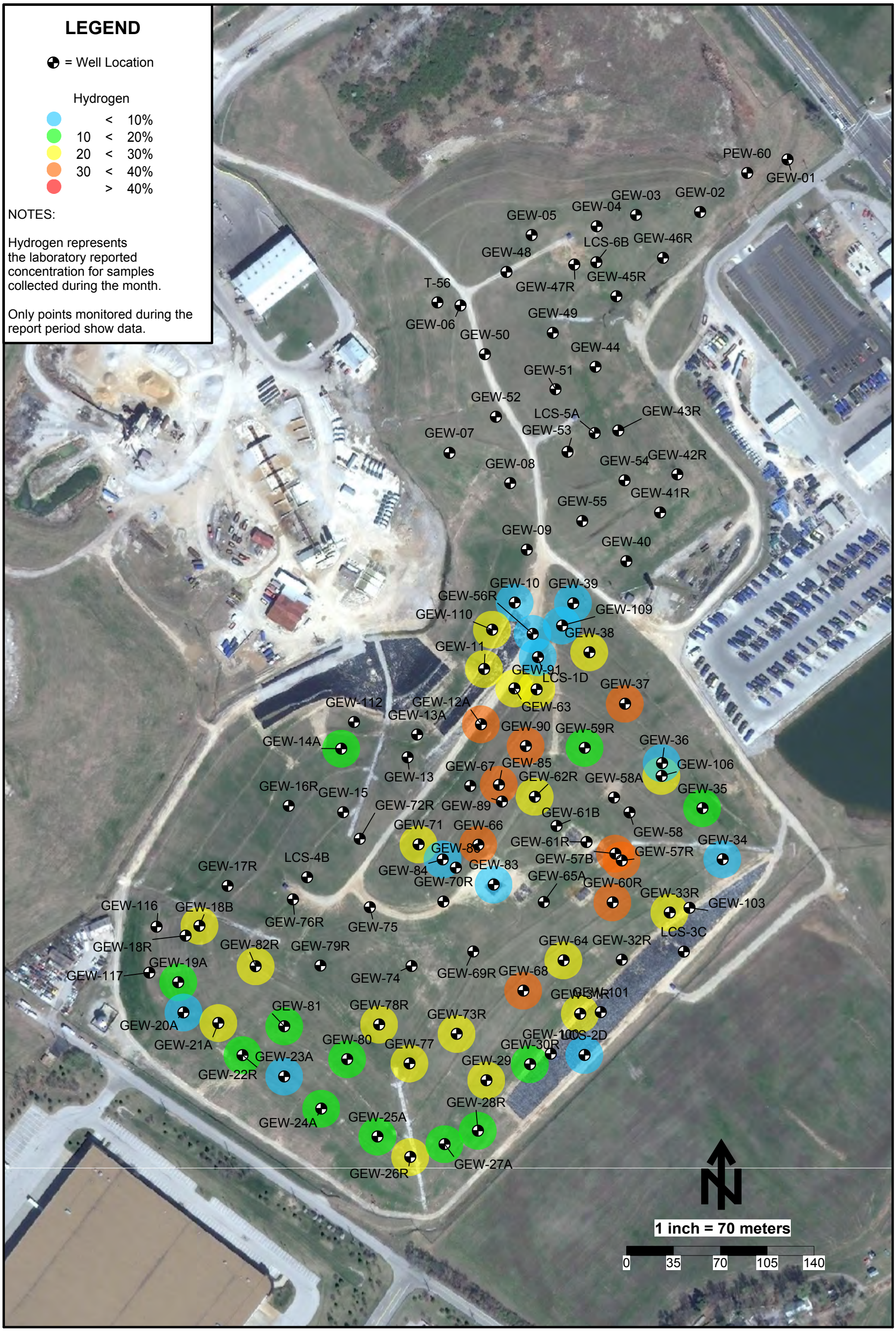
Hydrogen

		<	10%
	10	<	20%
	20	<	30%
	30	<	40%
		>	40%

NOTES:

Hydrogen represents the laboratory reported concentration for samples collected during the month.

Only points monitored during the report period show data.



Hydrogen Data Map - May 2013 - Bridgeton Landfill

SCS ENGINEERS

LEGEND

= Well Location

Hydrogen

		<	10%
	10	<	20%
	20	<	30%
	30	<	40%
		>	40%

NOTES:

Hydrogen represents the laboratory reported concentration for samples collected during the month.

Only points monitored during the report period show data.

PEW-60
GEW-01
GEW-03
GEW-02
GEW-04
GEW-05
LCS-6B
GEW-46R
GEW-48
GEW-47R
GEW-45R
T-56
GEW-06
GEW-49
GEW-50
GEW-44
GEW-51
GEW-52
LCS-5A
GEW-43R
GEW-53
GEW-07
GEW-54
GEW-42R
GEW-08
GEW-41R
GEW-55
GEW-09
GEW-40
GEW-10
GEW-39
GEW-56R
GEW-109
GEW-110
GEW-38
GEW-11
GEW-91
LCS-1D
GEW-37
GEW-63
GEW-112
GEW-12A
GEW-13A
GEW-90
GEW-59R
GEW-14A
GEW-36
GEW-106
GEW-67
GEW-85
GEW-62R
GEW-58A
GEW-13
GEW-16R
GEW-15
GEW-72R
GEW-89
GEW-61B
GEW-35
GEW-58
GEW-71
GEW-66
GEW-61R
GEW-34
GEW-57R
GEW-57B
GEW-17R
LCS-4B
GEW-84
GEW-83
GEW-70R
GEW-65A
GEW-60R
GEW-33R
GEW-103
GEW-116
GEW-18B
GEW-76R
GEW-75
LCS-3C
GEW-18R
GEW-82R
GEW-79R
GEW-64
GEW-32R
GEW-19A
GEW-117
GEW-74
GEW-69R
GEW-68
GEW-101
GEW-81
GEW-78R
GEW-73R
GEW-20A
GEW-21A
GEW-80
GEW-77
GEW-30R
LCS-2D
GEW-23A
GEW-22R
GEW-29
GEW-28R
GEW-24A
GEW-25A
GEW-27A
GEW-26R

1 inch = 70 meters

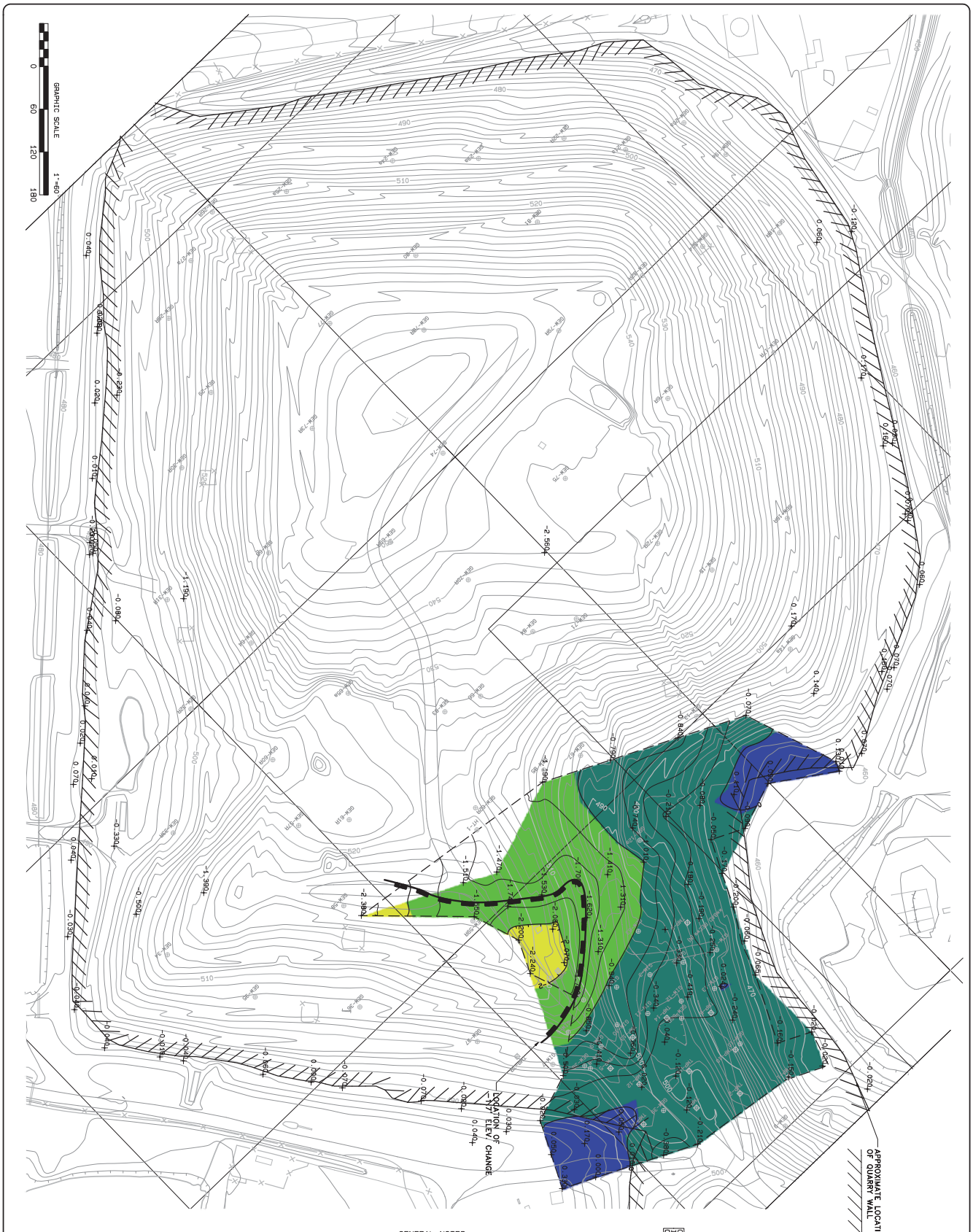
0 35 70 105 140

Hydrogen Data Map - June 2013 - Bridgeton Landfill

SCS ENGINEERS

ATTACHMENT E

SETTLEMENT FRONT MAP



ELEVATION CHANGE COLOR SCALE (FT)

-5 -4 -3 -2 -1 0 1

GENERAL NOTES
TOPOGRAPHY SHOWN BASED ON PHOTOGRAPHY DATED 2-23-2013

SETTLEMENT NOTES
CONTOURS ARE OF CHANGE IN ELEVATION FROM5-13-2013 TO 6-21-2013 PERFORMED AT GRID POINTS USING GPS METHODS

SETTLEMENT IS REPORTED AS A NEGATIVE CHANGE IN ELEVATION

DATA HAS BEEN FILTERED TO REMOVE POINTS THAT WERE NOTED TO HAVE BEEN SUBJECT TO FILL OR EXCAVATION ASSOCIATED WITH ONGOING CAPPING WORK OR UNDERGONE SIGNIFICANT AND OBVIOUS DISTURBANCE

COUNTOUR AT -1.7 FT IS SHOWN AS APPROXIMATE BOUNDARY OF SETTLEMENT FRONT AS OF 6/21/2013

LEGEND
- EXISTING TOPOGRAPHIC CONTOUR
- GAS WELL
- TMP
- SETTLEMENT GRID SURVEY POINT

SHEET 6 OF 6 DRAWING

BRIDGETON LANDFILL
SETTLEMONITORING

SETTLEMENT FROM MAY 13, 2013 TO JUNE 21, 2013 (38 DAYS)

PROJ. NO.: 179.002
DATE: 7/10/2013
DESIGNED BY: PJC
DRAWN BY: PJC/KLCH
CHECKED BY: PJC
APPROVED BY: PJC

P. J. CAREY & ASSOCIATES, P.C.
5878 VALINE WAY, SUGAR HILL, GA. 30518

REVISION	DATE
1	
2	
3	
4	
5	

BRIDGETON LANDFILL, LLC

ATTACHMENT F

GAS WELLFIELD DATA

ATTACHMENT F-1

GEM DATA SPREADSHEET

June 2013 Wellfield Monitoring Data - Bridgeton Landfill

Well Name	Date Sampled	Methane	CO_2	O_2	Balance Gas	Init Temp	Adj Temp	Init Flow	Adj Flow	Init Static Press	Adj Static Press	Init Diff Press	Adj Diff Press	System Pressure	Baro
		(%)				°F		scfm				"H_2O			"Hg
GEW-01	6/7/2013 11:58	0.5	3.5	19.1	76.9	89	90			-7.7	-8.5	-0.33	-0.12	-8.5	29.35
	6/7/2013 12:04	0.3	0.4	19.8	79.5	91	92			-8	-8	-0.007	-0.003	-8.27	29.35
	6/14/2013 10:56	18.5	11.4	13.7	56.4	96	97			-1.4	-1.4	-0.074	-0.074	-6.87	29.47
	6/14/2013 10:57	18.3	11.3	13.8	56.6	99	99			-2.1	-2.1	-0.079	-0.079	-7.04	29.47
	6/18/2013 10:18	26.9	15.2	11.4	46.5	100	100	5	5	-0.1	-0.1	0.006	0.009	-10.68	29.38
	6/18/2013 16:00	19.5	13.8	12.4	54.3	92	92			-0.9	-0.9	-0.023	-0.025	-8.29	29.34
GEW-02	6/3/2013 10:02	55.4	44.5	0	0.1	135	135			0.8	0.8	-0.05	-0.115	-6.3	29.45
	6/3/2013 10:03	55.2	44.7	0	0.1	135	135			0.8	0.8	-0.169	-0.184	-7.22	29.45
	6/7/2013 9:47	56.6	43.3	0	0.1	127	128	18	19	-0.3	-0.3	0.09	0.1	-7.88	29.29
	6/7/2013 9:52	56.8	43.1	0	0.1	127	128	29	28	-0.4	-0.2	0.221	0.202	-7.74	29.29
	6/14/2013 8:22	56.7	43.2	0	0.1	127	127	36	40	-1	-1.1	0.338	0.403	-8.77	29.46
	6/18/2013 10:28	57.3	42.6	0	0.1	129	129	21	22	-0.9	-0.7	0.121	0.125	-9.7	29.35
GEW-03	6/3/2013 10:08	43	36.3	0.4	20.3	120	120	120	120	-3.3	-3.3	3.514	3.566	-7.15	29.45
	6/6/2013 14:03	52.6	41	0	6.4	116	116	29	36	-0.2	-0.3	0.21	0.322	-6.3	29.26
	6/6/2013 14:08	52.3	40.6	0	7.1	116	116	33	33	-0.3	-0.2	0.278	0.273	-6.57	29.26
	6/14/2013 8:25	49.4	38.5	0	12.1	115	116	51	46	-1.5	-1.3	0.639	0.528	-7.65	29.46
	6/18/2013 10:31	57.4	38.2	0	4.4	120	120	11	42	-0.8	-1.1	0.033	0.438	-9.88	29.34
GEW-04	6/3/2013 10:12	51.6	39.4	0	9	118	118	38	38	-0.1	-0.1	0.367	0.366	-6.95	29.45
	6/7/2013 9:56	49.2	39.7	0	11.1	124	125	23	22	-1.2	-1.2	0.142	0.128	-7.9	29.3
	6/7/2013 10:01	49.7	39.1	0	11.2	125	125	24	20	-1.1	-1.2	0.154	0.105	-8.35	29.3
	6/14/2013 8:27	46.1	38	0	15.9	124	124	19	24	-1.4	-1.4	0.1	0.15	-7.18	29.44
	6/18/2013 10:33	51.7	37.7	0	10.6	125	125	19	17	-1.3	-1.3	0.1	0.075	-8.51	29.33
GEW-05	6/3/2013 10:24	48.9	37.7	0	13.4	112	112	16	34	0.2	-0.1	0.07	0.3	-6.27	29.44
	6/3/2013 10:25	48.5	36.8	0	14.7	112	112	32	33	-0.1	-0.2	0.258	0.282	-6.4	29.44
	6/7/2013 10:18	44.9	35.7	0	19.4	104	104	34	30	-1.4	-1.3	0.285	0.234	-7.84	29.29
	6/7/2013 10:23	45.1	35.7	0	19.2	104	104	31	40	-1.4	-1.4	0.244	0.395	-7.99	29.29
	6/14/2013 8:35	41.3	36.3	0	22.4	103	104	28	27	-1.6	-1.6	0.205	0.185	-6.98	29.44
	6/18/2013 10:48	41.2	34.7	0	24.1	110	110	33	37	-1.5	-1.6	0.281	0.347	-9.26	29.32
GEW-06	6/3/2013 10:31	55.3	38.4	0	6.3	92	98	10	41	0.2	-0.1	0.026	0.395	-5.65	29.45
	6/3/2013 10:33	54.2	38.2	0	7.6	98	98	30	38	-0.1	-0.1	0.219	0.339	-5.1	29.45
	6/7/2013 8:56	45.3	36.7	0.2	17.8	93	93	35	33	-1.6	-1.7	0.305	0.266	-8.04	29.28
	6/7/2013 9:01	45.4	36.1	0.2	18.3	93	93	33	32	-1.6	-1.6	0.266	0.254	-7.71	29.28
	6/14/2013 8:40	37.8	35.7	0	26.5	93	94	15	11	-1.5	-1.3	0.061	0.035	-6.54	29.44
	6/18/2013 10:54	40.2	35.8	0	24	92	95	17	17	-1	-1	0.073	0.081	-9.63	29.33
GEW-07	6/7/2013 8:30	57.5	40.3	0.3	1.9	107	108	2		-5.5	-5.6	0.002	-0.004	-7.79	29.32
	6/7/2013 8:35	57.3	41.3	0.3	1.1	107	108	13	16	-5.4	-5.3	0.048	0.065	-7.17	29.32
	6/14/2013 9:12	57.1	42.8	0	0.1	102	102	29	31	-2.2	-2	0.215	0.237	-2.84	29.48
	6/18/2013 14:27	56.8	42.6	0	0.6	110	110	14	12	-6.9	-7.4	0.056	0.04	-11.15	29.36
GEW-08	6/3/2013 11:35	54.8	40.3	0	4.9	122	126	19	31	0.6	-0.1	0.098	0.251	-6.47	29.49
	6/3/2013 11:37	54.7	41.1	0	4.2	126	126	32	33	-0.2	-0.2	0.264	0.28	-6.7	29.49
	6/7/2013 8:42	53.9	42.3	0	3.8	124	125	32	35	-2.5	-2.5	0.263	0.325	-8.95	29.3
	6/7/2013 8:46	54.2	41.9	0.1	3.8	124	125	30	39	-2.4	-2.5	0.244	0.39	-9.16	29.3
	6/14/2013 9:10	54.8	42.7	0	2.5	123	123	22	17	-2.2	-2.2	0.128	0.081	-5.42	29.46
	6/18/2013 14:23	52.3	42.6	0	5.1	120	120	32	37	-2.7	-2.9	0.262	0.347	-10.16	29.35
GEW-09	6/3/2013 11:42	46.8	37.9	0	15.3	118	118	25	23	-0.2	-0.2	0.168	0.144	-10.55	29.51
	6/6/2013 11:12	40.2	34.3	0	25.5	116	116	29	28	-0.3	-0.3	0.226	0.205	-14.56	29.26
	6/6/2013 11:17	40.6	33.9	0	25.5	116	116	30	28	-0.3	-0.2	0.231	0.209	-10.07	29.26
	6/14/2013 9:15	31.4	32.1	0	36.5	105	105	27	21	-0.8	-0.6	0.193	0.121	-6.6	29.49
	6/18/2013 14:34	52.3	43.8	0	3.9	90	90	8	7	0	0	0.017	0.014	-0.01	29.36

June 2013 Wellfield Monitoring Data - Bridgeton Landfill

Well Name	Date Sampled	Methane	CO_2	O_2	Balance Gas	Init Temp	Adj Temp	Init Flow	Adj Flow	Init Static Press	Adj Static Press	Init Diff Press	Adj Diff Press	System Pressure	Baro
		(%)				°F		scfm				$"H_2O$			"Hg
GEW-10	6/4/2013 14:11	33.2	54.4	0.1	12.3	118	118	21	13	-5.7	-5.8	0.135	0.055	-9.05	29.48
	6/12/2013 16:57	31.7	46.7	0	21.6	120	120	13	9	-7.4	-7.4	0.052	0.028	-11.5	29.22
	6/12/2013 17:02	31.9	46.4	0	21.7	120	120	4	17	-6.7	-7	0.006	0.092	-9.8	29.22
	6/19/2013 8:49	28.9	41.6	1.3	28.2	112	112	20	15	-4.6	-3.3	0.122	0.064	-5.82	29.45
	6/24/2013 14:22	44.8	44.9	0	10.3	116	116			-1.5	-1.5	-0.007	-0.009	-7.71	29.44
GEW-11	6/5/2013 9:10	5.3	68.1	0	26.6	186	186	31	22	-0.8	-0.9	0.366	0.199	-0.61	29.39
	6/13/2013 10:16	8.6	64.7	0	26.7	180	180	12	21	-1.9	-2	0.056	0.166	-2.18	29.36
	6/13/2013 10:22	8.6	64.8	0	26.6	180	180	19	22	-2.1	-2.4	0.148	0.185	-2.15	29.36
	6/19/2013 10:39	8.7	58	0	33.3	184	184	25	27	-4.8	-4.8	0.231	0.277	-5.06	29.51
	6/25/2013 9:05	7.6	60.2	0	32.2	182	182	34	35	-5.6	-5.9	0.427	0.469	-5.89	29.39
GEW-12A	6/13/2013 11:21	0.4	68.8	0	30.8	145	145	89	80	23.3	22.7	23.498	19.346	21.53	29.42
	6/13/2013 11:27	0.4	69	0	30.6	145	145	88	87	23	22.9	23.387	22.978	22.41	29.42
	6/19/2013 10:45	1	69.9	0	29.1	156	156	69	74	15	15.9	14.981	17.286	15.67	29.51
GEW-13A	6/6/2013 8:38	0.9	74.7	0	24.4	176	176	53	47	-0.7	-0.7	1.083	0.841	-0.92	29.29
	6/19/2013 9:23	1	77.2	0	21.8	182	182			2.8	2.7	-2.58	-2.909	3.13	29.5
	6/25/2013 8:33	1	75.5	0	23.5	180	180	83	83	-2.4	-2.3	2.653	2.609	-2.24	29.39
GEW-14A	6/13/2013 12:20	10	35.5	9.2	45.3	82	82		6	-2.5	-2.9	-0.009	0.014	-2.6	29.38
	6/13/2013 12:30	12.7	43	6.9	37.4	82	82		5	-2.8	-2.5	-0.054	0.009	-2.26	29.38
GEW-15	6/13/2013 12:00	2.4	70.9	0	26.7	150	150	59	63	5.6	5.4	1.237	1.394	2.19	29.35
	6/13/2013 12:12	2.3	70.7	0	27	150	150	47	62	5.2	5.1	0.808	1.354	1.44	29.35
	6/25/2013 9:54	3	70.3	0	26.7	154	154	42	49	6.9	6.9	0.64	0.875	2.78	29.38
GEW-18B	6/4/2013 8:59	0.2	78.5	0	21.3	176	176		2	0.3	0.4	-0.271	0.002	-0.21	29.4
	6/19/2013 13:44	3.3	76.3	0	20.4	160	160	13		-1.3	-0.8	0.074	-0.499	-1.91	29.44
	6/24/2013 8:49	0.1	78.8	0	21.1	158	158	18		-0.4	-0.6	0.139	-0.351	-0.8	29.46
GEW-18R	6/4/2013 9:02	1.5	19.3	15.5	63.7	72	72	8	19	-0.2	-0.1	0.019	0.103	-0.29	29.44
	6/19/2013 13:48	3.4	2.7	18.6	75.3	90	90		19	-2.1	-1.9	-0.005	0.1	-2.36	29.47
	6/19/2013 13:50	3.1	0.9	19.3	76.7	90	90	13	12	0	0	0.043	0.041	-2.11	29.47
	6/24/2013 8:52	18.6	71	0	10.4	92	92	13	13	0.1	0.1	0.056	0.06	-1.53	29.46
GEW-19A	6/4/2013 9:15	0.6	80	0.2	19.2	72	72	21	19	-0.1	0	0.16	0.123	-0.06	29.47
	6/11/2013 13:51	1.4	77.5	0.7	20.4	100	100			-2.2	-2.2	-0.008	-0.011	-1.95	29.34
	6/11/2013 14:15	2	72.3	1.8	23.9	100	100	10	18	-1.9	-2	0.039	0.119	-2.15	29.34
	6/19/2013 14:14	0.8	78.1	0	21.1	114	114	13	13	-2.8	-2.7	0.064	0.063	-2.85	29.5
	6/24/2013 9:16	1	76.1	0.8	22.1	88	88	18	18	-3.9	-3.2	0.118	0.121	-4.05	29.51
GEW-20A	6/4/2013 9:17	8	80.7	0	11.3	76	76	67	64	0.2	0.3	1.431	1.306	-0.41	29.46
	6/11/2013 14:27	16	77.7	1.9	4.4	102	102	81	85	-2.4	-2.4	2.12	2.304	-2.56	29.31
	6/11/2013 14:34	17.3	78.4	1.8	2.5	100	100	86	83	-2.6	-2.4	2.38	2.187	-2.56	29.31
	6/19/2013 14:19	3.6	79.2	0	17.2	122	122	98	97	-1.1	-1	3.332	3.221	-3.12	29.49
	6/24/2013 9:20	3.2	77.9	0.5	18.4	114	114	115	108	-3.5	-3.3	4.437	3.925	-3.74	29.5
GEW-21A	6/4/2013 9:23	2	72.5	0.2	25.3	76	76	22	18	-0.2	-0.1	0.166	0.115	-0.3	29.44
	6/11/2013 13:48	7.3	76.9	0.2	15.6	100	100	8	6	-2.3	-2.5	0.024	0.016	-2.32	29.3
	6/11/2013 13:53	8.4	76.8	0	14.8	100	100	8	10	-2.3	-2.2	0.023	0.038	-2.58	29.3
	6/19/2013 14:24	1.5	70.4	0.3	27.8	98	98	5	19	-2.7	-2.8	0.013	0.13	-2.88	29.49
	6/24/2013 9:27	2.8	69.6	0.4	27.2	84	84	13	12	-4	-4	0.063	0.056	-4.09	29.5
GEW-22R	6/4/2013 9:26	7	77.5	0	15.5	122	122			2.1	2.1	-1.815	-1.751	2.08	29.44
	6/11/2013 13:39	13.3	81.4	0	5.3	124	124			0.3	0.3	-0.387	-0.43	0.37	29.29
	6/11/2013 13:43	14.8	82.6	0	2.6	124	124			0.2	0.2	-0.361	-0.478	0.51	29.29
	6/24/2013 9:31	11.2	75.3	0	13.5	120	120	46	47	-0.3	-0.3	0.732	0.755	-0.53	29.48
GEW-23A	6/4/2013 9:28	13.8	76.2	0	10	128	128	37	38	2.8	2.8	0.481	0.5	0.88	29.44
	6/11/2013 13:30	20.2	78.5	0	1.3	124	124	44	36	0.9	0.9	0.652	0.441	0.48	29.3
	6/11/2013 13:35	20.6	79.3	0	0.1	124	124	35	33	0.8	0.9	0.429	0.374	0.38	29.3
	6/19/2013 14:30	14.6	72.3	0	13.1	124	124	49	48	1.8	1.8	0.796	0.768	0.38	29.46
	6/24/2013 9:34	18.6	74.6	0	6.8	120	120	59	44	1.3	1.2	1.128	0.654	0.26	29.48
GEW-24A	6/4/2013 9:31	12.1	75.7	0	12.2	134	134			0.3	0.3	-0.538	-0.524	-0.05	29.44
	6/11/2013 11:19	16.3	81.4	0	2.3	134	134			-2.1	-2.1	-0.436	-0.408	-2.4	29.29
	6/11/2013 11:24	16.9	81.4	0	1.7	134	134			-2	-2	-0.448	-0.388	-2.44	29.29
	6/19/2013 14:33	11.4	74.4	0	14.2	136	136			-2.1	-2	-0.431	-0.321	-2.6	29.46
	6/24/2013 9:38	11.7	74.8	0	13.5	138	138			-4.2	-4.2	-0.326	-0.233	-4.48	29.47

June 2013 Wellfield Monitoring Data - Bridgeton Landfill

Well Name	Date Sampled	Methane	CO_2	O_2	Balance Gas	Init Temp	Adj Temp	Init Flow	Adj Flow	Init Static Press	Adj Static Press	Init Diff Press	Adj Diff Press	System Pressure	Baro
		(%)				°F		scfm				"H_2O			"Hg
GEW-25A	6/4/2013 9:33	9.8	76.8	0	13.4	150	150			0.1	0.1	-0.08	-0.016	-0.39	29.43
	6/11/2013 11:11	14	81.7	0	4.3	150	150	14	16	-2	-1.9	0.082	0.097	-2.52	29.29
	6/11/2013 11:16	15.2	81.1	0	3.7	150	150	17	12	-1.9	-1.8	0.11	0.059	-2.39	29.29
	6/19/2013 14:36	11.1	74.6	0	14.3	152	152	25	29	-1.4	-1.4	0.239	0.312	-2.57	29.46
	6/24/2013 9:41	15.9	73.8	0	10.3	152	152	32	39	-3	-3.1	0.37	0.544	-4.22	29.47
GEW-26R	6/4/2013 9:36	0.5	80.7	0	18.8	186	186			6.4	6.3	-6.299	-6.389	1.42	29.43
	6/11/2013 11:02	0.8	88.3	0	10.9	184	184			4.5	4.3	-4.555	-4.361	-0.66	29.29
	6/11/2013 11:07	0.9	87.9	0	11.2	184	184			4.2	4.2	-4.348	-4.423	-0.83	29.29
GEW-27A	6/4/2013 9:38	6.9	76.9	0	16.2	152	152	18	25	0.1	0.1	0.123	0.231	0.26	29.43
	6/11/2013 10:52	13.1	80.7	0	6.2	150	150	32	32	-1.5	-1.6	0.395	0.381	-1.73	29.29
	6/11/2013 10:59	13.5	80.5	0	6	150	150	33	29	-1.9	-1.7	0.41	0.309	-2.08	29.29
	6/19/2013 14:39	11	74.7	0	14.3	150	150	41	40	-2	-2.1	0.611	0.582	-2.7	29.46
	6/24/2013 9:44	14	74.7	0	11.3	150	150	52	50	-4	-3.9	0.977	0.883	-3.78	29.47
GEW-28R	6/4/2013 9:41	13.7	75.6	0	10.7	126	126	24	25	-0.2	-0.2	0.211	0.222	-0.56	29.43
	6/11/2013 10:43	15.5	80	0.2	4.3	122	122	28	28	-2.6	-2.7	0.282	0.28	-2.9	29.26
	6/11/2013 10:48	15.8	79.9	0.2	4.1	122	122	18	20	-2.6	-2.6	0.116	0.145	-3.11	29.26
	6/19/2013 14:41	15.6	74.3	0	10.1	124	124	26	27	-3	-3.1	0.245	0.252	-3.62	29.46
	6/24/2013 9:46	20.1	75.9	0	4	122	122	33	31	-5.4	-5.4	0.375	0.329	-6.21	29.46
GEW-29	6/4/2013 10:07	4.8	72.9	0	22.3	140	140	53	56	2.8	2.9	0.981	1.086	1.8	29.41
	6/11/2013 10:24	5.1	71.6	0	23.3	140	140	63	59	1.3	1.3	1.362	1.218	-0.19	29.3
	6/11/2013 10:29	5.1	71.5	0	23.4	140	140	58	65	1.3	1.3	1.165	1.451	-0.02	29.3
	6/18/2013 10:01	4.8	71.8	0	23.4	134	134	70	71	2.1	2.2	1.662	1.709	0.63	29.34
	6/24/2013 10:28	8	73	0	19	140	140	72	75	0	0.1	1.788	1.924	-2.12	29.42
GEW-30R	6/4/2013 10:10	17.7	69.9	0	12.4	170	170	12	12	-0.2	-0.3	0.421	0.398	-0.46	29.45
	6/11/2013 10:36	21.3	64.9	0	13.8	165	165	16	11	-2.8	-2.8	0.687	0.306	-3.01	29.31
	6/11/2013 10:42	21.6	64.1	0	14.3	165	165	12	6	-2.7	-2.9	0.409	0.116	-2.89	29.31
	6/18/2013 10:04	15.7	69.1	0	15.2	164	164	12	13	-3.3	-3.1	0.376	0.498	-3.27	29.34
	6/24/2013 10:31	21.4	68.2	0	10.4	138	138			-7.4	-7.8	-0.005	-0.208	-7.98	29.45
GEW-31R	6/6/2013 8:44	0.3	73.5	0	26.2	176	176			-4.5	-4.4	-4.464	-4.828	-4.47	29.26
	6/13/2013 14:27	3.2	75.3	0.2	21.3	180	180			-3.6	-3.7	-3.616	-3.689	-3.66	29.4
	6/13/2013 14:32	3.3	76.5	0.2	20	180	180			-3.8	-3.9	-3.707	-3.74	-3.91	29.4
	6/21/2013 7:58	22.2	74.5	0.1	3.2	102	102			-0.1	-0.2	-0.432	-0.342	-0.1	29.51
GEW-33R	6/4/2013 10:23	0.1	44.5	6.8	48.6	196	196			-0.7	-1.7	-1.419	-2.481	-0.36	29.47
	6/13/2013 10:13	7	70	0	23	200	200	36	36	4.4	4.4	4.445	4.482	4.46	29.33
	6/13/2013 10:18	19.8	69.1	0	11.1	200	200	41	40	5	5	5.42	5.297	5	29.33
	6/18/2013 10:41	1.6	66.4	0	32	200	200	67	66	15.4	15.2	14.826	14.394	15.42	29.37
	6/24/2013 10:44	3.9	66.7	0	29.4	202	202			-1.9	-1.6	-2.049	-1.275	-2.15	29.47
GEW-34	6/4/2013 10:30	0.5	11.1	16.9	71.5	82	82	13	14	-3.5	-3.5	0.047	0.054	-4.31	29.46
	6/13/2013 10:01	4.5	57.3	3.6	34.6	106	106	7	10	-5.1	-5.2	0.02	0.037	-6.13	29.33
	6/13/2013 10:09	8.6	42.3	7.6	41.5	106	106	7	7	-5.3	-5.1	0.018	0.02	-5.78	29.33
	6/18/2013 10:53	19.8	62.6	0.9	16.7	104	104	25	25	-3.1	-2.8	0.201	0.206	-3.61	29.35
	6/24/2013 10:54	2	65.8	0	32.2	130	130	9	9	-2.3	-2.2	0.036	0.031	-5.73	29.45
GEW-35	6/4/2013 10:37	0.3	66.7	0.1	32.9	180	180	11	12	-4.2	-4.3	0.055	0.059	-5.87	29.47
	6/12/2013 13:44	0.2	72.7	0	27.1	190	190	6	5	-3.2	-3.2	0.017	0.013	-4.45	29.19
	6/12/2013 13:49	1.2	72	0	26.8	190	190	8	7	-3	-2.9	0.031	0.021	-5.31	29.19
	6/18/2013 11:11	8.9	64.2	0	26.9	196	196	24	23	-0.3	0	0.228	0.211	-3.36	29.38
	6/24/2013 11:00	0.2	66.2	0	33.6	198	198	9	9	-0.4	-0.3	0.037	0.037	-3.32	29.46
GEW-36	6/12/2013 13:29	5.3	70.6	0.1	24	104	104			-2.1	-2	-0.375	-0.091	-1.96	29.2
	6/12/2013 13:36	23.8	68.6	0.1	7.5	104	104			-2.1	-2	-0.119	-0.21	-2.09	29.2
	6/18/2013 11:15	12.9	62	0.2	24.9	102	102			-0.8	-0.5	-0.078	-0.22	-0.77	29.38
	6/24/2013 11:04	0	64.4	0.3	35.3	116	116			-1.2	-0.7	-0.001	-0.019	-1.2	29.47
GEW-37	6/4/2013 10:45	0.1	58.6	2.6	38.7	96	96		19	-4.6	-4.9	-0.043	0.12	-4.27	29.47
	6/12/2013 13:19	0.7	71.6	0	27.7	120	120	16		-1.2	-2.7	0.097	-0.253	-2.34	29.21
	6/12/2013 13:25	4.1	73.5	0	22.4	120	120	20	16	-1.5	-1.4	0.155	0.093	-1.69	29.21
	6/18/2013 11:20	31.7	64.6	0.2	3.5	112	112	41	42	1	1.1	0.501	0.536	1.76	29.38
	6/24/2013 11:08	0.1	67.2	0.1	32.6	126	126	21		2	1.3	0.167	-0.063	-0.27	29.47

June 2013 Wellfield Monitoring Data - Bridgeton Landfill

Well Name	Date Sampled	Methane	CO_2	O_2	Balance Gas	Init Temp	Adj Temp	Init Flow	Adj Flow	Init Static Press	Adj Static Press	Init Diff Press	Adj Diff Press	System Pressure	Baro
		(%)				°F		scfm				$"H_2O$			"Hg
GEW-38	6/4/2013 10:51	4.3	67.6	0	28.1	144	144	17	20	-8.4	-8.5	0.112	0.147	-11.7	29.48
	6/12/2013 11:47	3.5	74.1	0	22.4	144	144	17	12	-9.7	-9.5	0.116	0.062	-14.08	29.27
	6/12/2013 11:52	3.7	73.3	0	23	144	144	26	21	-9.1	-9	0.254	0.172	-12.91	29.27
	6/24/2013 11:11	1.9	67.3	0	30.8	148	148	17	24	-9.6	-9.3	0.112	0.222	-10.71	29.47
GEW-39	6/4/2013 10:56	42.2	53.7	0.2	3.9	120	120	69	65	-2.8	-3	1.314	1.169	-8.75	29.47
	6/12/2013 13:58	34.5	65.4	0	0.1	110	120	29	48	2.1	-0.5	0.262	0.695	-12.11	29.19
	6/12/2013 14:03	35.9	64	0	0.1	120	120	55	65	-1	-1.2	0.912	1.261	-11.74	29.19
	6/18/2013 11:25	39.6	55.7	0	4.7	120	120	53	58	-0.7	-0.7	0.79	0.935	-6.92	29.38
	6/24/2013 11:14	37.8	60.1	0	2.1	120	120	46	48	-1.2	-1.4	0.632	0.678	-9.14	29.46
GEW-40	6/3/2013 9:31	47.9	51.6	0	0.5	100	100	38	38	-0.2	-0.2	0.387	0.385	-12.68	29.46
	6/6/2013 10:52	47	51.8	0	1.2	100	100	28	27	-0.4	-0.4	0.207	0.196	-13.55	29.27
	6/6/2013 10:57	47.3	51.6	0	1.1	100	100	27	29	-0.5	-0.5	0.199	0.226	-13.87	29.27
	6/14/2013 7:57	47.6	52.3	0	0.1	97	97	13	21	-1.1	-1.1	0.051	0.119	-15.2	29.47
	6/18/2013 14:42	45.9	54	0	0.1	100	100	10	17	-0.4	-0.4	0.031	0.086	-9.34	29.34
	6/26/2013 8:12	50	49.4	0	0.6	98	98	21	19	-0.4	-0.4	0.125	0.102	-12.14	29.2
GEW-41R	6/3/2013 9:35	57.3	42.2	0	0.5	116	116	32	39	-0.1	-0.2	0.257	0.378	-12.2	29.46
	6/3/2013 9:36	56.8	41.1	0	2.1	116	116	40	43	-0.2	-0.3	0.402	0.458	-13	29.46
	6/6/2013 13:10	56.1	42.3	0	1.6	116	116	17	15	-0.2	-0.2	0.077	0.062	-14.49	29.25
	6/6/2013 13:14	56.8	42.1	0	1.1	116	116	34	34	-0.3	-0.3	0.288	0.294	-14.98	29.25
	6/14/2013 7:59	55.1	44.8	0	0.1	111	112	20	21	-0.7	-0.7	0.104	0.115	-11.31	29.47
	6/18/2013 14:45	55.7	44.2	0	0.1	112	112	14	13	-0.3	-0.3	0.052	0.046	-11.18	29.33
	6/26/2013 8:15	56.2	43.7	0	0.1	111	111	21	20	-0.2	-0.2	0.116	0.101	-11.69	29.21
GEW-42R	6/3/2013 9:39	53.3	39.9	0	6.8	112	112	17	18	-0.6	-0.6	0.08	0.082	-11.88	29.45
	6/6/2013 13:19	52.8	39.9	0	7.3	118	118	16	15	-0.8	-0.8	0.073	0.06	-12.43	29.25
	6/6/2013 13:24	52.9	39.5	0	7.6	118	118	15	33	-0.8	-0.9	0.061	0.282	-12.31	29.25
	6/14/2013 8:01	52.9	40	0	7.1	106	107	17	16	-1.4	-1.4	0.078	0.068	-12.38	29.46
	6/18/2013 14:48	53.1	41.3	0	5.6	105	105	12	11	-0.8	-0.9	0.04	0.035	-7.99	29.33
	6/26/2013 8:17	55.6	41.2	0	3.2	103	103	19	19	-0.9	-0.9	0.096	0.092	-13.53	29.2
GEW-43R	6/3/2013 9:45	57.4	42.5	0	0.1	96	138	16	31	0.7	-0.1	0.068	0.258	-10.64	29.45
	6/3/2013 9:46	56.4	43.5	0	0.1	140	140	35	34	-0.2	-0.2	0.33	0.301	-10.56	29.45
	6/6/2013 13:29	55.5	42.9	0	1.6	138	138	29	16	-0.6	-0.1	0.229	0.073	-10.84	29.26
	6/6/2013 13:35	56.6	42.6	0	0.8	138	138	22	20	-0.1	-0.1	0.128	0.109	-10.56	29.26
	6/14/2013 8:04	57.2	42.7	0	0.1	135	131	36	29	-0.9	-0.5	0.339	0.227	-11.81	29.45
	6/14/2013 8:09	56.7	43.2	0	0.1	129	129	29	33	-0.5	-0.5	0.218	0.279	-12.34	29.45
	6/18/2013 14:52	56.1	43.5	0	0.4	129	129	32	36	-0.1	-0.2	0.212	0.335	-9.85	29.33
	6/26/2013 8:20	55.6	42.9	0	1.5	133	134	27	24	-0.1	-0.1	0.191	0.153	-13.6	29.2
	6/26/2013 8:22	55.5	42.5	0	2	134	134	22	22	-0.1	-0.1	0.131	0.133	-13.08	29.2
GEW-44	6/3/2013 9:49	40.6	37.5	2.5	19.4	108	108	31	28	-0.8	-0.8	0.246	0.211	-10.87	29.44
	6/7/2013 11:43	44.2	33.8	1.1	20.9	105	105	10	11	-1.3	-1.3	0.03	0.031	-13.71	29.32
	6/7/2013 11:51	42.5	32.4	1.9	23.2	114	108	11	11	-1.5	-1.4	0.032	0.033	-13.14	29.32
	6/14/2013 8:13	39	33.8	1.3	25.9	96	96	6	6	-1.1	-0.9	0.012	0.011	-11.6	29.45
	6/18/2013 14:55	50.3	37.9	0.4	11.4	100	100	9		-0.3	-0.3	0.024	-0.005	-10.54	29.33
	6/18/2013 16:35	53.5	39.2	0	7.3	100	100	1		-0.1	-0.4	0	-0.004	-9.89	29.31
	6/26/2013 8:24	50.1	38.9	0	11	104	105	32	32	-0.5	-0.5	0.263	0.253	-11.63	29.2
GEW-45R	6/3/2013 9:54	51.3	38.1	0	10.6	92	92	49	50	-2	-2	0.571	0.599	-7.52	29.45
	6/6/2013 13:41	51.7	38.4	0	9.9	108	108	23	24	-1.7	-1.8	0.132	0.147	-7.15	29.26
	6/6/2013 13:46	52	37.8	0	10.2	108	108	23	24	-1.7	-1.7	0.131	0.142	-7.02	29.26
	6/14/2013 8:17	51.6	39.4	0	9	103	104	15	18	-2	-2	0.059	0.083	-7.73	29.46
	6/18/2013 14:58	51.8	39.7	0	8.5	110	110	17	15	-1.9	-1.9	0.081	0.06	-9.76	29.34
	6/26/2013 8:29	54.7	44	0	1.3	97	100	21	22	0.5	-0.1	0.112	0.121	-0.14	29.21
	6/26/2013 8:33	54.8	43.5	0	1.7	102	102	5	20	-0.1	-0.1	0.007	0.106	-0.29	29.21
GEW-46R	6/3/2013 9:57	39.9	34.8	0	25.3	104	106	24	37	0	-0.1	0.153	0.348	-7	29.46
	6/3/2013 9:58	39	34	0	27	106	106	34	33	-0.1	-0.1	0.294	0.273	-6.95	29.46
	6/6/2013 13:52	37.4	32.8	0	29.8	106	106	27	33	-0.4	-0.4	0.19	0.274	-7.58	29.27
	6/6/2013 13:57	37.6	32.6	0	29.8	106	106	32	26	-0.4	-0.4	0.268	0.172	-7.28	29.27
	6/14/2013 8:19	39.5	34.6	0	25.9	101	102	34	33	-1	-1	0.299	0.278	-7.36	29.47
	6/18/2013 15:00	38.8	35.2	0	26	100	100	5	30	-1	-1	0.009	0.226	-1.05	29.33
	6/18/2013 15:01	38.8	35.2	0	26	100	100	5	15	-1	-1	0.009	0.063	-9.54	29.33

June 2013 Wellfield Monitoring Data - Bridgeton Landfill

Well Name	Date Sampled	Methane	CO_2	O_2	Balance Gas	Init Temp	Adj Temp	Init Flow	Adj Flow	Init Static Press	Adj Static Press	Init Diff Press	Adj Diff Press	System Pressure	Baro
		(%)				°F		scfm		"H_2O					"Hg
GEW-47R	6/3/2013 10:18	54.4	42.1	0	3.5	84	112		29	0.2	-0.1	-0.041	0.217	-6.52	29.45
	6/3/2013 10:19	53.4	42.9	0	3.7	120	120	26	27	-0.2	-0.2	0.18	0.188	-6.44	29.45
	6/7/2013 10:08	30.7	31.6	0.2	37.5	120	120	29	27	-1.3	-1.3	0.236	0.195	-7.74	29.28
	6/7/2013 10:14	30.9	31.3	0.2	37.6	119	120	33	33	-1.3	-1.3	0.286	0.286	-6.91	29.28
	6/14/2013 8:33	25.2	30.8	0	44	117	116	18	2	-1.5	-1.3	0.09	0.001	-6.87	29.44
	6/18/2013 10:41	29.4	30.9	0	39.7	120	120	20	18	-1.2	-1.2	0.109	0.095	-9.2	29.32
GEW-48	6/3/2013 10:28	52.3	38	0	9.7	110	110	28	26	-0.1	-0.1	0.196	0.169	-6.04	29.44
	6/7/2013 10:28	50	37.8	0	12.2	108	109	27	31	-1.3	-1.3	0.183	0.249	-7.3	29.28
	6/7/2013 10:32	50.2	37.5	0	12.3	109	109	34	29	-1.3	-1.3	0.287	0.207	-7.74	29.28
	6/14/2013 8:37	48.7	37.8	0	13.5	108	108	19	18	-1.6	-1.6	0.1	0.089	-6.75	29.44
	6/18/2013 10:51	48.3	37.5	0	14.2	102	102	23	24	-1.5	-1.6	0.136	0.148	-8.54	29.32
GEW-49	6/3/2013 11:10	38.8	34	0	27.2	108	108	25	26	0	-0.1	0.159	0.176	-9.51	29.48
	6/3/2013 11:11	37.3	33.3	0	29.4	112	112	27	27	-0.1	-0.1	0.196	0.195	-9.78	29.48
	6/7/2013 10:37	30.5	30.3	0.3	38.9	111	111	25	27	-0.8	-0.8	0.164	0.193	-11.45	29.29
	6/7/2013 10:42	30.7	29.5	0.3	39.5	112	112	44	41	-0.8	-0.8	0.502	0.44	-11.98	29.29
	6/14/2013 8:54	28.7	30.5	0.2	40.6	108	107	24	24	-1.1	-0.9	0.156	0.157	-8.38	29.45
	6/18/2013 11:27	37.7	34.3	0	28	108	108	13		-0.5	-0.5	0.047	-0.018	-8.95	29.33
GEW-50	6/3/2013 11:03	56.6	39.2	0	4.2	110	110	29	28	-0.1	-0.1	0.212	0.191	-3.27	29.47
	6/7/2013 9:06	52.8	39	0	8.2	110	111	22	20	-1.7	-1.7	0.127	0.107	-7.07	29.28
	6/7/2013 9:12	53	38.9	0	8.1	111	111	26	24	-1.6	-1.6	0.168	0.144	-7.18	29.28
	6/14/2013 8:46	50.7	39	0	10.3	109	110	11	13	-1.5	-1.4	0.034	0.049	-4.36	29.46
	6/18/2013 11:21	51.6	39	0	9.4	118	118	18	24	-1.7	-1.7	0.083	0.155	-8.41	29.33
GEW-51	6/3/2013 11:14	48.9	38.6	0	12.5	124	124	12	11	-0.6	-0.6	0.043	0.035	-9.78	29.47
	6/7/2013 11:09	49.3	38.6	0	12.1	125	125	25	21	-0.7	-0.7	0.163	0.121	-12.18	29.3
	6/7/2013 11:14	49.3	38.6	0	12.1	125	126	39	38	-0.8	-0.8	0.386	0.377	-11.89	29.3
	6/14/2013 8:56	51.7	40.6	0	7.7	123	123	12	7	-1.2	-1.2	0.043	0.014	-7.41	29.45
	6/18/2013 11:29	51.7	40.2	0	8.1	125	125	29	29	-0.5	-0.5	0.227	0.217	-11.36	29.33
GEW-52	6/3/2013 11:07	44.9	35	0	20.1	116	116	30	28	-0.1	-0.1	0.225	0.209	-5.39	29.47
	6/7/2013 9:36	42.9	34.2	0	22.9	114	114	38	39	-0.9	-0.9	0.363	0.393	-8.23	29.29
	6/7/2013 9:40	41.5	34.4	0	24.1	114	114	26	23	-0.8	-0.8	0.172	0.141	-8.49	29.29
	6/14/2013 8:49	35.5	34.6	0	29.9	111	112	22	16	-0.9	-0.7	0.137	0.068	-6	29.45
	6/18/2013 11:24	39.4	36.1	0	24.5	112	112	6	10	-0.2	-0.2	0.011	0.031	-9.91	29.34
GEW-53	6/3/2013 11:18	47.1	37.4	0	15.5	138	132	12	10	-0.6	-0.4	0.04	0.029	-8.55	29.48
	6/3/2013 11:21	46.8	38.2	0	15	126	126	9	10	-0.3	-0.3	0.022	0.031	-8	29.48
	6/7/2013 11:18	51.1	43.2	0	5.7	83	89	1	3	-0.2	-0.2	0	0.002	-11.16	29.3
	6/7/2013 11:23	51.3	43.2	0	5.5	93	94	7	7	-0.2	-0.2	0.013	0.016	-11.44	29.3
	6/14/2013 8:59	52	42.5	0	5.5	107	107	2	9	-0.7	-0.7	0.002	0.025	-6.58	29.45
	6/18/2013 11:37	52.4	42	0	5.6	120	125		4	0	-0.1	-0.006	0.004	-10.97	29.33
	6/18/2013 11:38	53	42.3	0	4.7	125	125			-0.1	-0.1	0	0	-9.66	29.33
GEW-54	6/3/2013 11:27	49.4	39.7	0	10.9	142	138			-0.3	-0.1	-0.054	-0.111	-11.36	29.48
	6/3/2013 11:28	48.3	40.2	0	11.5	136	136			-0.1	-0.1	-0.718	-0.647	-11.47	29.48
	6/7/2013 11:27	45.9	43	0	11.1	146	147	10	11	-0.2	-0.2	0.033	0.037	-14.88	29.31
	6/7/2013 11:32	46.2	42.9	0	10.9	147	147	12	12	-0.1	-0.2	0.043	0.046	-14.25	29.31
	6/14/2013 9:03	48.1	43.1	0	8.8	145	146	6	1	-0.3	-0.2	0.013	0	-8.5	29.45
	6/14/2013 9:05	47.7	44.6	0	7.7	142	142	2	1	-0.1	-0.1	0.001	0	-8.66	29.45
	6/18/2013 14:02	49	43.5	0	7.5	112	152	9	16	0.6	0	0.022	0.077	-10.83	29.34
	6/18/2013 14:04	47.8	42.3	0	9.9	155	155	17	22	-0.1	-0.1	0.081	0.145	-10.4	29.34
GEW-55	6/3/2013 11:31	44.7	39.9	0	15.4	128	128	10	7	-0.4	-0.4	0.033	0.016	-11.91	29.48
	6/6/2013 11:01	45.4	39.6	0	15	132	132	26	26	-0.1	-0.1	0.182	0.18	-14.13	29.27
	6/6/2013 11:07	46.2	39.2	0	14.6	132	132	26	26	-0.1	-0.1	0.189	0.184	-14.01	29.27
	6/14/2013 9:07	47.7	41.7	0	10.6	126	127	29	27	-0.8	-0.7	0.22	0.192	-7.35	29.46
	6/18/2013 14:08	47.3	42.6	0	10.1	132	132	13	10	-0.1	0	0.048	0.033	-11.91	29.34
	6/18/2013 14:18	47.6	41.8	0	10.6	132	132	16	16	-0.1	-0.1	0.07	0.073	-10.77	29.34
GEW-56R	6/4/2013 14:07	24.8	60.1	0	15.1	136	136	26	26	-1	-1.2	0.227	0.217	-5.99	29.48
	6/12/2013 16:42	24.2	52	0	23.8	140	140	32	13	-0.7	-0.4	0.329	0.06	-10.63	29.2
	6/12/2013 16:48	25.3	41.4	0	33.3	142	142	11		-2.5	-2.5	0.042	-0.03	-8.53	29.2
	6/19/2013 8:35	22.8	67.6	0	9.6	80	80	13	13	0.2	0.2	0.052	0.052	-3.68	29.45
	6/24/2013 14:18	19.7	69.1	0	11.2	102	102			0.4	0.4	-0.019	-0.018	-9.77	29.44

June 2013 Wellfield Monitoring Data - Bridgeton Landfill

Well Name	Date Sampled	Methane	CO_2	O_2	Balance Gas	Init Temp	Adj Temp	Init Flow	Adj Flow	Init Static Press	Adj Static Press	Init Diff Press	Adj Diff Press	System Pressure	Baro
		(%)				°F		scfm				$"H_2O$			"Hg
GEW-57B	6/6/2013 9:14	0.1	70.4	0.4	29.1	180	180	98	95	-3.1	-3.2	3.549	3.345	-3.18	29.25
	6/12/2013 15:17	0.2	75.2	0.3	24.3	174	174	94	79	-3	-2.7	3.352	2.362	-3.11	29.15
	6/12/2013 15:21	0.2	74.5	0.2	25.1	174	174	86	92	-3.1	-3.4	2.814	3.197	-3.04	29.15
	6/18/2013 13:57	0.4	65.4	1.2	33	180	180	105	100	-3.9	-3.4	4.017	3.648	-3.97	29.36
	6/24/2013 13:19	4	63.3	1.8	30.9	165	165	113	99	-3.8	-2.9	4.449	3.434	-3.98	29.43
GEW-57R	6/4/2013 11:21	0.5	68.3	0	31.2	196	196	60	60	-1.2	-1	1.409	1.397	-1.1	29.47
	6/12/2013 15:24	1.4	73.9	0	24.7	194	194	87	88	-2.9	-2.8	2.954	3.003	-3.02	29.15
	6/12/2013 15:29	4.4	72.3	0	23.3	194	194	93	90	-2.9	-3.2	3.256	3.068	-3.06	29.15
	6/24/2013 13:13	2.3	68.3	0	29.4	194	194	103	97	-3.3	-3.8	3.983	3.53	-3.69	29.44
GEW-59R	6/4/2013 11:03	16.9	69.1	0	14	178	178	98	91	-2.6	-2.5	3.331	2.928	-2.88	29.46
	6/12/2013 14:59	11.5	74.1	0.1	14.3	178	178		48	-0.3	-0.6	-0.451	0.876	-0.63	29.16
	6/12/2013 15:06	11.8	74.2	0	14	178	178	31	45	-0.7	-0.5	0.379	0.759	-1.09	29.16
	6/18/2013 13:33	9	69.4	0	21.6	182	182			1.9	2.3	-0.907	-1.244	2.92	29.35
	6/24/2013 11:19	10.3	69.9	0	19.8	180	180			2.7	1.9	-2.935	-1.195	2.17	29.46
GEW-60R	6/4/2013 11:19	0.3	67.7	0	32	198	198			-1.3	-1.1	-1.48	-1.471	-1.14	29.46
	6/12/2013 15:32	2	70.6	0.4	27	194	194			-3.2	-2.8	-3.479	-2.597	-3.02	29.15
	6/12/2013 15:36	5.1	70.3	0.3	24.3	194	194			-2.9	-2.7	-2.594	-2.958	-2.88	29.15
	6/18/2013 13:48	3.2	59.6	0.7	36.5	194	194			-1.6	-1.4	-1.981	-1.861	-1.49	29.37
GEW-62R	6/4/2013 11:29	0.6	67	0	32.4	184	184	36	36	3.8	3.8	3.637	3.68	3.86	29.45
	6/13/2013 9:03	1.7	66.8	0	31.5	110	110	14	14	0.3	0.4	0.485	0.493	0.4	29.32
	6/13/2013 9:08	1.7	67.5	0	30.8	110	110	12	14	0.4	0.4	0.405	0.479	0.44	29.32
GEW-63	6/19/2013 10:42	1	72.6	0	26.4	196	196	19	36	-0.8	-0.5	0.153	0.517	-1.78	29.51
GEW-64	6/4/2013 11:42	0.5	71.3	0	28.2	194	194			-0.7	-0.7	-1.023	-1.325	-0.76	29.45
	6/13/2013 10:44	0.3	75.7	0	24	194	194			-0.5	-1	-0.438	-0.129	-1.28	29.32
	6/13/2013 10:49	0.4	75.3	0	24.3	194	194		12	-3	-0.6	-3.131	0.419	-0.84	29.32
	6/18/2013 14:24	0.4	70.4	0	29.2	192	192			-4.2	-4	-3.783	-4.28	-4.18	29.36
GEW-66	6/4/2013 11:34	0.3	70.7	0.2	28.8	200	200	29	10	-0.1	-0.3	0.35	0.046	-0.45	29.45
	6/13/2013 9:23	0.8	74	0.3	24.9	184	184	77	72	-3	-2.3	2.26	1.97	-2.46	29.31
	6/13/2013 9:27	1.1	74	0.2	24.7	184	184	88	79	-2.4	-2.6	2.949	2.387	-3.12	29.31
	6/18/2013 14:12	2.9	70.5	0	26.6	196	196	101	113	-3.4	-4.4	3.881	4.797	-5.08	29.37
	6/24/2013 13:33	0.3	71	0	28.7	194	194	108	95	-3.6	-3.4	4.435	3.452	-3.46	29.44
GEW-68	6/4/2013 11:48	2.8	71.3	0	25.9	92	92	18	17	8.2	8.2	0.107	0.105	8.19	29.43
	6/13/2013 10:35	2.3	74.1	0	23.6	70	70			8	8	-5.438	-5.439	8.05	29.31
	6/13/2013 10:40	2.3	75.3	0	22.4	70	70			8.2	8.2	-3.191	-3.193	8.28	29.31
	6/18/2013 14:30	2.2	70.9	0	26.9	100	100			6.7	6.7	-0.015	-0.009	6.74	29.33
GEW-71	6/5/2013 9:59	0.6	73.4	0	26	186	186			1.6	1.7	-1.095	-1.477	1.56	29.36
	6/13/2013 11:07	0.2	78	0	21.8	182	182	13		0	-0.1	0.08	-0.893	0.12	29.33
	6/13/2013 11:13	0.2	77.9	0	21.9	182	182			0.1	0.2	-0.67	-0.466	0.16	29.33
	6/18/2013 14:39	0.1	73.4	0.2	26.3	182	182	88	75	-2.7	-1.8	2.943	2.171	-2.5	29.35
	6/25/2013 9:58	0.7	72	0.1	27.2	180	180	100	99	-2.9	-2.4	3.741	3.625	-2.39	29.36
GEW-73R	6/4/2013 10:04	4.1	73.5	0	22.4	136	136	38	37	1.4	1.5	0.52	0.504	1	29.4
	6/11/2013 10:12	4	71.1	0	24.9	135	135	41	50	0.2	0.2	0.599	0.864	-0.79	29.27
	6/11/2013 10:18	3.9	71.6	0	24.5	135	135	51	52	0.2	0.1	0.923	0.957	-0.74	29.27
	6/18/2013 9:24	3.3	71.9	0	24.8	138	138	31	30	1.9	2	0.347	0.339	1.61	29.31
	6/24/2013 10:22	11.1	73.5	0	15.4	132	132	66	67	-1.2	-1.2	1.483	1.522	-2.75	29.42
GEW-77	6/4/2013 8:48	4.2	73.1	0	22.7	140	140	35	38	1.3	1.3	0.449	0.535	0.81	29.39
	6/11/2013 10:05	4.3	75.5	0	20.2	142	142	42	33	-0.7	-0.6	0.648	0.407	-1.48	29.27
	6/11/2013 10:10	4.1	78.5	0	17.4	142	142	45	47	-0.8	-0.9	0.754	0.798	-1.38	29.27
	6/19/2013 13:32	10.3	72	0	17.7	140	140	40	41	-0.5	-0.5	0.576	0.609	-1.16	29.43
	6/24/2013 8:30	3.9	72.6	0	23.5	144	144	42	37	-1.8	-1.8	0.641	0.514	-2.65	29.4
GEW-78R	6/4/2013 8:45	2.1	70.4	0	27.5	140	140	51	55	2.4	2.4	0.917	1.071	1.58	29.38
	6/11/2013 10:13	1.8	77.7	0	20.5	140	140	54	48	0.7	0.8	1.069	0.834	-0.28	29.26
	6/11/2013 10:18	1.9	77.6	0	20.5	140	140	54	57	0.7	0.8	1.072	1.182	-0.28	29.26
	6/19/2013 13:29	7.2	70.5	0	22.3	140	140	50	55	1.1	1	0.868	1.047	-0.14	29.42
	6/24/2013 8:27	2.1	70.2	0	27.7	140	140	60	64	0	-0.1	1.285	1.429	-1.47	29.39
GEW-80	6/4/2013 8:50	8	76.2	0	15.8	128	128	63	55	2.6	2.5	1.371	1.035	1.1	29.39
	6/11/2013 10:22	7.6	82.7	0	9.7	124	124	61	61	0.7	0.7	1.321	1.296	-1.06	29.29
	6/11/2013 10:26	7.7	82.4	0	9.9	124	124	58	58	0.7	0.9	1.191	1.195	-0.95	29.29
	6/19/2013 13:35	16.4	75.1	0	8.5	130	130	60	64	1.4	1.6	1.198	1.352	-0.61	29.44
	6/24/2013 8:33	7.8	74.5	0	17.7	128	128	72	62	0	0	1.746	1.314	-2.19	29.4

June 2013 Wellfield Monitoring Data - Bridgeton Landfill

Well Name	Date Sampled	Methane	CO_2	O_2	Balance Gas	Init Temp	Adj Temp	Init Flow	Adj Flow	Init Static Press	Adj Static Press	Init Diff Press	Adj Diff Press	System Pressure	Baro
		(%)				°F		scfm				"H_2O			"Hg
GEW-81	6/4/2013 8:53	8	77.2	0	14.8	134	134			2.9	2.9	-0.177	-0.113	0.83	29.4
	6/11/2013 10:30	7.4	84.8	0	7.8	132	132	41	36	0.9	1	0.633	0.47	0.44	29.27
	6/11/2013 10:34	7.9	84.5	0	7.6	132	132	34	37	1	1	0.426	0.519	0.58	29.27
	6/19/2013 13:37	14.6	77	0	8.4	134	134	41	43	1.9	1.8	0.591	0.641	1.15	29.43
	6/24/2013 8:36	7.3	76.4	0	16.3	134	134	43	37	0.7	0.8	0.651	0.49	0.2	29.41
GEW-82R	6/4/2013 8:56	3.1	74	0	22.9	176	176			7.8	7.8	-0.648	-0.397	4.57	29.41
	6/11/2013 13:31	3.4	73.5	0	23.1	175	175			6.1	6.2	-0.626	-0.245	2.31	29.3
	6/11/2013 13:38	3.3	73.6	0	23.1	175	175		18	6.1	6.1	-0.621	0.134	2.4	29.3
	6/19/2013 13:40	10.1	72.3	0	17.6	178	178			5.8	5.7	-0.161	-0.05	2.09	29.45
	6/24/2013 8:41	4.2	72.8	0	23	172	172			3.9	3.9	-0.588	-0.929	0.55	29.43
GEW-83	6/4/2013 11:39	28.4	68.8	0	2.8	110	110	51	59	-0.5	-0.6	0.789	1.062	-0.58	29.44
	6/13/2013 9:30	30	69.9	0	0.1	108	108	84	85	-2.3	-2	2.124	2.179	-2.23	29.31
	6/13/2013 9:35	30.3	69.6	0	0.1	108	108	96	92	-2.3	-2.6	2.76	2.524	-2.55	29.31
	6/18/2013 14:20	29.8	65.3	0	4.9	106	106	118	115	-3.9	-4	4.069	3.827	-4.16	29.36
	6/24/2013 13:38	29	67.1	0	3.9	110	110	112	109	-3.6	-3.6	3.691	3.515	-3.48	29.42
GEW-84	6/5/2013 10:01	19.6	80.3	0	0.1	120	120			1.3	1.2	-1.19	-1.013	1.26	29.37
	6/13/2013 10:59	16.4	83.5	0	0.1	110	110	32	39	-0.1	-0.6	0.357	0.519	-0.26	29.32
	6/13/2013 11:04	16.7	83.2	0	0.1	110	110	22		-0.1	-0.1	0.179	-0.02	-0.18	29.32
	6/18/2013 14:44	19.1	79.7	0	1.2	114	114	81	71	-2.4	-2.2	2.132	1.681	-2.45	29.35
	6/25/2013 10:00	21.4	78.5	0	0.1	116	116	106	106	-3.5	-3.6	3.593	3.635	-3.64	29.36
GEW-85	6/6/2013 9:29	0.1	67.6	0.5	31.8	186	186	94	89	-2.3	-2.4	3.264	2.958	-2.39	29.26
	6/13/2013 9:13	0.2	70.6	0.5	28.7	184	184	85	87	-3.2	-3	2.74	2.889	-3.01	29.32
	6/13/2013 9:18	0.8	70.2	0.5	28.5	184	184	78	92	-3	-3.1	2.308	3.176	-2.95	29.32
	6/18/2013 14:57	0.1	66.5	0.7	32.7	188	186	103	85	-4.1	-2.8	3.947	2.668	-4.1	29.39
	6/25/2013 10:03	1.1	67.1	0.2	31.6	186	186	78	62	-2.1	-2.1	2.259	1.459	-4.64	29.38
GEW-90	6/6/2013 9:18	0.7	67	0	32.3	186	186	80	64	-1.5	-1.2	2.375	1.524	-1.65	29.25
	6/12/2013 15:34	0.5	64.4	0	35.1	200	200	35	56	-1.7	-1.4	0.479	1.193	-1.46	29.19
	6/12/2013 15:39	0.5	65.4	0	34.1	200	200	76	86	-1.4	-1.7	2.212	2.779	-0.72	29.19
GEW-91	6/19/2013 8:30	0.2	74.8	0	25	194	194	103	27	-0.7	-1.8	4.065	0.298	-2.29	29.44
	6/25/2013 10:11	2.3	73.1	0	24.6	194	194	112	114	-2.9	-4.7	4.794	4.947	-6.84	29.37
GEW-106	6/6/2013 8:58	0.2	73.8	0.4	25.6	120	120	139	138	-6.2	-6.2	6.593	6.499	-6.27	29.27
	6/13/2013 11:43	0.4	80.8	0.5	18.3	80	80	56	63	-1.9	-1.7	1.043	1.308	-1.59	29.39
	6/13/2013 11:49	0.5	81.6	0.2	17.7	80	80	47	51	-0.8	-0.8	0.754	0.886	-1.03	29.39
	6/21/2013 8:05	0.8	71.5	1.6	26.1	82	82	100	99	-2.8	-2.9	3.126	3.08	-2.9	29.51
GEW-109	6/4/2013 10:58	12	60.5	0	27.5	124	124	18	13	-3	-3.1	0.119	0.064	-11.03	29.48
	6/12/2013 11:36	13.8	69.4	0	16.8	128	128	11	10	-2.8	-2.8	0.043	0.038	-11.95	29.27
	6/12/2013 11:41	13.9	69.3	0	16.8	124	124	17	22	-2.9	-3	0.102	0.176	-10.97	29.27
	6/18/2013 11:28	10.5	56	0	33.5	130	130	34	32	-7.3	-7.3	0.382	0.355	-8.72	29.38
	6/24/2013 11:16	9.2	58.5	0	32.3	134	134	22	25	-7.3	-7.6	0.179	0.227	-8.04	29.47
GEW-110	6/4/2013 14:16	18.3	61.3	0	20.4	90	96	18	13	0	-0.2	0.109	0.053	-9.93	29.49
	6/4/2013 14:17	18.3	61	0	20.7	96	96	17	17	-0.2	-0.2	0.091	0.099	-8.28	29.49
	6/13/2013 10:01	12.3	42	5.8	39.9	105	105			-1	-1	-0.383	-0.429	-6.11	29.34
	6/13/2013 10:10	5.9	25.5	10.3	58.3	100	100	3	4	-0.8	-0.8	0.003	0.006	-10.7	29.34
	6/19/2013 9:05	0	0.2	20.3	79.5	82	82			-0.1	-0.1	0	-0.032	-0.13	29.48
	6/24/2013 14:30	22.5	52.4	0.2	24.9	100	100	2	4	-0.2	-0.3	0.001	0.007	-0.19	29.46
LCS-1D	6/4/2013 14:04	61	38.9	0	0.1	102	102			0.6	1	-2.17	-0.496	1.68	29.47
	6/12/2013 16:32	62.8	35.5	0	1.7	100	100	69		2	1	1.056	-1.713	1.85	29.2
	6/12/2013 16:37	62.1	35.7	0	2.2	100	100			2	1.5	-0.157	-0.412	1.3	29.2
	6/19/2013 8:33	60.6	39.3	0	0.1	96	96	81	53	0.4	-0.9	1.473	0.651	-0.17	29.45
	6/24/2013 14:16	65.3	33.4	0	1.3	122	122		86	-0.7	-1.5	-1.359	1.649	-1.27	29.44
LCS-2D	6/13/2013 13:59	49.7	50.2	0	0.1	102	102	74	60	-1.1	-1.1	1.392	0.909	-1.21	29.41
	6/13/2013 14:05	49.5	50.4	0	0.1	102	102	35	26	-0.4	-0.3	0.319	0.18	-0.34	29.41
	6/21/2013 11:58	49.4	48.7	0	1.9	103	103	110	112	-3.2	-3.2	3.014	3.145	-3.84	29.52
	6/26/2013 10:31	48.9	51	0	0.1	102	102	111	109	-2.6	-3	3.069	2.989	-2.96	29.21
LCS-3C	6/6/2013 8:54	6.8	33.5	11.2	48.5	132	132	127	126	-4.2	-4.2	4.682	4.618	-4.21	29.27
	6/13/2013 14:41	3.4	16.8	15.9	63.9	98	98	116	117	-3.7	-3.6	3.458	3.486	-3.82	29.39
	6/13/2013 14:46	4.1	17.1	15.8	63	98	98	124	121	-4.1	-4	3.91	3.754	-4.05	29.39
LCS-5A	6/3/2013 11:23	60.3	38.2	0	1.5	88	88	193	193	-8.1	-8.1	8.068	8.032	-8.14	29.47
	6/14/2013 9:01	56.5	43.4	0	0.1	98	98	160	156	-5.5	-5.5	5.895	5.632	-5.8	29.45
	6/18/2013 11:33	57.3	42.2	0	0.5	98	98	213	213	-9.8	-10	10.335	10.339	-10.14	29.34

June 2013 Wellfield Monitoring Data - Bridgeton Landfill

Well Name	Date Sampled	Methane	CO_2	O_2	Balance Gas	Init Temp	Adj Temp	Init Flow	Adj Flow	Init Static Press	Adj Static Press	Init Diff Press	Adj Diff Press	System Pressure	Baro
		(%)				°F		scfm		$"H_2O$					"Hg
LCS-6B	6/3/2013 10:15	46.1	39	1.1	13.8	120	120	17	17	-5.2	-5.3	0.082	0.081	-6.08	29.45
	6/14/2013 8:30	37.8	36.4	0.8	25	120	120	7	11	-6	-5.9	0.016	0.038	-7.17	29.45
	6/18/2013 10:45	39.1	35.1	0.8	25	120	120	10	8	-8.2	-7.1	0.029	0.018	-10.49	29.33
PEW60	6/6/2013 9:37	67.5	32.2	0	0.3	90	90	26	40	0.6	0.4	0.144	0.335	0.58	29.29
	6/6/2013 9:40	67.9	31.5	0	0.6	90	90	26	26	0.6	0.5	0.15	0.146	0.62	29.29
	6/14/2013 10:52	7.2	4.5	18.2	70.1	91	91			-7.5	-7.5	-0.048	-0.057	-7.17	29.47
	6/14/2013 10:53	7.3	4.3	18.2	70.2	92	92			-8	-8	-0.063	-0.063	-7.23	29.47
	6/18/2013 10:25	67.1	32.7	0	0.2	95	95	10	9	25.4	-0.9	0.023	0.021	-8.99	29.41
T-56	6/3/2013 10:36	44.2	33.8	0.4	21.6	72	72	35	43	0.2	-0.1	0.282	0.43	-6.04	29.46
	6/3/2013 10:37	44.1	33	0.4	22.5	72	72	47	42	-0.2	-0.2	0.497	0.413	-5.73	29.46
	6/14/2013 8:43	24.7	25.2	3.8	46.3	77	77	32	24	-0.5	-0.3	0.254	0.148	-7	29.45
	6/18/2013 10:56	41	33.4	0.9	24.7	78	78	23	28	-0.3	-0.2	0.135	0.186	-9.09	29.34

ATTACHMENT F-2

MAXIMUM TEMPERATURE SPREADSHEET

Wellfield Temperature - Bridgeton Landfill

Well Name	Maximum Initial Temperature °F			
	Mar	Apr	May	June
GEW-01	70	75	94	100
GEW-02	125	129	133	135
GEW-03	112	123	123	120
GEW-04	102	119	123	125
GEW-05	102	102	103	112
GEW-06	92	91	95	98
GEW-07	108	109	108	110
GEW-08	123	122	124	126
GEW-09	99	100	117	118
GEW-10	115	108	116	120
GEW-11	170	170	180	186
GEW-12A	102	170	150	156
GEW-13	120	154	154	--
GEW-14A	128	122	90	82
GEW-15	144	140	144	154
GEW-16R	150	148	--	--
GEW-17R	154	170	--	--
GEW-18B	142	142	152	176
GEW-18R	125	122	85	92
GEW-19A	44	88	96	114
GEW-20A	40	90	100	122
GEW-21A	148	140	85	100
GEW-22R	118	122	122	124
GEW-23A	122	120	122	128
GEW-24A	134	126	132	138
GEW-25A	134	140	150	152
GEW-26R	180	180	185	186
GEW-27A	140	142	150	152
GEW-28R	126	124	129	126
GEW-29	130	128	136	140
GEW-30R	168	164	168	170
GEW-31R	45	64	170	180
GEW-32R	190	190	192	202
GEW-33R	198	194	82	130
GEW-34	65	80	74	100
GEW-35	190	188	160	198
GEW-36	178	168	90	116
GEW-37	170	180	140	126
GEW-38	120	126	138	148
GEW-39	112	118	120	120

Wellfield Temperature - Bridgeton Landfill

Well Name	Maximum Initial Temperature °F			
	Mar	Apr	May	June
GEW-40	94	95	98	100
GEW-41R	108	109	113	116
GEW-42R	95	89	113	118
GEW-43R	125	107	139	140
GEW-44	97	107	108	114
GEW-45R	95	97	94	110
GEW-46R	101	97	101	106
GEW-47R	116	108	96	120
GEW-48	107	107	109	110
GEW-49	104	98	110	112
GEW-50	108	109	112	118
GEW-51	120	121	125	125
GEW-52	107	103	113	116
GEW-53	127	124	138	138
GEW-54	127	126	146	155
GEW-55	120	124	128	132
GEW-56R	122	108	120	142
GEW-57B	174	172	178	180
GEW-57R	182	182	192	196
GEW-58	178	164	184	--
GEW-59R	180	164	186	182
GEW-60R	196	190	196	198
GEW-62R	146	165	180	184
GEW-63	190	196	196	196
GEW-64	190	188	196	194
GEW-65A	--	--	170	--
GEW-66	198	190	198	200
GEW-68	130	124	100	100
GEW-69R	--	--	92	--
GEW-70R	194	194	150	--
GEW-71	170	164	182	186
GEW-72R	--	--	--	
GEW-73R	132	130	140	138
GEW-74	196	--	--	--
GEW-75	--	--	--	--
GEW-76R	200	--	--	--
GEW-77	137	132	142	144
GEW-78R	132	132	138	140
GEW-79R	--	--	--	--
GEW-80	120	125	126	130

Wellfield Temperature - Bridgeton Landfill

Well Name	Maximum Initial Temperature °F			
	Mar	Apr	May	June
GEW-81	126	126	130	134
GEW-82R	180	178	180	178
GEW-83	100	98	110	110
GEW-84	120	110	110	120
GEW-85	154	160	188	188
GEW-90	192	186	196	200
GEW-91	170	182	194	194
GEW-106	120	136	154	120
GEW-109	115	90	102	134
GEW-110	60	78	86	105
GEW-111	--	--	--	--
GIW-01	159	172	178	181
GIW-02	137	160	154	157
GIW-03	134	150	162	166
GIW-04	157	160	158	158
GIW-05	185	172	188	181
GIW-06	134	166	168	176
GIW-07	--	140	148	147
GIW-08	60	105	118	118
GIW-09	190	145	144	143
GIW-10	167	178	181	183
GIW-11	70	138	138	142
GIW-12	120	136	130	114
GIW-13	70	110	141	143
LCS-1D	70	46	94	122
LCS-2D	95	98	102	103
LCS-3C	115	118	128	132
LCS-4B	--	--	--	--
LCS-5A	60	99	100	98
LCS-6B	80	109	124	120
PEW60	56	72	95	95
T-56	53	62	76	78

-- = Indicates no data available.

ATTACHMENT F-3

LAB ANALYSES SPREADSHEET

Laboratory Analysis - Bridgeton Landfill

Well Name	Date Sampled	Methane	CO_2	O_2/Argon	Nitrogen	Hydrogen	Carbon Monoxide
		(%)					(ppm)
GEW-10	3/5/2013	30	55	2	10	0	390
	4/22/2013	30	41	ND	28	ND	60
	5/14/2013	19	30	8	42	ND	ND
	6/12/2013	30	45	2	21	ND	370
GEW-11	3/5/2013	7.1	57	3	13	19	2,500
	4/22/2013	7.7	61	ND	5.3	24	2,500
	5/14/2013	5.6	63	ND	ND	25	3,000
	6/13/2013	7.3	59	ND	6	26	2,300
GEW-12A	3/5/2013	0.2	47	6	22	24	3,400
	4/22/2013	0.38	60	2	6	29	3,400
	5/14/2013	0.32	61	ND	ND	32	3,700
	6/13/2013	0.38	62	ND	ND	33	3,600
GEW-13	1/23/2013	0.19	75	1	3	20	6,000
	2/13/2013	0.2	77	1	2	18	4,800
	3/6/2013	0.2	46	9	33	11	3,200
	4/22/2013	0.23	76	ND	5	14	5,300
GEW-14A	3/6/2013	9.5	70	0	0	17	2,600
	4/22/2013	18	69	ND	ND	8.1	960
	5/14/2013	7.2	51	5	17	19	2,500
	6/13/2013	12	41	8	28	11	1,700
GEW-15	2/13/2013	3.7	69	1	2.1	24	3,400
	3/6/2013	2.5	67	0	0	27	3,800
	4/22/2013	2.7	67	ND	ND	25	3,700
	6/13/2013	2.1	64	ND	ND	29	4,000
GEW-16R	1/25/2013	3.1	68	1	3.1	24	5,000
	2/13/2013	1.8	70	1	2	24	4,300
	3/6/2013	1.8	69	0	0	26	4,600
GEW-17R	1/25/2013	8.1	69	1	4.3	16	4,300
	2/12/2013	9.5	71	1	2.5	16	3,500
	3/6/2013	6.1	70	0	0	19	4,100
	4/25/2013	0.19	37	10	38	13	3,000
GEW-18B	2/12/2013	2.7	73	1	2.3	21	4,400
	3/6/2013	3.7	69	0	0	23	4,300
	4/25/2013	0.13	68	2	7.6	20	6,400
	5/14/2013	0.17	72	ND	ND	22	6,400
GEW-18R	2/12/2013	6.5	71	1	4.9	16	3,500
	3/6/2013	7.3	46	8	28	11	1,800
GEW-19A	3/6/2013	1.4	71	0	3.7	21	4,500
	4/25/2013	1.1	76	ND	ND	19	3,900
	5/14/2013	0.8	71	ND	6.4	18	3,500
	6/11/2013	0.8	73	ND	5	19	3,100
GEW-20A	3/6/2013	6.7	21	16	57	ND	170
	4/25/2013	4.3	36	12	43	3.7	920
	5/14/2013	6.3	37	11	42	ND	840
	6/11/2013	4.5	68	3	11	13	3,000

Laboratory Analysis - Bridgeton Landfill

Well Name	Date Sampled	Methane	CO_2	O_2/Argon	Nitrogen	Hydrogen	Carbon Monoxide
		(%)					(ppm)
GEW-21A	3/6/2013	1.9	67	2	6.6	21	3,900
	4/25/2013	1.5	68	ND	5.2	23	4,800
	5/14/2013	1.7	65	ND	4.4	26	5,600
	6/11/2013	1.7	66	ND	ND	27	5,800
GEW-22R	3/6/2013	13	73	0	4	8.3	1,700
	4/25/2013	5.9	53	7	25	8.8	1,600
	5/14/2013	8.1	74	ND	ND	14	1,900
	6/11/2013	5.9	71	ND	ND	18	2,400
GEW-23A	3/6/2013	23	65	0	3.9	6.9	890
	4/25/2013	16	70	ND	ND	10	1,500
	5/14/2013	14	57	4	16	8.5	910
	6/11/2013	12	71	ND	ND	14	1,700
GEW-24A	3/6/2013	17	56	4	13	9.5	1,300
	4/25/2013	11	40	9	33	7.5	900
	5/14/2013	17	66	ND	ND	13	1,100
	6/11/2013	11	71	ND	ND	15	1,800
GEW-25A	3/6/2013	8.1	50	7	24	11	1,400
	4/25/2013	12	66	ND	4.4	15	1,800
	5/14/2013	14	66	ND	ND	15	1,300
	6/11/2013	10	70	ND	ND	16	1,700
GEW-26R	3/6/2013	0.5	70	1	5	22	4,100
	4/25/2013	0.49	74	ND	ND	22	4,300
	5/14/2013	0.6	73	ND	ND	22	3,200
	6/11/2013	0.48	75	ND	ND	20	4,200
GEW-27A	3/6/2013	21	63	0	0	12	1,500
	4/25/2013	19	64	ND	ND	13	1,500
	5/14/2013	21	62	ND	3.6	12	910
	6/11/2013	11	69	ND	ND	16	1,700
GEW-28R	3/6/2013	13	46	7	25	8.3	960
	4/25/2013	20	65	ND	ND	13	1,200
	5/14/2013	17	64	ND	3.7	13	1,300
	6/11/2013	14	70	ND	3.8	11	930
GEW-29	3/5/2013	9.5	68	0	0	20	2,200
	4/22/2013	7.4	68	ND	ND	22	2,300
	5/15/2013	6.3	68	ND	ND	23	2,400
	6/11/2013	5	66	ND	ND	26	2,700
GEW-30R	3/5/2013	12	66	0	0	19	2,700
	4/22/2013	25	60	ND	ND	12	1,700
	5/15/2013	21	60	ND	ND	15	1,900
	6/11/2013	20	57	ND	5.5	15	2,100
GEW-31R	2/12/2013	0.6	67	2	6.1	24	5,100
	3/5/2013	0.4	68	0	0	27	5,000
	5/15/2013	0.29	64	ND	ND	28	4,300
	6/13/2013	0.95	49	6	21	21	3,100
GEW-32R	1/23/2013	1.1	60	1.2	4	32	4,700
	2/12/2013	0.9	55	3.4	13	27	3,700
	3/5/2013	1	62	0	0	33	4,100

Laboratory Analysis - Bridgeton Landfill

Well Name	Date Sampled	Methane	CO_2	O_2/Argon	Nitrogen	Hydrogen	Carbon Monoxide
		(%)					(ppm)
GEW-33R	3/5/2013	0.3	60	0	0	36	5,400
	4/22/2013	0.67	57	ND	ND	35	4,400
	5/15/2013	0.17	37	8	29	23	2,700
	6/13/2013	0.23	55	ND	3.8	34	4,100
GEW-34	3/5/2013	2.7	61	0	4	30	2,500
	4/22/2013	1.2	8.7	19	68	ND	210
	5/15/2013	0.44	4.6	20	73	ND	ND
	6/13/2013	1.1	34	9	34	20	1,400
GEW-35	2/12/2013	0.28	69	1	3	25	4,600
	4/22/2013	0.31	38	8	29	23	2,200
	5/15/2013	0.23	30	11	40	18	1,600
	6/12/2013	0.24	56	ND	ND	34	3,100
GEW-36	3/5/2013	0.7	61	0	0	34	3,300
	4/22/2013	0.14	38	8	30	22	1,900
	5/15/2013	0.021	9.4	18	66	5.7	710
	6/12/2013	0.12	58	ND	ND	36	3,400
GEW-37	3/5/2013	0.2	66	0	4	28	4,700
	4/22/2013	0.15	45	6	21	26	2,600
	5/15/2013	0.17	57	ND	5	33	3,200
	6/12/2013	0.13	58	ND	ND	33	3,200
GEW-38	3/5/2013	6.7	63	2	6.5	22	1,600
	4/22/2013	5.6	63	ND	ND	27	1,800
	5/15/2013	4.1	57	2	8	26	2,000
	6/12/2013	3.3	61	ND	ND	31	2,700
GEW-39	3/5/2013	43	53	0	0	ND	100
	4/22/2013	40	52	ND	5.5	ND	140
	5/15/2013	33	46	3	15	ND	230
	6/12/2013	34	56	ND	ND	5.8	630
GEW-56R	3/5/2013	21	57	0	18	ND	270
	4/22/2013	21	45	ND	31	ND	140
	5/14/2013	22	40	ND	33	4.1	240
	6/12/2013	21	ND	5	38	3.4	230
GEW-57B	3/5/2013	0.2	60	0	5	32	4,300
	4/22/2013	0.2	57	2	8	30	3,600
	5/14/2013	0.21	59	ND	6	31	3,500
	6/12/2013	0.21	62	ND	4	30	3,900
GEW-57R	3/5/2013	3.7	62	0	0	30	2,900
	4/22/2013	1.7	59	ND	4.6	31	2,900
	5/14/2013	1.1	59	ND	3.8	32	3,100
	6/12/2013	0.46	60	ND	ND	32	3,800
GEW-58	1/23/2013	1.7	55	2	7.7	32	3,300
	2/12/2013	1.2	53	3	12	29	2,500
	3/5/2013	1.3	60	0	0	34	2,900
GEW-59R	3/5/2013	17	64	0	4	13	1,400
	4/22/2013	18	60	ND	7.3	14	1,000
	5/14/2013	16	59	ND	6.6	16	1,200
	6/12/2013	12	63	ND	ND	21	1,600

Laboratory Analysis - Bridgeton Landfill

Well Name	Date Sampled	Methane	CO_2	O_2/Argon	Nitrogen	Hydrogen	Carbon Monoxide
		(%)					(ppm)
GEW-60R	3/5/2013	0.4	59	2	6.9	30	4,200
	4/22/2013	0.39	55	3	10	30	3,300
	5/14/2013	0.52	56	ND	7.1	31	3,100
	6/12/2013	0.42	58	ND	3.7	32	3,700
GEW-62R	3/6/2013	6.1	45	5.8	22	20	1,300
	4/22/2013	4.6	43	5.9	21	23	1,700
	5/14/2013	1.8	50	4	15	28	2,300
	6/13/2013	1.6	ND	ND	ND	36	3,500
GEW-63	1/23/2013	0.27	69	1	4.3	24	6,500
	2/13/2013	0.19	71	1	3.3	23	5,400
	3/5/2013	0.3	70	0	0	26	6,100
	5/14/2013	0.32	67	ND	ND	26	4,800
GEW-64	2/12/2013	0.22	65	1	2	30	4,800
	4/22/2013	0.25	48	6	22	22	3,600
	5/15/2013	0.42	64	ND	3	29	4,500
	6/13/2013	0.32	64	ND	ND	31	5,200
GEW-65A	11/7/2012	0.19	57	3	9.3	30	5,600
	12/5/2012	0.4	60	1	4.8	32	6,400
	1/24/2013	0.32	62	1	5	30	6,700
	2/12/2013	0.27	62	2	7	27	5,000
GEW-66	3/6/2013	0.3	61	2	8.4	27	5,800
	4/22/2013	0.26	57	2	8.5	28	4,900
	5/14/2013	0.29	62	ND	ND	30	5,400
	6/13/2013	0.3	ND	ND	ND	30	5,500
GEW-68	3/5/2013	4.5	67	0	0	25	2,700
	4/22/2013	2.1	64	ND	ND	30	3,400
	5/15/2013	2.3	64	ND	ND	30	3,200
	6/13/2013	2.2	64	ND	ND	30	3,900
GEW-69R	11/6/2012	1.4	67	1	4	24	6,300
	12/6/2012	8.3	65	1	5	20	4,900
	1/24/2013	7.6	68	1	3	19	5,400
	2/13/2013	2.2	68	2	6	20	5,100
GEW-70R	1/24/2013	0.19	64	1	5	29	6,500
	2/12/2013	0.15	67	1	2.1	28	5,500
	3/5/2013	0.2	66	0	0	30	6,100
GEW-71	3/6/2013	3.9	66	0	5.2	23	4,200
	4/22/2013	1.7	43	9	33	12	2,800
	5/14/2013	0.35	66	ND	3.9	27	5,200
	6/13/2013	0.27	67	ND	ND	28	6,400
GEW-72R	11/1/2012	1.7	68	1	4.5	24	6,900
	12/5/2012	0.51	70	1	3.2	23	8,900
	1/22/2013	20	60	1	5.8	13	1,800
GEW-73R	3/5/2013	8.3	68	0	0	21	2,700
	4/22/2013	6.6	64	ND	5.4	22	2,700
	5/15/2013	4.9	66	ND	ND	25	2,900
	6/11/2013	4	67	ND	ND	26	3,400

Laboratory Analysis - Bridgeton Landfill

Well Name	Date Sampled	Methane	CO_2	O_2/Argon	Nitrogen	Hydrogen	Carbon Monoxide
		(%)					(ppm)
GEW-74	1/24/2013	0.35	67	1	3	28	8,000
	2/12/2013	0.24	66	1	4	26	6,100
	3/5/2013	0.3	66	0	0	28	6,400
GEW-75	11/1/2012	0.26	66	1	4	27	7,300
	1/24/2013	0.23	47	7	26	18	4,200
GEW-76R	1/24/2013	0.28	59	4	16	19	6,900
	2/13/2013	0.2	71	1	2.3	23	6,700
	3/5/2013	0.2	69	0	0	25	6,500
GEW 77	3/6/2013	6.4	68	0	0	23	3,100
	4/25/2013	4.9	67	ND	ND	25	3,100
	5/14/2013	4.7	66	ND	ND	25	2,900
	6/11/2013	4.2	67	ND	ND	25	3,000
GEW-78R	3/6/2013	3.9	63	0	4.5	26	3,800
	4/25/2013	2.3	65	ND	ND	29	4,000
	5/14/2013	2.3	64	ND	ND	29	3,800
	6/11/2013	1.9	65	ND	ND	29	3,900
GEW-79R	11/1/2012	0.56	73	1	3	22	8,000
	12/5/2012	2.1	70	1	2.7	23	6,700
GEW 80	3/6/2013	10	74	0	0	13	2,100
	4/25/2013	8.1	71	ND	ND	17	2,300
	5/14/2013	7.9	71	ND	ND	17	2,100
	6/11/2013	7.3	71	ND	ND	19	2,100
GEW 81	3/6/2013	9.7	73	0	3.7	12	2,000
	4/25/2013	7.7	74	ND	ND	16	1,900
	5/14/2013	6.9	72	ND	ND	15	1,700
	6/11/2013	7.2	73	ND	ND	17	1,800
GEW-82R	3/6/2013	2.1	57	5	16	20	2,900
	4/25/2013	1.9	68	ND	ND	26	3,500
	5/14/2013	2.3	67	ND	3.7	24	3,200
	6/11/2013	3	66	ND	ND	27	2,900
GEW-83	3/6/2013	26	60	0	11	ND	230
	4/22/2013	24	58	ND	13	ND	300
	5/14/2013	26	62	ND	7	3.9	350
	6/13/2013	28	64	ND	ND	4	440
GEW-84	3/6/2013	5.5	66	0	3.7	23	2,000
	4/22/2013	14	72	ND	3.4	8	400
	5/14/2013	16	75	ND	3.4	3.9	160
	6/13/2013	19	77	ND	ND	ND	57
GEW-85	3/6/2013	14	65	0	ND	17	1,500
	4/22/2013	16	57	2.6	12	11	850
	5/14/2013	0.16	57	1.8	6.4	33	3,300
	6/13/2013	0.15	ND	ND	4.1	32	4,300
GEW-90	3/5/2013	7.1	57	0	6.1	27	3,000
	4/22/2013	2.7	51	2.7	14	28	2,700
	5/14/2013	3.2	56	ND	4.4	32	2,800
	6/12/2013	0.49	58	ND	ND	36	3,500

Laboratory Analysis - Bridgeton Landfill

Well Name	Date Sampled	Methane	CO_2	O_2/Argon	Nitrogen	Hydrogen	Carbon Monoxide
		(%)					(ppm)
GEW-91	2/12/2013	0.15	72	0.61	2.2	24	5,800
	3/5/2013	0.1	70	0	ND	25	3,100
	4/22/2013	0.21	71	ND	ND	24	5,500
	5/14/2013	0.16	59	4	15	21	4,500
GEW-106	3/5/2013	10	37	10	38	4.2	710
	4/22/2013	0.19	69	ND	ND	25	4,900
	5/15/2013	0.27	67	ND	ND	27	4,200
	6/13/2013	0.31	71	ND	4.3	21	5,600
GEW-109	3/5/2013	12	62	0	14	12	1,300
	4/22/2013	11	47	2.3	30	9.5	1,200
	5/15/2013	20	55	ND	13	9.8	770
	6/12/2013	13	58	ND	4.2	22	1,500
GEW-110	4/22/2013	8.8	62	ND	8.8	19	940
	5/14/2013	5.3	67	ND	4.4	21	1,700
	6/13/2013	4.9	23	12	52	7.4	920
GEW-111	2/13/2013	7.9	37	5.5	43	5.7	980
LCS-1D	2/12/2013	57	30	2.7	10	ND	52
	3/6/2013	66	31	0	0	ND	0
	5/14/2013	61	36	ND	ND	ND	ND
	6/12/2013	62	35	ND	ND	ND	ND
LCS-2D	2/12/2013	47	39	3	11	ND	21
	4/22/2013	52	45	ND	ND	ND	ND
	5/15/2013	49	43	1.7	6.4	ND	ND
	6/13/2013	51	45	ND	ND	ND	ND
LCS-3C	2/12/2013	17	70	0.97	3.5	8.1	1,600
	3/5/2013	16	69	0	4.6	8.7	1,800
	4/25/2013	2.6	13	17	65	ND	380
	6/13/2013	1.1	ND	17	63	ND	650
LCS-4B	12/5/2012	0.2	64	4.3	15	15	7,600
	2/13/2013	0.11	31	13	47	8.2	3,500
INLET	3/5/2013	12	55	3.9	17	13	2,100
	4/25/2013	8	32	11	40	8.1	1,200
	5/15/2013	11	49	5	20	13	1,900
	6/13/2013	9.8	40	7.6	30	10	1,700

ND = Analyte not detected in sample.

ATTACHMENT G

WELLHEAD TEMPERATURE MAPS

LEGEND

= Well Location

Maximum Temperature

- < 131°
- 131 < 151°
- 151 < 171°
- 171 < 191°
- 191 < 211°
- 211 < 231°
- > 231°

NOTES:

Maximum Temperature represents the maximum initial wellhead temperature reading collected during the month.

Only points monitored during the report period show data.

PEW-60
GEW-01
GEW-03
GEW-02
GEW-04
GEW-05
LCS-6B
GEW-46R
GEW-48
GEW-47R
GEW-45R
T-56
GEW-06
GEW-49
GEW-50
GEW-44
GEW-51
GEW-52
LCS-5A
GEW-43R
GEW-07
GEW-53
GEW-08
GEW-54
GEW-42R
GEW-41R
GEW-55
GEW-09
GEW-40
GEW-10
GEW-39
GEW-56R
GEW-109
GEW-110
GEW-38
GEW-11
GEW-91
LCS-1D
GEW-37
GEW-63
GEW-112
GEW-13A
GEW-12A
GEW-90
GEW-59R
GEW-14A
GEW-36
GEW-106
GEW-85
GEW-62R
GEW-58A
GEW-35
GEW-16R
GEW-15
GEW-13
GEW-67
GEW-72R
GEW-89
GEW-61B
GEW-58
GEW-71
GEW-66
GEW-61R
GEW-57R
GEW-34
GEW-80
LCS-4B
GEW-84
GEW-83
GEW-57B
GEW-17R
GEW-70R
GEW-65A
GEW-60R
GEW-103
GEW-18R
GEW-18B
GEW-76R
GEW-75
GEW-33R
GEW-116
LCS-3C
GEW-82R
GEW-79R
GEW-64
GEW-32R
GEW-117
GEW-19A
GEW-74
GEW-69R
GEW-68
GEW-31R
GEW-101
GEW-81
GEW-78R
GEW-73R
GEW-20A
GEW-100
LCS-2D
GEW-21A
GEW-80
GEW-77
GEW-23A
GEW-29
GEW-22R
GEW-28R
GEW-30R
GEW-24A
GEW-25A
GEW-27A
GEW-26R

N

1 inch = 70 meters

0 35 70 105 140

Initial Temperature Maximums - March 2013 - Bridgeton Landfill

SCS ENGINEERS

LEGEND

= Well Location

Maximum Temperature

- < 131°
- 131 < 151°
- 151 < 171°
- 171 < 191°
- 191 < 211°
- 211 < 231°
- > 231°

NOTES:

Maximum Temperature represents the maximum initial wellhead temperature reading collected during the month.

Only points monitored during the report period show data.

PEW-60
GEW-01
GEW-03
GEW-02
GEW-04
GEW-05
LCS-6B
GEW-46R
GEW-48
GEW-47R
GEW-45R
T-56
GEW-06
GEW-49
GEW-50
GEW-44
GEW-51
GEW-52
LCS-5A
GEW-43R
GEW-53
GEW-07
GEW-54
GEW-42R
GEW-08
GEW-41R
GEW-55
GEW-09
GEW-40
GEW-10
GEW-39
GEW-56R
GEW-109
GEW-110
GEW-38
GEW-11
GEW-91
LCS-1D
GEW-37
GEW-63
GEW-112
GEW-13A
GEW-12A
GEW-90
GEW-59R
GEW-14A
GEW-36
GEW-106
GEW-85
GEW-62R
GEW-13
GEW-67
GEW-58A
GEW-35
GEW-16R
GEW-15
GEW-72R
GEW-89
GEW-61B
GEW-58
GEW-71
GEW-66
GEW-61R
GEW-57R
GEW-34
GEW-88
LCS-4B
GEW-57B
GEW-17R
GEW-84
GEW-83
GEW-65A
GEW-70R
GEW-60R
GEW-103
GEW-18R
GEW-18B
GEW-33R
GEW-76R
GEW-75
GEW-116
LCS-3C
GEW-82R
GEW-79R
GEW-64
GEW-32R
GEW-117
GEW-19A
GEW-74
GEW-69R
GEW-68
GEW-31R
GEW-101
GEW-81
GEW-78R
GEW-73R
GEW-20A
GEW-100
LCS-2D
GEW-21A
GEW-80
GEW-77
GEW-23A
GEW-29
GEW-22R
GEW-28R
GEW-30R
GEW-24A
GEW-25A
GEW-27A
GEW-26R

N

1 inch = 70 meters

0 35 70 105 140

Initial Temperature Maximums - April 2013 - Bridgeton Landfill

SCS ENGINEERS

LEGEND

= Well Location

Maximum Temperature

- < 131°
- 131 < 151°
- 151 < 171°
- 171 < 191°
- 191 < 211°
- 211 < 231°
- > 231°

NOTES:

Maximum Temperature represents the maximum initial wellhead temperature reading collected during the month.

Only points monitored during the report period show data.

PEW-60
GEW-01
GEW-03
GEW-02
GEW-04
GEW-05
LCS-6B
GEW-46R
GEW-48
GEW-47R
GEW-45R
T-56
GEW-06
GEW-49
GEW-50
GEW-44
GEW-51
GEW-52
LCS-5A
GEW-43R
GEW-53
GEW-07
GEW-08
GEW-54
GEW-42R
GEW-41R
GEW-55
GEW-09
GEW-40
GEW-10
GEW-39
GEW-56R
GEW-109
GEW-110
GEW-38
GEW-11
GEW-91
LCS-1D
GEW-37
GEW-63
GEW-13A
GEW-12A
GEW-112
GEW-90
GEW-59R
GEW-14A
GEW-36
GEW-106
GEW-85
GEW-13
GEW-67
GEW-62R
GEW-58A
GEW-16R
GEW-15
GEW-72R
GEW-89
GEW-61B
GEW-58
GEW-35
GEW-71
GEW-66
GEW-61R
GEW-57R
GEW-34
LCS-4B
GEW-17R
GEW-84
GEW-83
GEW-57B
GEW-70R
GEW-65A
GEW-60R
GEW-103
GEW-18R
GEW-18B
GEW-76R
GEW-75
GEW-33R
GEW-116
LCS-3C
GEW-82R
GEW-79R
GEW-64
GEW-32R
GEW-117
GEW-19A
GEW-74
GEW-69R
GEW-68
GEW-31R
GEW-101
GEW-81
GEW-78R
GEW-73R
GEW-20A
GEW-100
LCS-2D
GEW-21A
GEW-80
GEW-77
GEW-23A
GEW-29
GEW-22R
GEW-28R
GEW-30R
GEW-24A
GEW-25A
GEW-27A
GEW-26R

N

1 inch = 70 meters

0 35 70 105 140

Initial Temperature Maximums - May 2013 - Bridgeton Landfill

SCS ENGINEERS

LEGEND

= Well Location

Maximum Temperature

- < 131°
- 131 < 151°
- 151 < 171°
- 171 < 191°
- 191 < 211°
- 211 < 231°
- > 231°

NOTES:

Maximum Temperature represents the maximum initial wellhead temperature reading collected during the month.

Only points monitored during the report period show data.

PEW-60
GEW-01
GEW-03
GEW-02
GEW-04
GEW-05
LCS-6B
GEW-46R
GEW-48
GEW-47R
GEW-45R
T-56
GEW-06
GEW-49
GEW-50
GEW-44
GEW-51
GEW-52
LCS-5A
GEW-43R
GEW-53
GEW-07
GEW-54
GEW-42R
GEW-08
GEW-41R
GEW-55
GEW-09
GEW-40
GEW-10
GEW-39
GEW-56R
GEW-109
GEW-110
GEW-38
GEW-11
GEW-91
LCS-1D
GEW-37
GEW-63
GEW-13A
GEW-12A
GEW-112
GEW-90
GEW-59R
GEW-14A
GEW-36
GEW-106
GEW-85
GEW-13
GEW-67
GEW-62R
GEW-58A
GEW-16R
GEW-15
GEW-72R
GEW-89
GEW-61B
GEW-35
GEW-58
GEW-71
GEW-66
GEW-61R
GEW-57R
GEW-34
GEW-88
GEW-57B
LCS-4B
GEW-17R
GEW-84
GEW-83
GEW-70R
GEW-65A
GEW-60R
GEW-103
GEW-18R
GEW-18B
GEW-33R
GEW-116
GEW-76R
GEW-75
GEW-64
GEW-32R
LCS-3C
GEW-82R
GEW-79R
GEW-117
GEW-19A
GEW-74
GEW-69R
GEW-68
GEW-31R
GEW-101
GEW-81
GEW-78R
GEW-73R
GEW-20A
GEW-100
LCS-2D
GEW-21A
GEW-80
GEW-77
GEW-23A
GEW-29
GEW-22R
GEW-28R
GEW-30R
GEW-24A
GEW-25A
GEW-27A
GEW-26R

N

1 inch = 70 meters

0 35 70 105 140

Initial Temperature Maximums - June 2013 - Bridgeton Landfill

SCS ENGINEERS

ATTACHMENT H

SUMMARY OF ODOR COMPLAINTS

June 1, 2013-June 7, 2013

Voicemails

Resident: Natalie Blackwell

Voicemail: Ms. Blackwell's message was inaudible due to static.

Follow-up: Ms. Blackwell explained that she wanted to know how to get updates and information about what is happening at the landfill. The website link was shared and it was explained to her that at link to the MDNR site is on our webpage. We provided her with our 855 number to call should she have any further questions.

Resident: George Porter

Voicemail: Mr. Porter called asking for an update on the work being done at the Bridgeton Landfill.

Follow-up: Mr. Porter said that he has no computer and just wanted to know if the work is going well and on schedule. We explained to him that the weather may have caused a delay. He said that he is enjoying the hotel he was relocated to. We reminded him that Jennifer and Kurt will let him know more about the timing for the hotel stay.

Resident: John James

Voicemail: Mr. James left a message asking if we received his email.

Follow-up: Mr. James indicated that when he tried to fax the completed relocation/reimbursement forms to DRP, it was a wrong number and someone answered the line. He let us know that prior to the tornado knocking out the electricity, he was staying with is daughter and that he is now staying at another location. He was provided with the correct phone and extension number for both Jennifer and Kurt at DRP.

Resident: Joy Lamartina

Voicemail: Ms. Lamartina left a voicemail asking for information about trash pickup.

Follow-up: Ms. Lamartina was provided with the customer service number.

Resident: Jenell Wright

Voicemail: Ms. Wright left a voicemail asking for a return call.

Follow-up: Ms. Wright said she visits the areas surrounding the landfill frequently because of friends and family living nearby. She has accessed the BL web site and spoken with Joe Trunko with the MDNR and Larry Lehman recently who she says did a very good job explaining to her the work being done.

Resident: Mrs. Dailey

Voicemail: Mrs. Dailey left a voicemail saying that she received a notice that the work on the Bridgeton Landfill was complete but that she knows it is not because she can still smell the odors.

Follow-up: Mrs. Dailey was informed that the concrete removal process is complete and no we are moving forward with placing a durable cap over the landfill. She was pleased to know the work continues and that the odors will be drastically reduced over the next few months.

Resident: Jeremy Merth

Voicemail: Mr. Merth left a voicemail looking for an address to drop off a load of construction debris.

Follow-up: Mr. Merth was informed that the Bridgeton Landfill is no longer accepting waste and then provided with the customer service number where he can get the information he needs.

Resident: Charles Dalton

Voicemail: Mr. Dalton left a message giving his address and explaining that he smells the odors from the Bridgeton Landfill daily. He explained that he has a young child and a baby on the way and is interested in the reimbursement offer he heard about for people inconvenienced by the odors.

Follow-up: It was explained to Mr. Dalton that he lives outside MOAG agreed upon neighborhoods eligible for voluntary relocation or reimbursement. We also let him know that we are ahead of schedule with the RCP abandonment work and that the relocation/reimbursement ends this Friday. Mr. Dalton hung up after we started to tell him about the cap that will be placed on the landfill and drastically reduce the odors.

Resident: Mary Jo Mansell

Voicemail: Ms. Mansell left us a voicemail, very upset about the odors coming from the Bridgeton Landfill.

Follow-up: We apologized to Ms. Mansell for the inconvenience of the odors, and she calmly restated that for the past two nights the odor has been horrible. It was explained to her that

wind and barometric conditions can make the odors more noticeable. She understands that we finished the concrete work early and I explained about placing the cap which she read on our mailer. She said that both she and her neighbor thought it was very nice of us to offer the voluntary relocation. The Mansells didn't take up the offer because the odors are not a problem generally. She didn't want to take advantage of us like others may have and that even prior to us taking over the landfill, the odors have been noticeable at night for years.

Resident: Diana Wollard

Voicemail: Ms. Wollard left a voicemail to complain about the odors that she has noticed over the past couple days.

Follow-up: After reaching Ms. Wollard's voicemail, we left her a message apologizing for the odors coming from the Bridgeton Landfill. She was informed that weather and wind conditions brought about by the storm are likely the reason for the very recent odors and that our work is not finished as we continue as placed to place a cap over the landfill. Within the next few months, the odors should be drastically reduced. She was given the 855 number to call should she have any questions.

Resident: Ms. Johnson

Voicemail: Ms. Johnson called to say she has a problem with the checkout date for the voluntary relocation/reimbursement program.

Follow-up: Ms. Johnson explained to us that we said we would give a three-day notice and she just found out yesterday that the program ends tomorrow. Hotel checkout time is 12pm and Ms. Johnson has to meet an adjuster at her home between 10am - 12pm so she may not be able to check out in time. It was conveyed to her that notice of the end of the relocation program was provided as per the agreement and that if she stays at the hotel beyond the program's end tomorrow, all additional charges and expenses will be her responsibility. She indicated the notice was left on her door when we knew she was at the hotel rather than her home. We confirmed with DRP that participants were also notified by emails and telephone calls.

Resident: Deborah Strickland

Voicemail: Ms. Strickland left a voicemail complaining about the odors coming from the Bridgeton Landfill and wanting a call from Tim Trost.

Follow-up: Ms. Strickland explained that she has a medical condition and extreme allergies. She vacated the temporary housing hotel and returned home on Thursday. The smell she is detecting is chemicals not trash and she has relocated to her parents. She thinks the housing was to continue until June 14th as we completed work on the odor elimination efforts. She was informed that notices were distributed about the voluntary relocation that indicated that we

anticipated the work to take as long June 14th, though it stipulated it could vary and proper advance notice would be provided in advance of the ending date of the relocation period. That voluntary relocation was limited to the time it took to complete the RCP removal which was finished ahead of schedule, and now we are moving forward to place a cap over the landfill which will drastically reduce the odors within the next several months. As for the odors, there is no health or safety risk from the odors as reported by the MDNR on their frequent and ongoing air quality tests. We provide a link to the MDNR site and report info on www.bridgetonlandfill.com

Resident: Tiffany Bern, Operations Manager, Chesterfield Suites Hotel

Voicemail: Ms. Bern left a message saying one resident participating in the lodging program, Mr. Easman, was refusing to leave the property because he has no ride home. She requested a return call.

Follow-up: We called DRP and asked them to call the hotel to try to resolve the situation.

Emails

Resident: Mark Graham

Resident email: I received a voice mail message from Jennifer that my disposal was not aligned correctly. I received 2 harassing calls tonight from 314-403-6393 and 314-280-8009 after I had left a voice mail of un-satisfaction earlier. Do I need to notify the BBB of threats and allegations???

Response: Customer service will handle this response.

Resident: Mary Foster

Resident email: We are interested in getting a large trash can on wheels, like the ones we use for our trash and recycling, for our yard waste. We live at 3520 El Ferrol Court, Bridgeton 63044, phone number is 314-601-5111, Spanish Village Subdivision. Thank you, Mary

Response: Our customer service team should be able to help with your request. They can be reached at 636-947-5959.

Resident: Ellen Wortham

Resident email: Now that the work on the landfill has been completed, why are we still smelling the odors? Were the underground fires/elevated ground temperatures resolved? There has been no posting on your site since Monday June 3rd.

Response: Thank you for your inquiry. Due to an Order entered by the United States District Court for the Eastern District of Missouri on May 28, 2013, our reply must be presented to a third party. We are working to both prepare a response to your inquiry and obtain authorization and will do so as quickly as possible. We appreciate your patience while we comply with the Court's Order.

Resident: Bob Nowlin

Resident email: Why is the relocation program being ended when the odors in Spanish Village and even further away are as bad today as they have been previously? Even the DNR report this morning says the odors are bad. I am a resident of Spanish Village and participating in the relocation program. Also why did Republic end their daily reports on 6/3/13? This all seems like a cover-up with no real concern for the residents and businesses being affected. I also would like to know what is being done with the leachate that MSD stopped taking because of high levels of Benzene and other harmful chemicals in it! Bob Nowlin

Response: Thank you for your inquiry. Due to an Order entered by the United States District Court for the Eastern District of Missouri on May 28, 2013, our reply must be presented to a third party. We are working to both prepare a response to your inquiry and obtain authorization and will do so as quickly as possible. We appreciate your patience while we comply with the Court's Order.

June 8, 2013-June 14, 2013

Voicemails

Resident: Patricia Splett

Voicemail: Ms. Splett left a message regarding the odors coming from the Bridgeton Landfill that she understood would be gone at the end of the voluntary relocation period.

Follow-up: We reached Ms. Splett's voicemail and left a message explaining the MOAG approval for the relocation through the end of the RCP Abandonment work which we completed ahead of schedule. While we work to install the cap over the landfill, there may continue to be some detectible odors over the next several months, though the intensity should be greatly reduced. She was provided with the 855 number should she have any future questions. When Ms. Splett returned our call, she said she was unhappy with the continued odor. She said that the scope of the RCP Abandonment was not clear to her and she will be sure to communicate with the MOAG because she believes they think the cap was to have been installed during the relocation period. We relayed that while not speaking for MOAG's office, we are following their written plan for the long-term odor reduction.

Resident: John Cushman

Voicemail: Mr. Cushman called because of the odors coming from the Bridgeton Landfill.

Follow-up: We returned Mr. Cushman's phone call to apologize for the odors and explain that we are adding a cap over 32 acres of the landfill. We told him we expect the project to continue throughout the summer and that when complete, he should notice a drastic decrease in the intensity of the odors. He asked if the odor particles will be smaller and travel farther. The well work done through the winter and upgrades to the onsite processing facility were described to him. Those systems combined with the cap should well manage the odors. He asked about toxicity, and we indicated that the MDNR period air quality testing shows no health or safety risk. He referenced the EPA, to which it was explained to him that the EPA monitors the West Lake Landfill which is separate from the Bridgeton Landfill. He was provided with the 855 number should he have any further questions.

Resident: Dave Schutte

Voicemail: Mr. Schutte left a message asking for a call back.

Follow-up: When we reached Mr. Schutte, he explained that he received a flyer on his door on June 7th that the work was finished and the cap installed yet the odor today is worse than ever. We apologized for the odor inconvenience and explained that the flyer advised that the RCP Abandonment work was finished ahead of schedule and we are now working on the placement

of the cap which will continue through the summer. He said he must have skimmed the flyer and misunderstood and he is concerned about the particulate and how to get a copy of the reports. He was directed to the MDNR site or the link to it on the Bridgeton Landfill site.

Resident: Delk

Voicemail: Delk left a message regarding the odor coming from the Bridgeton Landfill and asked for a return call.

Follow-up: Delk said that he only wanted us to know that the odor is drifting as far as his home in St. Charles. He also works at the airport, and at 2 AM, he noticed especially bad smells.

Resident: Ms. Loss

Voicemail: Ms. Loss left a message looking to drop off some large items.

Follow-up: Ms. Loss was provided with the customer service number for dropping off her large items.

Resident: Gregory Myers

Voicemail: Mr. Myers left a message explaining that he believed that upon his return home to Gallatin Lane after the voluntary relocation, our work would be complete and the odor gone.

Follow-up: We apologized for the odor inconvenience and explained that the temporary housing agreed upon by the MOAG was only to cover the time it took to complete the RCP Abandonment work which we finished ahead of schedule. We explained that the capping work being done will continue through the summer and when finished, there will be a drastic decrease in the intensity of odors. He stated he plans to sell his condo late summer/early fall and wants to know if the Landfill will be assuming any responsibility for decreased property values. We advised that we have no information about that.

Resident: Henry Kauffman

Voicemail: Mr. Kauffman said that Republic Services picks up his garbage normally and he was wondering if we could pick up a small piece of chain-link fence if he left it by his garbage cans.

Follow-up: We returned Mr. Kauffman's call and provided him with the customer service phone number where someone will be able to answer his question.

Resident: Jane Hodges

Voicemail: Ms. Hodges said she would like to leave out an old dresser and requested a call back.

Follow-up: Ms. Hodges was provided with the customer service phone number where someone will be able to answer her question.

Resident: Chris Gaston

Voicemail: Ms. Gaston left a message asking for a call back.

Follow-up: Ms. Gaston is the Chair of the Board of Directors for a daycare located at the Arlington United Methodists Church, about three miles from the landfill. Parents are starting to ask about potential safety hazards to their children due to potential toxins in the air. She said a parent who lives close to the landfill let her know that there is an air monitor at the community playground. She wants to know if it is possible to gen an air monitor at the daycare. We explained to Ms. Gaston that MDNR testing and studies show there is no health or safety risk associated with the odor coming from the Bridgeton Landfill. She stated that the DNR is only testing twice weekly and that she is getting ready to write a letter to the daycare parents and wants to be as informative and reassuring as possible. She was referred to Joe Trunko with the DNR and given the main 800 number to reach him. We also offered to help Ms. Gaston gather information for the letter to the parents. She said that she wants to keep it brief because people don't like to read, so she will think about anything she may need from us and call back. Essentially, it is a letter of information and to be signed by parents if they do not want their child to go outdoors for playtime because of the odors/safety concerns with the Bridgeton Landfill.

Complaints forwarded by MDNR

Resident: Bob Nowlin

Message: Mr. Nowlin submitted a complaint to the MDNR regarding the odors coming from the Bridgeton Landfill. He wants to know why Republic Services is being allowed to end their voluntary relocation program when residents can still smell the odors in the neighborhoods that were approved for the lodging program.

Email Response: Thank you for your inquiry. Due to an Order entered by the United States District Court for the Eastern District of Missouri on May 28, 2013, our reply must be presented to a third party. We are working to both prepare a response to your inquiry and obtain authorization and will do so as quickly as possible. We appreciate your patience while we comply with the Court's Order.

Follow-up call: After reaching Mr. Nowlin by phone, he explained that he spoke with someone at the DNR who explained that the relocation was coordinated with the approval of the MOAG and was set to conclude when the RCP Abandonment work was finished. We reconfirmed this and explained that we completed that portion ahead of schedule and are now working to place the cap over the landfill. While odors may worsen (or not) during this phase of the long term solution, odors should be drastically reduced within the next few months. Mr. Nowlin then said

that his concern is with the health risks associated with long term exposure since he has lived there for 36 years. After explaining that the MDNR's air findings show no health or safety risk, he said that no one seems to be concerned or measuring for the long term exposure risk. He was referred to the West Lake Landfill website and was made aware that the EPA has been monitoring that site as it is an EPA Super Fund site. He was told that his inquiries regarding the West Lake Landfill should be directed to them

Emails

Resident: Councilwoman Linda J. Eaker

Resident email: (In response to project update) Thank you. By the way, the odor was noticeable at my house last night: 3255 Autumn View Pointe Drive.
It was a strong chemical odor.

Response: The temporary housing program was provided to local residents during the reinforced concrete pipe (RCP) abandonment project when odors were expected to be at their most intense. The program was only intended to run during that period of improvements. Because we understand the importance of completing the next phase of improvements as efficiently and effectively as possible, we hired an additional company, to join with our current contractor, to expedite the work. We would be happy to provide you with a follow-up tour so you can see the extent of the work involved in this next phase. Once the EVOH capping system is installed, local residents should notice a significant decrease in odor. We apologize that the odor continues during this phase but this work is required to complete this project and reduce the odor.

Resident response: I had surgery for breast cancer 5 weeks ago and I'm still in the recovery mode. Thanks for the offer.

Response: We are very sorry to hear that and we wish you a speedy recovery.

Resident: Patricia Splett

Resident email: Hi, I am very confused. I was under the impression that the temp housing was to get away from the odors. The stench is worse today 6/7/13 than it has ever been. What was the relocation for if it was not for the odors? When will the terrible stench stop? I would love to go outside and enjoy the cool temperatures but can't get past the stink, my eyes are watering, and my throat is raw. Please advise. 314---------

Response: We called Ms. Splett in follow-up to her email and apologized for the odors. Our current work installing the Ethylene Vinyl Alcohol (EVOH) capping system was explained in detail to her. We told her that we expect a drastic reduction in odors once the cap is fully installed. Ms. Splett was reminded that the temporary housing program was to designed only to cover the time involved to complete the reinforced concrete pipe (RCP) abandonment

project, where there was a likely chance that odors would increase. We assured her that we are now working into the evenings to expedite our improvements and complete the project as effectively and efficiently as possible. Ms. Splett said that since we spoke on Friday, she has spoken with Mr. Nagel at MDNR who reinforced our information on the relocation timeframe. She said that she and her neighbors misunderstood this.

Resident: T.J. Moore

Resident email: Hello, I am looking for used wide mouth Gatorade bottles to use for our church ministry. We are partnered with Samaritans Purse and our church members fill Gatorade bottles with quarters and dimes to purchase water filters for families in poor countries to filter dirty water for a lifetime. This is a great ministry. We were wondering if we could send a team of people to your recycling center in Edwardsville to pull those types of bottles. Please call me at 618--------. My name is T.J. Moore from Metro Community Church.

Response: This inquiry was directed to customer service.

June 15, 2013-June 21, 2013

Complaints forwarded by MDNR

Resident: Bari Miller, Virbac Animal Health

Message: Ms. Miller contacted the MDNR concerning the Bridgeton Landfill. She is the new EHS Director at Virbac Animal Health and had general questions about the site. She also inquired about where she could obtain information and if she could receive regular updates about what was happening at the landfill. She was given a general overview of the site and what the current status is. She was provided with links to the MDNR and Republic websites and given contact information for the Missouri Department of Health and Senior Services. She was informed that Bridgeton Landfill may be contacting her.

Follow-up: Bridgeton Landfill site representatives will follow up with Ms. Miller as part of their ongoing updates to neighboring businesses.

Resident: Cynthia Williams

Message: Ms. Williams contacted the MDNR concerning the Bridgeton Landfill. She was at the Pattonville High School meeting and had concerns about the health effects of the landfill odors. She was given a general overview of the site and what the current status is. She was provided with links to the MDNR and Republic websites and given contact information for the Missouri Department of Health and Senior Services. She was informed that Republic may be contacting her.

Follow-up: Despite attending the town hall meeting at Patterson High School last night, Ms. Williams wanted to know if the air is safe for her to breathe. We confirmed that in each of the previous as well as current air quality tests conducted by the MDNR, there is no health or safety risk to the community from the odors from the Bridgeton Landfill. She went on to tell us about a friend living in Chicago near a landfill for the past 40 years and all the sickness, cancer and deformed babies. We said we had no information about what may be or may not be taking place in Chicago, and the MDNR is monitoring and testing the air quality here and there is no health or safety risk; it is totally separate from any reporting in Chicago. She thanked us for calling and was provided with our 855 number for further questions.

Resident: Michelle Evans

Message: The odors from the landfill in the Tuesday evening hours and this morning are noticeable.

Follow-up: We left a message for Ms. Evans, apologizing for the increased odors. We explained the work we are doing to place a cap over the landfill which is part of the long term solution,

though odors may be more noticeable in the short run depending on weather conditions or the work progression.

Emails

Resident: Liz

Resident email: I was under the impression that after the "voluntary relocation" that the smell would be reduced. We have had days in the past several weeks since we have been home that have been awful. Two days ago was disgusting. Today I took my daughter to the pool and sure enough after about an hour the stink from YOUR landfill increased and forced us indoors on my day off. It seems obvious to me that the project completing ahead of schedule was premature and absolutely nothing to celebrate. What was the point of the relocation if not just a publicity stunt aimed to try to make us compliant with your negligence?

Response: Thank you for your inquiry. Due to an Order entered by the United States District Court for the Eastern District of Missouri on May 28, 2013, our reply must be presented to a third party. We are working to both prepare a response to your inquiry and obtain authorization and will do so as quickly as possible. We appreciate your patience while we comply with the Court's Order.

Resident: Jennifer

Resident email: I am pregnant and NEED to know if this is harmful to my child. Please let me know. I work right there in Bridgeton.

Response: [response covered in next section].

June 22, 2013-June 30, 2013

Voicemails

Resident: Bill Harlan

Voicemail: Mr. Harlan left a voice message complaining about the landfill odors over the weekend.

Follow-up: Mr. Harlan complained of headaches when he is outside and claims the smells are strong. We apologized for the inconvenience the odor is causing then explained the work we are doing as a long term solution as well as the ongoing air quality testing by the MDNR and DHSS. We advised that we update our website frequently. He closed the call by saying that he'll keep going to the meetings and listen to the lies being told. He was encouraged to continue attending meetings and visiting our site regularly for information.

Resident: Judy Austin

Voicemail: Ms. Austin left a message requesting help with pickup of yard waste.

Follow-up: Ms. Austin was advised that customer service would be able to help her and was provided with their number.

Resident: Kay Lunden

Voicemail: Ms. Lunden called requesting help with pickup of a mattress.

Follow-up: Ms. Lunden was advised that customer service would be able to help her and was provided with their number.

Resident: Andrea, City of Washington

Voicemail: Andrea left a message asking for help with information specific to their expansion of a soil bar area.

Follow-up: We reached Andrea's voicemail in the Engineering Department and left a message that we received her call and that her request has been forwarded internally and a member of the Bridgeton Landfill team would follow up.

Resident: Jacob Williams

Voicemail: Jacob, an area Boy Scout, is working on his citizenship and community merit badge. He called asking to interview someone about what's happening at the landfill and how young people can help

Follow-up: Jacob was directed to www.bridgetonlandfill.com and we are working with the client team to follow up with Jacob.

Complaints forwarded by MDNR

Resident: Kim Miller

Message: We work in Earth City and we can smell the landfill all day long. Is there anything that can be done about this, as it's not a pleasant environment to be working in with the smell?

Follow-up: Ms. Miller was left a detailed message, explaining about the capping process and long term solution. We apologized for the odor inconvenience and offered to add her business to our email contact list and asked that she let us know if this type contact is something she would like by calling our 855 number.

Emails

Resident: Sharona

Resident email: I wanted to complain about your phone customer service. I have some questions and I have called on 3 different occasions, only to be around 40 minutes on hold, listening to how great you are and all, until I had to disconnect to do other things. I find it highly unacceptable that you treat your customers like waste. This is shameful. I guess I will stop paying my bills, maybe someone will call me than.

Response: We are very sorry for the inconvenience. Perhaps you can try submitting your questions via the contact us page on the Republic Services website. Here is the link: http://www.republicservices.com/Corporate/Contact/customer-service.aspx
Again, we apologize and hope you are able to reach the customer service team shortly.

Resident: Jennifer

Resident email: I am pregnant and NEED to know if this is harmful to my child. Please let me know. I work right there in Bridgeton.

Response: Bridgeton Landfill continues to work with the Missouri Department of Natural Resources (MDNR) and the Missouri Department of Health and Senior Services (MDHSS) on ongoing air monitoring, along with several additional more intensive air monitoring

events. This data has been and will continue to be analyzed by the DHSS and DHSS is providing their assessments of the results. All results and DHSS analysis are available on MDNR's website as well as Bridgeton Landfill's website at www.bridgetonlandfill.com. Additionally, both MDNR and MDHSS participated in a webinar on June 17th and much of the discussion at that webinar was related to the ongoing assessment by DHSS of the impact of the odor causing emissions. As noted in the presentation by DHSS, they have not observed any chemicals at levels of public health concern for acute exposure. The webinar presentation and video area available through MDNR's website and may be helpful in understanding the scope of MDNR's air testing and the ongoing risk review by DHSS. Because we agree that it is imperative that sufficient data is gathered to allow for these health assessments, we will continue to cooperate with the agencies as they continue to closely monitor and provide reports on protection of public health.

Follow-up: We left Jennifer a detailed message advising that we have been and will continue to work in conjunction with the MDNR and DHSS to monitor air quality. We let her know that she can view their findings on the bridgetonlandfill.com site or directly on the MDNR site. She was given the 855 number and the website if she has additional questions.

Neighboring property owner Joe Turned reported 10 odor reports during the month of June. Mr. Turner's calls are managed by a Bridgeton Landfill team member who updates Mr. Turner on site activities, any recent changes and remedial measures, and logs the calls.

ATTACHMENT I

LIQUID CHARACTERIZATION DATA

The Liquid Characterization Data for June 2013 consists of 1,940 pages of laboratory results.

In order to make this Monthly Report a manageable electronic document, the Liquid Characterization Data will be provided in separate file(s).

ATTACHMENT J

LIQUID TRANSPORT MANIFEST LOGS

Manifest Summary

Bridgeton Landfill Liquids

Load ID	Waste	Disposal Facility	Source	Transporter	Qty (gal)	Manifest No.	Clerk
Loading Date 6/1/2013							
1	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	MBI	7,500	086574	Emily Heikes
2	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Tank Battery 3	Coal City Cob	6,000	011449634	Emily Heikes
3	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	MBI	7,700	086575	Emily Heikes
4	Non-Hazardous Leachate	Advanced Waste - Cedar Rapids	Tank Battery 3	Sully	5,800	AWS 77058	Emily Heikes
5	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Tank Battery 3	Coal City Cob	5,400	011449635	Emily Heikes
6	Non-Hazardous Leachate	Advanced Waste - Cedar Rapids	Tank Battery 3	Sully	6,000	AWS 77059	Emily Heikes
7	Non-Hazardous Leachate	Advanced Waste - Kankakee Metro	Tank Battery 3	Turn Key	6,000	011449753	Emily Heikes
8	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	MBI	7,500	086576	Emily Heikes
9	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	MBI	7,700	086578	Emily Heikes
10	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	MBI	7,500	086579	Emily Heikes
11	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Tank Battery 3	Transwood Inc	5,500	011449636	Emily Heikes
12	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	MBI	7,700	086580	Emily Heikes
13	Non-Hazardous Leachate	Advanced Waste - Kankakee Metro	Tank Battery 1	Turn Key	5,500	011449754	Emily Heikes
14	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Tank Battery 1	Coal City Cob	5,600	AWS 77665	Emily Heikes
15	Non-Hazardous Leachate	Advanced Waste - Cedar Rapids	Tank Battery 1	Transwood Inc	5,200	AWS 77060	Emily Heikes
16	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Tank Battery 1	Coal City Cob	5,500	AWS 77666	Emily Heikes
17	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Tank Battery 1	K&R	6,100	AWS 77667	Emily Heikes
18	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Tank Battery 3	K&R	6,100	AWS 77668	Emily Heikes
18					**114,300**		
Loading Date 6/2/2013							
1	Non-Hazardous Leachate	Advanced Waste - Cedar Rapids	Tank Battery 3	Sully	6,000	AWS 77061	John Powell

Load ID	Waste	Disposal Facility	Source	Transporter	Qty (gal)	Manifest No.	Clerk
2	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Tank Battery 3	K&R	6,000	AWS 77669	John Powell
3	Non-Hazardous Leachate	Advanced Waste - Cedar Rapids	Tank Battery 3	Sully	5,800	AWS 77062	John Powell
4	Non-Hazardous Leachate	Advanced Waste - Kankakee Metro	Tank Battery 3	Turn Key	6,000	011449755 JJK	John Powell
5	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Tank Battery 3	Coal City Cob	6,000	011449637 JJK	John Powell
6	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Tank Battery 5	Coal City Cob	5,600	011449638 JJK	John Powell
7	Non-Hazardous Leachate	Advanced Waste - Chemworks	Sparge 2	TDR Transport	5,200	AWS 77670	John Powell
7					**40,600**		

Loading Date 6/3/2013

1	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Sparge 2	Coal City Cob	6,000	011449639 JJK	John Powell
2	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	MBI	7,500	086581	John Powell
3	Non-Hazardous Leachate	Advanced Waste - Cedar Rapids	Sparge 2	Sully	6,000	AWS 77063	John Powell
4	Non-Hazardous Leachate for Rockford IPC	Advanced Waste - Rockford IPC	Tank Battery 5	Wayne Transports	6,000	011449886 JJK	John Powell
5	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Sparge 2	Schiber	5,000	AWS 77673	John Powell
6	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	MBI	7,400	086582	John Powell
7	Non-Hazardous Leachate	Advanced Waste - Cedar Rapids	Sparge 2	Sully	6,000	AWS 77064	John Powell
8	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Sparge 2	Ziron Environmental	5,000	011449640 JJK	John Powell
9	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Sparge 2	Ziron Environmental	5,000	011449641 JJK	John Powell
10	Non-Hazardous Leachate	Metalworking Lubricants	Tank Battery 8	Metalworking Lubricants	5,500	ML 005	John Powell
11	Non-Hazardous Leachate	Advanced Waste - Cedar Rapids	Sparge 2	Transwood Inc	5,500	AWS 77065	John Powell
12	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Sparge 2	Transwood Inc	5,600	011449642 JJK	John Powell
13	Non-Hazardous Leachate	Advanced Waste - Chemworks	Sparge 2	SET Environmental	5,200	AWS 77672	John Powell
14	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	MBI	7,500	086583	John Powell
15	Non-Hazardous Leachate	Advanced Waste - Chemworks	Sparge 2	TDR Transport	5,200	AWS 77671	John Powell
16	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Tank Battery 2	Ziron Environmental	5,000	011449643 JJK	John Powell

Load ID	Waste	Disposal Facility	Source	Transporter	Qty (gal)	Manifest No.	Clerk
17	Non-Hazardous Leachate	Advanced Waste - Chemworks	Sparge 2	TDR Transport	5,000	AWS 77674	John Powell
18	Non-Hazardous Leachate for Rockford IPC	Advanced Waste - Rockford IPC	Tank Battery 5	Wayne Transports	6,000	011449887 JJK	John Powell
19	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	MBI	7,700	086584	John Powell
20	Non-Hazardous Leachate	Advanced Waste - Kankakee Metro	Sparge 2	Turn Key	5,500	011449756 JJK	John Powell
21	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 8	Schiber	5,600	1702432-15240	John Powell
22	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Sparge 1	K&R	6,000	AWS 77675	John Powell
23	Non-Hazardous Leachate for Rockford IPC	Advanced Waste - Rockford IPC	Tank Battery 5	Wayne Transports	6,100	011449888 JJK	John Powell
24	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	MBI	7,500	086585	John Powell
25	Non-Hazardous Leachate	Advanced Waste - Kankakee Metro	Sparge 1	Turn Key	5,750	011449757 JJK	John Powell
26	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Sparge 1	Schiber	5,000	AWS 77676	John Powell
27	Non-Hazardous Leachate for Rockford IPC	Advanced Waste - Rockford IPC	Tank Battery 5	Coal City Cob	5,500	011449889 JJK	John Powell
28	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Sparge 1	Coal City Cob	5,500	011449644 JJK	John Powell
29	Non-Hazardous Leachate for Rockford IPC	Advanced Waste - Rockford IPC	Tank Battery 5	Wayne Transports	6,000	011449890 JJK	John Powell
30	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Sparge 1	K&R	5,800	AWS 77677	John Powell
31	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	MBI	7,700	086586	John Powell
32	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Sparge 1	KRD Trucking	6,000	011449645 JJK	John Powell
33	Non-Hazardous Leachate for Rockford IPC	Advanced Waste - Rockford IPC	Tank Battery 5	Coal City Cob	5,400	011449891 JJK	John Powell
34	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Sparge 1	KRD Trucking	5,800	011449646 JJK	John Powell
35	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	MBI	7,500	086587	John Powell
36	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Sparge 1	Coal City Cob	5,800	011449647 JJK	John Powell
37	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Sparge 1	Wetterau Homestead	5,200	AWS 77678	John Powell
38	Non-Hazardous Leachate	Advanced Waste - Kankakee Metro	Sparge 1	Turn Key	6,000	011449758 JJK	John Powell
39	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 8	Mid America Waste Solutions	5,000	1702213-15240	John Powell

Load ID	Waste	Disposal Facility	Source	Transporter	Qty (gal)	Manifest No.	Clerk
40	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Sparge 1	Coal City Cob	6,000	011449648 JJK	John Powell
41	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	MBI	7,700	086588	John Powell
42	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Sparge 1	Coal City Cob	5,600	AWS 77679	John Powell
43	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	MBI	7,500	086589	John Powell
44	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 8	Neier	5,400	1702232-15240	John Powell
45	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 2	MBI	7,700	086590	John Powell
46	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 2	MBI	7,500	086591	John Powell
47	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 8	Neier	5,000	1702233-15240	John Powell
48	Non-Hazardous Leachate	Advanced Waste - Chemworks	Tank Battery 2	Coal City Cob	5,500	AWS 77680	John Powell
49	Non-Hazardous Leachate	Advanced Waste - Chemworks	Tank Battery 2	Coal City Cob	5,600	AWS 77681	John Powell
50	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Tank Battery 2	Transwood Inc	5,500	011449649 JJK	John Powell
51	Non-Hazardous Leachate	Advanced Waste - Chemworks	Tank Battery 2	TDR Transport	5,200	AWS 77682	John Powell
52	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 2	MBI	7,700	086679	John Powell
53	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Tank Battery 2	Schiber	5,500	AWS 77683	John Powell
53					**318,150**		

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1	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 2	MBI	7,500	086680	John Powell
2	Non-Hazardous Leachate for Rockford IPC	Advanced Waste - Rockford IPC	Tank Battery 5	Coal City Cob	6,000	011449892 JJK	John Powell
3	Non-Hazardous Leachate for Rockford IPC	Advanced Waste - Rockford IPC	Tank Battery 5	Wayne Transports	6,000	011449893 JJK	John Powell
4	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 2	MBI	7,700	086681	John Powell
5	Non-Hazardous Leachate	Advanced Waste - Chemworks	Tank Battery 6	TDR Transport	5,000	AWS 77684	John Powell
6	Non-Hazardous Leachate	Advanced Waste - Chemworks	Tank Battery 6	TDR Transport	5,200	AWS 77685	John Powell
7	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Tank Battery 6	Ziron Environmental	5,000	011449650 JJK	John Powell

Load ID	Waste	Disposal Facility	Source	Transporter	Qty (gal)	Manifest No.	Clerk
8	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 3	MBI	7,500	086682	John Powell
9	Non-Hazardous Leachate	Advanced Waste - Cedar Rapids	Tank Battery 6	Sully	6,000	AWS 77066	John Powell
10	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Tank Battery 6	Ziron Environmental	5,500	011449651 JJK	John Powell
11	Non-Hazardous Leachate	Advanced Waste - Cedar Rapids	Tank Battery 6	Sully	6,000	AWS 77067	John Powell
12	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 3	MBI	7,700	086683	John Powell
13	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Tank Battery 6	Schiber	5,500	AWS 77686	John Powell
14	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 8	Schiber	5,800	1702433-15240	John Powell
15	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Tank Battery 6	Ziron Environmental	5,000	011449652 JJK	John Powell
16	Non-Hazardous Leachate for Rockford IPC	Advanced Waste - Rockford IPC	Tank Battery 6	Wayne Transports	6,000	011449894 JJK	John Powell
17	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 3	MBI	7,500	086684	John Powell
18	Non-Hazardous Leachate for Rockford IPC	Advanced Waste - Rockford IPC	Tank Battery 6	Wayne Transports	6,100	011449895 JJK	John Powell
19	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 8	Mid America Waste Solutions	5,000	1702214-15240	John Powell
20	Non-Hazardous Leachate for Rockford IPC	Advanced Waste - Rockford IPC	Tank Battery 6	Wayne Transports	6,000	011449896 JJK	John Powell
21	Non-Hazardous Leachate	Advanced Waste - Kankakee Metro	Tank Battery 6	Turn Key	5,800	011449759 JJK	John Powell
22	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 3	MBI	7,700	086685	John Powell
23	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 3	MBI	7,500	086686	John Powell
24	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Sparge 1	KRD Trucking	6,000	011449653 JJK	John Powell
25	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Sparge 1	KRD Trucking	6,000	011449654 JJK	John Powell
26	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 8	Neier	5,400	1702240-15240	John Powell
27	Non-Hazardous Leachate	Advanced Waste - Kankakee Metro	Sparge 1	Turn Key	5,500	011449761 JJK	John Powell
28	Non-Hazardous Leachate	Advanced Waste - Cedar Rapids	Sparge 1	Transwood Inc	5,200	AWS 77068	John Powell
29	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Sparge 1	Transwood Inc	5,500	011449655 JJK	John Powell
30	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 3	MBI	7,700	086687	John Powell
31	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Sparge 1	K&R	6,000	AWS 77687	John Powell

Load ID	Waste	Disposal Facility	Source	Transporter	Qty (gal)	Manifest No.	Clerk
32	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 3	SET Environmental	5,800	086692	John Powell
33	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Sparge 1	K&R	6,100	AWS 77688	John Powell
34	Non-Hazardous Leachate	Advanced Waste - Kankakee Metro	Sparge 1	Turn Key	5,750	011449763 JJK	John Powell
35	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 3	MBI	7,500	086688	John Powell
36	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Sparge 1	Coal City Cob	5,400	AWS 77689	John Powell
37	Non-Hazardous Leachate for Rockford IPC	Advanced Waste - Rockford IPC	Tank Battery 3	Coal City Cob	5,500	011449897 JJK	John Powell
38	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Sparge 1	Coal City Cob	6,000	011449656 JJK	John Powell
39	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Sparge 1	Coal City Cob	5,500	AWS 77690	John Powell
40	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Sparge 1	Wetterau Homestead	5,400	AWS 77691	John Powell
41	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 3	MBI	7,700	086689	John Powell
42	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 8	Neier	5,000	1702241-15240	John Powell
43	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 8	Neier	5,200	1702242-15240	John Powell
44	Non-Hazardous Leachate	Advanced Waste - Chemworks	Sparge 1	SET Environmental	5,300	AWS 77693	John Powell
45	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 4	MBI	7,500	086690	John Powell
46	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Sparge 2	Transwood Inc	5,500	011449657 JJK	John Powell
47	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 8	Neier	4,800	1702243-15240	John Powell
48	Non-Hazardous Leachate	Advanced Waste - Chemworks	Sparge 2	Coal City Cob	5,600	AWS 77692	John Powell
49	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 8	Neier	6,000	1702244-15240	John Powell
50	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 4	MBI	7,700	086691	John Powell
51	Non-Hazardous Leachate	Advanced Waste - Chemworks	Sparge 2	TDR Transport	5,200	AWS 77694	John Powell
52	Non-Hazardous Leachate	Advanced Waste - Cedar Rapids	Sparge 2	Transwood Inc	5,256	AWS 77069	John Powell
52					**314,006**		

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Load ID	Waste	Disposal Facility	Source	Transporter	Qty (gal)	Manifest No.	Clerk
1	Non-Hazardous Leachate for Rockford IPC	Advanced Waste - Rockford IPC	Tank Battery 6	Coal City Cob	6,000	011449898 JJK	John Powell
2	Non-Hazardous Leachate	Advanced Waste - Cedar Rapids	Sparge 2	Sully	6,000	AWS 77070	John Powell
3	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 8	Schiber	5,800	1702434-15240	John Powell
4	Non-Hazardous Leachate for Rockford IPC	Advanced Waste - Rockford IPC	Tank Battery 6	Wayne Transports	6,000	011449899 JJK	John Powell
5	Non-Hazardous Leachate	Advanced Waste - Chemworks	Sparge 2	TDR Transport	5,000	AWS 77695	John Powell
6	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	MBI	7,500	086693	John Powell
7	Non-Hazardous Leachate	Advanced Waste - Chemworks	Sparge 2	TDR Transport	5,200	AWS 77696	John Powell
8	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	MBI	7,700	086694	John Powell
9	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Sparge 2	Ziron Environmental	5,500	011449658 JJK	John Powell
10	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 8	Neier	5,500	1702245-15240	John Powell
11	Non-Hazardous Leachate	Advanced Waste - Cedar Rapids	Sparge 2	Sully	6,000	AWS 77071	John Powell
12	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Sparge 2	Ziron Environmental	5,000	011449659 JJK	John Powell
13	Non-Hazardous Leachate	Advanced Waste - Kankakee Metro	Sparge 2	Turn Key	5,800	011449765 JJK	John Powell
14	Non-Hazardous Leachate	Advanced Waste - Kankakee Metro	Sparge 2	Turn Key	5,500	011449767 JJK	John Powell
15	Non-Hazardous Leachate for Rockford IPC	Advanced Waste - Rockford IPC	Tank Battery 6	Wayne Transports	6,000	011449900 JJK	John Powell
16	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	MBI	7,500	086695	John Powell
17	Non-Hazardous Leachate for Rockford IPC	Advanced Waste - Rockford IPC	Tank Battery 6	Coal City Cob	5,500	011449901 JJK	John Powell
18	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	MBI	7,700	086696	John Powell
19	Non-Hazardous Leachate for Rockford IPC	Advanced Waste - Rockford IPC	Tank Battery 6	Wayne Transports	6,100	011449902 JJK	John Powell
20	Non-Hazardous Leachate for Rockford IPC	Advanced Waste - Rockford IPC	Tank Battery 6	K&R	6,100	011449903 JJK	John Powell
21	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 8	Mid America Waste Solutions	5,000	1702215-15240	John Powell
22	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Sparge 2	KRD Trucking	6,000	011449660 JJK	John Powell

Load ID	Waste	Disposal Facility	Source	Transporter	Qty (gal)	Manifest No.	Clerk
23	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Sparge 1	KRD Trucking	6,000	011449661 JJK	John Powell
24	Non-Hazardous Leachate for Rockford IPC	Advanced Waste - Rockford IPC	Tank Battery 6	Wayne Transports	6,000	011449904 JJK	John Powell
25	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Sparge 1	KRD Trucking	6,000	011449662 JJK	John Powell
26	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 7	Neier	5,400	1702246-15240	John Powell
27	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Sparge 1	Ziron Environmental	5,500	011449663 JJK	John Powell
28	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	MBI	7,500	086697	John Powell
29	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 7	Schiber	5,000	1702435-15240	John Powell
30	Non-Hazardous Leachate	Advanced Waste - Kankakee Metro	Sparge 1	Turn Key	5,750	011449769 JJK	John Powell
31	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	MBI	7,700	086698	John Powell
32	Non-Hazardous Leachate for Rockford IPC	Advanced Waste - Rockford IPC	Tank Battery 6	Advanced Waste	5,000	011449905 JJK	John Powell
33	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Sparge 1	K&R	6,000	AWS 77697	John Powell
34	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	MBI	7,500	086699	John Powell
35	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	MBI	7,700	086700	John Powell
36	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Sparge 1	Coal City Cob	6,000	011449664 JJK	John Powell
37	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 7	Neier	5,500	1702247-15240	John Powell
38	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Sparge 1	Transwood Inc	5,500	011449665 JJK	John Powell
39	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Sparge 1	Transwood Inc	5,500	011449666 JJK	John Powell
40	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 2	MBI	7,500	086701	John Powell
41	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 7	Neier	4,800	1702248-15240	John Powell
42	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 7	Neier	5,000	1702249-15240	John Powell
43	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 2	MBI	7,700	086702	John Powell
44	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 7	Neier	5,200	1702250-15240	John Powell
45	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 7	Neier	5,400	1702251-15240	John Powell
46	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 2	MBI	7,500	086703	John Powell

Load ID	Waste	Disposal Facility	Source	Transporter	Qty (gal)	Manifest No.	Clerk
47	Non-Hazardous Leachate	Advanced Waste - Chemworks	Sparge 1	TDR Transport	5,200	AWS 77698	John Powell
48	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 7	Neier	5,800	1701557-15240	John Powell
49	Non-Hazardous Leachate for Rockford IPC	Advanced Waste - Rockford IPC	Tank Battery 4	Coal City Cob	5,500	011449906 JJK	John Powell
50	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Sparge 1	Coal City Cob	5,500	AWS 77699	John Powell
50					**301,050**		

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1	Non-Hazardous Leachate	Advanced Waste - Cedar Rapids	Tank Battery 4	Sully	6,000	AWS 77072	Emily Heikes
2	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 2	MBI	7,500	086706	Emily Heikes
3	Non-Hazardous Leachate	Advanced Waste - Cedar Rapids	Tank Battery 4	Transwood Inc	5,370	AWS 77073	Emily Heikes
4	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 2	MBI	7,700	086707	Emily Heikes
5	Non-Hazardous Leachate	Advanced Waste - Cedar Rapids	Tank Battery 4	Sully	6,000	AWS 77074	Emily Heikes
6	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Tank Battery 4	Ziron Environmental	5,000	011449667	Emily Heikes
7	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 2	SET Environmental	5,700	086708	Emily Heikes
8	Non-Hazardous Leachate	Advanced Waste - Chemworks	Tank Battery 4	TDR Transport	5,200	AWS 77700	Emily Heikes
9	Non-Hazardous Leachate	Advanced Waste - Kankakee Metro	Tank Battery 4	Turn Key	5,800	011449771	Emily Heikes
10	Non-Hazardous Leachate	Advanced Waste - Kankakee Metro	Tank Battery 4	Turn Key	5,500	011449773	Emily Heikes
11	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Tank Battery 4	K&R	6,100	AWS 77701	Emily Heikes
12	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 2	MBI	7,500	086709	Emily Heikes
13	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 2	MBI	7,700	086710	Emily Heikes
14	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 7	Neier	5,400	1701558-15240	Emily Heikes
15	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 7	Mid America Waste Solutions	5,000	1702216-15240	Emily Heikes
16	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 4	MBI	7,500	086711	Emily Heikes
17	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 3	MBI	7,700	086712	Emily Heikes
18	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Sparge 2	Ziron Environmental	5,500	011449668	Emily Heikes

Load ID	Waste	Disposal Facility	Source	Transporter	Qty (gal)	Manifest No.	Clerk
19	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Sparge 2	KRD Trucking	6,200	011449669	Emily Heikes
20	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Sparge 2	KRD Trucking	6,100	011449670	Emily Heikes
21	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 7	Neier	4,800	1701559-15240	Emily Heikes
22	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Sparge 2	Coal City Cob	5,400	011449671	Emily Heikes
23	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 3	MBI	7,500	086713	Emily Heikes
24	Non-Hazardous Leachate	Advanced Waste - Kankakee Metro	Sparge 2	Turn Key	5,500	011449775	Emily Heikes
25	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Sparge 2	K&R	5,800	AWS 77702	Emily Heikes
26	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 3	MBI	7,700	086714	Emily Heikes
27	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Sparge 2	Coal City Cob	5,700	AWS 77703	Emily Heikes
28	Non-Hazardous Leachate	Advanced Waste - New Castle	Sparge 2	Kuhnle Bros	5,100	AWS 77337	Emily Heikes
29	Non-Hazardous Leachate	Advanced Waste - New Castle		Kuhnle Bros	5,400	AWS 77338	Emily Heikes
30	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Sparge 2	KRD Trucking	6,000	011449672	Emily Heikes
31	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 3	MBI	7,500	086715	Emily Heikes
32	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Sparge 2	Neier	5,500	1701560-15240	Emily Heikes
33	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Sparge 2	Schiber	5,000	1702436-15240	Emily Heikes
34	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 3	MBI	7,700	086716	Emily Heikes
35	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Sparge 2	Neier	5,500	1701561-15240	Emily Heikes
36	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Sparge 1	Neier	5,400	1701562-15240	Emily Heikes
37	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Sparge 1	Neier	5,000	1701563-15240	Emily Heikes
38	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 4	MBI	7,500	086717	Emily Heikes
39	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Sparge 1	Transwood Inc	5,500	011449673	Emily Heikes
40	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Sparge 1	Neier	5,400	1701564-15240	Emily Heikes
41	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 3	MBI	7,700	086718	Emily Heikes
42	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Sparge 1	Transwood Inc	5,500	011449674	Emily Heikes
43	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Sparge 1	Coal City Cob	5,500	AWS 77704	Emily Heikes

Load ID	Waste	Disposal Facility	Source	Transporter	Qty (gal)	Manifest No.	Clerk
44	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Sparge 1	Coal City Cob	5,500	AWS 77705	Emily Heikes
45	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Sparge 1	TDR Transport	5,200	AWS 77706	Emily Heikes
46	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Sparge 1	Coal City Cob	5,600	AWS 77707	Emily Heikes
46					**278,370**		

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0	Non-Hazardous Leachate for MSD	MSD - Missouri River	AST	MSD Direct Discharge	15,169	2013-06-07	
1	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Sparge 1	Wetterau Homestead	5,200	AWS 77708	Emily Heikes
2	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	MBI	7,500	086719	Emily Heikes
3	Non-Hazardous Leachate	Advanced Waste - Cedar Rapids	Sparge 1	Sully	6,000	AWS 77075	Emily Heikes
4	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	MBI	7,700	086720	Emily Heikes
5	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Sparge 1	Coal City Cob	6,000	011449675	Emily Heikes
6	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	SET Environmental	5,500	086722	Emily Heikes
7	Non-Hazardous Leachate	Advanced Waste - Cedar Rapids	Sparge 1	Sully	6,000	AWS 77076	Emily Heikes
8	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	MBI	7,500	086721	Emily Heikes
9	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	MBI	7,700	086723	Emily Heikes
10	Non-Hazardous Leachate	Advanced Waste - New Castle	Sparge 1	Kuhnle Bros	5,200	AWS 77339	Emily Heikes
11	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Sparge 2	Coal City Cob	5,600	011449676	Emily Heikes
12	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	MBI	7,500	086724	Emily Heikes
13	Non-Hazardous Leachate	Advanced Waste - Chemworks	Sparge 2	TDR Transport	5,200	AWS 77709	Emily Heikes
14	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 8	Neier	5,400	1702252-15240	Emily Heikes
15	Non-Hazardous Leachate	Advanced Waste - Kankakee Metro	Sparge 2	Turn Key	6,000	011449777	Emily Heikes
16	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 8	Mid America Waste Solutions	5,000	1702217-15240	Emily Heikes
17	Non-Hazardous Leachate	Advanced Waste - Kankakee Metro	Sparge 2	Turn Key	5,500	011449789	Emily Heikes
18	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	MBI	7,700	086725	Emily Heikes

Load ID	Waste	Disposal Facility	Source	Transporter	Qty (gal)	Manifest No.	Clerk
19	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Sparge 2	Schiber	5,000	AWS 77710	Emily Heikes
20	Non-Hazardous Leachate	Advanced Waste - Chemworks	Sparge 2	Coal City Cob	5,600	AWS 77711	Emily Heikes
21	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Sparge 2	Ziron Environmental	5,000	011449679	Emily Heikes
22	Non-Hazardous Leachate	Advanced Waste - New Castle	Sparge 2	Kuhnle Bros	5,200	AWS 77341	Emily Heikes
23	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	MBI	7,500	086726	Emily Heikes
24	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Sparge 2	Ziron Environmental	5,000	011449677	Emily Heikes
25	Non-Hazardous Leachate	Advanced Waste - Cedar Rapids	Sparge 2	Transwood Inc	5,300	AWS 77077	Emily Heikes
26	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 8	Neier	5,500	1703746-15240	Emily Heikes
27	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Sparge 2	KRD Trucking	6,000	011449678	Emily Heikes
28	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Sparge 2	KRD Trucking	6,200	011449680	Emily Heikes
29	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 2	MBI	7,700	086727	Emily Heikes
30	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 2	Neier	5,500	1702253-15240	Emily Heikes
31	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Sparge 2	K&R	6,000	AWS 77712	Emily Heikes
32	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 2	MBI	7,500	086728	Emily Heikes
33	Non-Hazardous Leachate	Advanced Waste - Kankakee Metro	Tank Battery 4	Turn Key	6,000	011449790	Emily Heikes
34	Non-Hazardous Leachate	Advanced Waste - Kankakee Metro	Tank Battery 4	Turn Key	5,500	011449791	Emily Heikes
35	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 2	MBI	7,700	086729	Emily Heikes
36	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Tank Battery 4	K&R	6,100	AWS 77713	Emily Heikes
37	Non-Hazardous Leachate	Advanced Waste - Portage	Tank Battery 4	Transwood Inc	5,300	AWS 77468	Emily Heikes
38	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 2	MBI	7,500	086730	Emily Heikes
39	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 4	Neier	4,800	1702254-15240	Emily Heikes
40	Non-Hazardous Leachate	Advanced Waste - Chemworks	Tank Battery 4	Coal City Cob	5,500	AWS 77714	Emily Heikes
41	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 2	MBI	7,700	086731	Emily Heikes
42					**266,469**		

Load ID	Waste	Disposal Facility	Source	Transporter	Qty (gal)	Manifest No.	Clerk
Loading Date 6/8/2013							
0	Non-Hazardous Leachate for MSD	MSD - Missouri River	AST	MSD Direct Discharge	15,325	2013-06-08	
1	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 3	MBI	7,500	086732	Emily Heikes
2	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 3	MBI	7,700	086733	Emily Heikes
3	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 8	SET Environmental	5,400	1703562-15240	Emily Heikes
4	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 8	Schiber	5,000	1703561-15240	Emily Heikes
5	Non-Hazardous Leachate	Advanced Waste - Cedar Rapids	Tank Battery 6	Sully	6,000	AWS 77078	Emily Heikes
6	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Tank Battery 6	Coal City Cob	5,600	AWS 77715	Emily Heikes
7	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 8	Neier	5,500	1702234-15240	Emily Heikes
8	Non-Hazardous Leachate	Advanced Waste - Cedar Rapids	Tank Battery 6	Sully	5,800	AWS 77079	Emily Heikes
9	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 8	Heritage Transport	6,000	1703564-15240	Emily Heikes
10	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 3	MBI	7,500	086734	Emily Heikes
11	Non-Hazardous Leachate	Advanced Waste - Cedar Rapids	Tank Battery 6	Transwood Inc	5,370	AWS 77080	Emily Heikes
12	Non-Hazardous Leachate	Advanced Waste - Kankakee Metro	Tank Battery 6	Turn Key	5,500	011449792	Emily Heikes
13	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 3	MBI	7,700	086735	Emily Heikes
14	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 8	Triad Transport	4,900	1703745-15240	Emily Heikes
15	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 3	MBI	7,500	086736	Emily Heikes
16	Non-Hazardous Leachate	Advanced Waste - Kankakee Metro	Tank Battery 6	Turn Key	6,000	011449793	Emily Heikes
17	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 8	Neier	5,400	1703565-15240	Emily Heikes
18	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 8	SET Environmental	5,400	1703563-15240	Emily Heikes
19	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 3	MBI	7,700	086737	Emily Heikes
20	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 8	Triad Transport	5,000	1700504-15240	Emily Heikes
21	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 8	Neier	5,500	1703566-15240	Emily Heikes
22	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 3	Neier	6,000	1703567-15240	Emily Heikes
23	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Sparge 1	K&R	6,100	AWS 77716	Emily Heikes

Load ID	Waste	Disposal Facility	Source	Transporter	Qty (gal)	Manifest No.	Clerk
24	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Sparge 1	Coal City Cob	5,600	AWS 77717	Emily Heikes
25					**160,995**		

Loading Date 6/9/2013

0	Non-Hazardous Leachate for MSD	MSD - Missouri River	AST	MSD Direct Discharge	19,196	2013-06-09	
1	Non-Hazardous Leachate	Advanced Waste - Cedar Rapids	Tank Battery 3	Sully	5,800	AWS 77081	John Powell
2	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Tank Battery 4	K&R	6,000	AWS 77718	John Powell
3	Non-Hazardous Leachate	Advanced Waste - Cedar Rapids	Tank Battery 4	Sully	6,000	AWS 77082	John Powell
4	Non-Hazardous Leachate	Advanced Waste - Chemworks	Tank Battery 4	TDR Transport	4,600	AWS 77719	John Powell
5	Non-Hazardous Leachate	Advanced Waste - Chemworks	Tank Battery 4	Coal City Cob	5,600	AWS 77720	John Powell
6	Non-Hazardous Leachate	Advanced Waste - Chemworks	Tank Battery 4	TDR Transport	5,200	AWS 77721	John Powell
7					**52,396**		

Loading Date 6/10/2013

0	Non-Hazardous Leachate for MSD	MSD - Missouri River	AST	MSD Direct Discharge	17,502	2013-06-10	
1	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Sparge 1	Coal City Cob	6,000	011449681 JJK	John Powell
2	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	MBI	7,500	086738	John Powell
3	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	MBI	7,700	086739	John Powell
4	Non-Hazardous Leachate	Advanced Waste - Chemworks	Sparge 1	SET Environmental	5,300	AWS 77722	John Powell
5	Non-Hazardous Leachate for Rockford IPC	Advanced Waste - Rockford IPC	Tank Battery 6	Wayne Transports	6,000	011449907 JJK	John Powell
6	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Sparge 1	Ziron Environmental	5,000	011449682 JJK	John Powell
7	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	SET Environmental	5,300	086751	John Powell
8	Non-Hazardous Leachate	Advanced Waste - Cedar Rapids	Sparge 1	Sully	6,000	AWS 77083	John Powell
9	Non-Hazardous Leachate	Advanced Waste - Cedar Rapids	Sparge 1	Sully	6,000	AWS 77084	John Powell
10	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Sparge 1	Ziron Environmental	5,000	011449683 JJK	John Powell

Load ID	Waste	Disposal Facility	Source	Transporter	Qty (gal)	Manifest No.	Clerk
11	Non-Hazardous Leachate	Advanced Waste - Kankakee Metro	Sparge 1	Turn Key	5,500	011449801 JJK	John Powell
12	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	MBI	7,500	086741	John Powell
13	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Sparge 1	Transwood Inc	5,500	011449684 JJK	John Powell
14	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Sparge 1	K&R	6,000	AWS 77723	John Powell
15	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	MBI	7,700	086742	John Powell
16	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 7	Schiber	5,500	1704709-15240	John Powell
17	Non-Hazardous Leachate for Rockford IPC	Advanced Waste - Rockford IPC	Tank Battery 6	Wayne Transports	6,100	011449911 JJK	John Powell
18	Non-Hazardous Leachate for Rockford IPC	Advanced Waste - Rockford IPC	Tank Battery 6	Wayne Transports	6,000	011449912 JJK	John Powell
19	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	MBI	7,500	086743	John Powell
20	Non-Hazardous Leachate	Advanced Waste - Kankakee Metro	Sparge 1	Turn Key	5,500	011449802 JJK	John Powell
21	Non-Hazardous Leachate for Rockford IPC	Advanced Waste - Rockford IPC	Tank Battery 6	Wayne Transports	6,000	011449913 JJK	John Powell
22	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	MBI	7,700	086744	John Powell
23	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Tank Battery 5	Wetterau Homestead	5,200	AWS 77724	John Powell
24	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Tank Battery 5	K&R	6,000	AWS 77725	John Powell
25	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	MBI	7,500	086745	John Powell
26	Non-Hazardous Leachate	Advanced Waste - Kankakee Metro	Tank Battery 5	Turn Key	6,000	011449803 JJK	John Powell
27	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	MBI	7,700	086746	John Powell
28	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Tank Battery 5	KRD Trucking	6,000	011449685 JJK	John Powell
29	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 2	MBI	7,500	086747	John Powell
30	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Tank Battery 5	KRD Trucking	6,200	011449686 JJK	John Powell
31	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 2	MBI	7,700	086748	John Powell
32	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 2	MBI	7,500	086749	John Powell
33	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Tank Battery 5	Coal City Cob	5,600	AWS 77726	John Powell
34	Non-Hazardous Leachate	Advanced Waste - Chemworks	Tank Battery 5	Coal City Cob	5,400	AWS 77727	John Powell

Load ID	Waste	Disposal Facility	Source	Transporter	Qty (gal)	Manifest No.	Clerk
35	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 2	MBI	7,700	086750	John Powell
36	Non-Hazardous Leachate	Advanced Waste - Chemworks	Tank Battery 5	TDR Transport	5,200	AWS 77728	John Powell
37	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Tank Battery 5	Coal City Cob	5,600	AWS 77729	John Powell
38	Non-Hazardous Leachate	Advanced Waste - Chemworks	Tank Battery 5	Coal City Cob	5,600	AWS 77730	John Powell
39					**256,202**		

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0	Non-Hazardous Leachate for MSD	MSD - Missouri River	AST	MSD Direct Discharge	14,784	2013-06-11	
1	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Tank Battery 5	Coal City Cob	6,000	011449687 JJK	John Powell
2	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 2	MBI	7,500	086752	John Powell
3	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Tank Battery 5	Coal City Cob	6,000	011449688 JJK	John Powell
4	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 2	MBI	7,700	086753	John Powell
5	Non-Hazardous Leachate	Advanced Waste - Cedar Rapids	Tank Battery 5	Sully	6,000	AWS 77085	John Powell
6	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 7	Schiber	5,400	1704710-15240	John Powell
7	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 2	SET Environmental	5,500	086764	John Powell
8	Non-Hazardous Leachate for Rockford IPC	Advanced Waste - Rockford IPC	Tank Battery 6	Wayne Transports	6,000	011449915 JJK	John Powell
9	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 7	Neier	5,500	1704715-15240	John Powell
10	Non-Hazardous Leachate for Rockford IPC	Advanced Waste - Rockford IPC	Tank Battery 6	Wayne Transports	6,100	011449916 JJK	John Powell
11	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 3	MBI	7,500	086754	John Powell
12	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 3	MBI	7,700	086755	John Powell
13	Non-Hazardous Leachate for Rockford IPC	Advanced Waste - Rockford IPC	Tank Battery 6	Wayne Transports	6,000	011449918 JJK	John Powell
14	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Sparge 1	Transwood Inc	5,500	011449689 JJK	John Powell
15	Non-Hazardous Leachate	Advanced Waste - Cedar Rapids	Sparge 1	Transwood Inc	5,500	AWS 77086	John Powell
16	Non-Hazardous Leachate	Advanced Waste - Cedar Rapids	Sparge 1	Sully	6,000	AWS 77087	John Powell

Load ID	Waste	Disposal Facility	Source	Transporter	Qty (gal)	Manifest No.	Clerk
17	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 3	MBI	7,500	086756	John Powell
18	Non-Hazardous Leachate	Advanced Waste - Chemworks	Sparge 1	TDR Transport	5,200	AWS 77731	John Powell
19	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Sparge 1	Ziron Environmental	5,000	011449690 JJK	John Powell
20	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Sparge 1	Ziron Environmental	5,000	011449691 JJK	John Powell
21	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 3	MBI	7,700	086757	John Powell
22	Non-Hazardous Leachate for Rockford IPC	Advanced Waste - Rockford IPC	Tank Battery 6	Wayne Transports	6,000	011449919 JJK	John Powell
23	Non-Hazardous Leachate	Advanced Waste - Kankakee Metro	Sparge 1	Turn Key	5,500	011449804 JJK	John Powell
24	Non-Hazardous Leachate	Advanced Waste - Chemworks	Sparge 1	Coal City Cob	5,500	AWS 77732	John Powell
25	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Sparge 1	Transwood Inc	5,500	011449692 JJK	John Powell
26	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 7	Neier	6,000	1704716-15240	John Powell
27	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Sparge 1	K&R	6,000	AWS 77733	John Powell
28	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Sparge 1	KRD Trucking	6,000	011449693 JJK	John Powell
29	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 3	MBI	7,500	086758	John Powell
30	Non-Hazardous Leachate	Advanced Waste - Kankakee Metro	Sparge 1	Turn Key	5,500	011449805 JJK	John Powell
31	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 3	MBI	7,700	086759	John Powell
32	Non-Hazardous Leachate	Advanced Waste - Kankakee Metro	Sparge 1	Turn Key	6,000	011449806 JJK	John Powell
33	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Sparge 2	K&R	6,100	AWS 77735	John Powell
34	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Sparge 2	Transwood Inc	5,500	011449694 JJK	John Powell
35	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Sparge 2	KRD Trucking	6,000	011449695 JJK	John Powell
36	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 7	Mid America Waste Solutions	5,200	1704794-15240	John Powell
37	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 3	MBI	7,500	086760	John Powell
38	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 7	Neier	5,500	1704717-15240	John Powell
39	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Sparge 2	KRD Trucking	6,200	011449696 JJK	John Powell
40	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 3	MBI	7,700	086761	John Powell
CANCEI	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Sparge 2	Coal City Cob	0	AWS 77736	John Powell

Load ID	Waste	Disposal Facility	Source	Transporter	Qty (gal)	Manifest No.	Clerk
42	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 7	Neier	6,000	1704718-15240	John Powell
43	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 7	Neier	5,000	1704719-15240	John Powell
44	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Sparge 2	KRD Trucking	5,000	011449697 JJK	John Powell
45	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 3	MBI	7,500	086762	John Powell
46	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 4	MBI	7,700	086763	John Powell
47	Non-Hazardous Leachate	Advanced Waste - Chemworks	Sparge 2	TDR Transport	5,200	AWS 77737	John Powell
48	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Sparge 2	Coal City Cob	5,600	AWS 77738	John Powell
49					**303,984**		

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1	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	MBI	7,500	086765	John Powell
2	Non-Hazardous Leachate for Rockford IPC	Advanced Waste - Rockford IPC	Tank Battery 6	Wayne Transports	6,000	011449920 JJK	John Powell
3	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	MBI	7,700	086766	John Powell
4	Non-Hazardous Leachate	Advanced Waste - Cedar Rapids	Tank Battery 5	Sully	6,000	AWS 77088	John Powell
5	Non-Hazardous Leachate	Advanced Waste - Cedar Rapids	Tank Battery 5	Sully	6,000	AWS 77089	John Powell
6	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 7	Schiber	5,000	1704711-15240	John Powell
7	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Tank Battery 5	Ziron Environmental	5,500	011449698 JJK	John Powell
8	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	SET Environmental	5,600	086777	John Powell
9	Non-Hazardous Leachate	Advanced Waste - Chemworks	Tank Battery 5	Coal City Cob	6,000	AWS 77739	John Powell
10	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	MBI	7,500	086767	John Powell
11	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Tank Battery 5	Ziron Environmental	5,000	011449699 JJK	John Powell
12	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	MBI	7,700	086768	John Powell
13	Non-Hazardous Leachate	Advanced Waste - Kankakee Metro	Tank Battery 5	Turn Key	5,500	011449807 JJK	John Powell
14	Non-Hazardous Leachate for Rockford IPC	Advanced Waste - Rockford IPC	Tank Battery 6	Wayne Transports	6,100	011449922 JJK	John Powell

Load ID	Waste	Disposal Facility	Source	Transporter	Qty (gal)	Manifest No.	Clerk
15	Non-Hazardous Leachate for Rockford IPC	Advanced Waste - Rockford IPC	Tank Battery 6	Wayne Transports	6,000	011449921 JJK	John Powell
16	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 7	Neier	5,500	1704721-15240	John Powell
17	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 7	Neier	5,000	1704722-15240	John Powell
18	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	MBI	7,500	086769	John Powell
19	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 7	Neier	6,000	1704723-15240	John Powell
20	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 7	Mid America Waste Solutions	5,200	1704795-15240	John Powell
21	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Tank Battery 5	Transwood Inc	5,500	011449700 JJK	John Powell
22	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	MBI	7,700	086770	John Powell
23	Non-Hazardous Leachate	Heritage - Covanta Tulsa	Tank Battery 7	Triad Transport	4,800	1702262-16209	John Powell
24	Non-Hazardous Leachate	Advanced Waste - Kankakee Metro	Tank Battery 5	Turn Key	6,000	011449808 JJK	John Powell
25	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Tank Battery 5	K&R	6,000	AWS 77740	John Powell
26	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 2	MBI	7,500	086771	John Powell
27	Non-Hazardous Leachate	Advanced Waste - Kankakee Metro	Tank Battery 5	Turn Key	6,000	011449809 JJK	John Powell
28	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 2	MBI	7,700	086772	John Powell
29	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Tank Battery 5	Coal City Cob	5,600	AWS 77742	John Powell
30	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Tank Battery 5	K&R	6,000	AWS 77741	John Powell
31	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 2	MBI	7,500	086773	John Powell
32	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Tank Battery 5	KRD Trucking	6,000	011449701 JJK	John Powell
33	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Tank Battery 6	Wetterau Homestead	5,200	AWS 77743	John Powell
34	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 2	MBI	7,700	086774	John Powell
35	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Sparge 1	KRD Trucking	6,200	011458038 JJK	John Powell
36	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Sparge 1	Coal City Cob	5,400	AWS 77744	John Powell
37	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Sparge 1	KRD Trucking	6,000	011458039 JJK	John Powell
38	Non-Hazardous Leachate	Advanced Waste - Chemworks	Sparge 1	Coal City Cob	6,000	AWS 77745	John Powell
39	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 2	MBI	7,500	086775	John Powell

Load ID	Waste	Disposal Facility	Source	Transporter	Qty (gal)	Manifest No.	Clerk
40	Non-Hazardous Leachate	Heritage - Covanta Tulsa	Tank Battery 8	Triad Transport	5,000	1702263-16209	John Powell
41	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 8	Neier	5,000	1704724-15240	John Powell
42	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 8	Neier	5,500	1704725-15240	John Powell
43	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 2	MBI	7,700	086776	John Powell
44	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 8	Neier	5,200	1704726-15240	John Powell
45	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Sparge 1	Transwood Inc	5,500	011458040 JJK	John Powell
46	Non-Hazardous Leachate	Advanced Waste - Chemworks	Sparge 1	Wayne Transports	6,000	AWS 77746	John Powell
47	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 8	Neier	5,500	1704727-15240	John Powell
48	Non-Hazardous Leachate	Advanced Waste - Chemworks	Sparge 1	TDR Transport	5,200	AWS 77747	John Powell
49	Non-Hazardous Leachate	Advanced Waste - Chemworks	Sparge 1	TDR Transport	5,200	AWS 77748	John Powell
49					**298,400**		

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1	Non-Hazardous Leachate	Advanced Waste - Chemworks	Tank Battery 6	Wayne Transports	6,000	AWS 77749	Emily Heikes
2	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 3	MBI	7,500	086778	Emily Heikes
3	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Tank Battery 6	Transwood Inc	5,500	011458041	Emily Heikes
4	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 3	MBI	7,700	086779	Emily Heikes
5	Non-Hazardous Leachate	Advanced Waste - Cedar Rapids	Tank Battery 6	Sully	6,000	AWS 77090	Emily Heikes
6	Non-Hazardous Leachate	Advanced Waste - Chemworks	Tank Battery 6	Coal City Cob	6,000	AWS 77750	Emily Heikes
7	Non-Hazardous Leachate	Advanced Waste - Cedar Rapids	Tank Battery 6	Sully	6,000	AWS 77091	Emily Heikes
8	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 3	SET Environmental	5,600	086780	Emily Heikes
9	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Tank Battery 6	Ziron Environmental	5,500	011458042	Emily Heikes
10	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 8	Schiber	5,000	1704712-15240	Emily Heikes
11	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Tank Battery 6	Ziron Environmental	5,000	011458043	Emily Heikes
12	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 3	MBI	7,500	086781	Emily Heikes

Load ID	Waste	Disposal Facility	Source	Transporter	Qty (gal)	Manifest No.	Clerk
13	Non-Hazardous Leachate	Advanced Waste - Kankakee Metro	Tank Battery 6	Turn Key	5,500	011449810	Emily Heikes
14	Non-Hazardous Leachate	Advanced Waste - Chemworks	Tank Battery 6	Wayne Transports	6,000	AWS 77752	Emily Heikes
15	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 3	MBI	7,700	086782	Emily Heikes
16	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 8	Mid America Waste Solutions	5,000	1704796-15240	Emily Heikes
17	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Tank Battery 6	Transwood Inc	5,500	011458044	Emily Heikes
18	Non-Hazardous Leachate	Advanced Waste - Chemworks	Tank Battery 6	Wayne Transports	6,000	AWS 77753	Emily Heikes
19	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 8	Neier	6,000	1704728-15240	Emily Heikes
20	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 4	MBI	7,500	086783	Emily Heikes
21	Non-Hazardous Leachate	Advanced Waste - Kankakee Metro	Tank Battery 6	Turn Key	6,000	011449816	Emily Heikes
22	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 4	MBI	7,700	086784	Emily Heikes
23	Non-Hazardous Leachate	Advanced Waste - Kankakee Metro	Tank Battery 6	Turn Key	6,000	011449817	Emily Heikes
24	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 8	Neier	5,000	1704729-15240	Emily Heikes
25	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Tank Battery 5	K&R	6,100	AWS 77754	Emily Heikes
26	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 8	Neier	5,000	1704730-15240	Emily Heikes
27	Non-Hazardous Leachate	Heritage - Covanta Tulsa	Tank Battery 8	Triad Transport	4,800	1702264-16209	Emily Heikes
28	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Tank Battery 5	K&R	6,000	AWS 77755	Emily Heikes
29	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Tank Battery 5	KRD Trucking	6,000	011458045	Emily Heikes
30	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 4	MBI	7,500	086785	Emily Heikes
31	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 8	Neier	5,500	1704731-15240	Emily Heikes
32	Non-Hazardous Leachate	Advanced Waste - Chemworks	Sparge 1	Coal City Cob	6,000	AWS 77756	Emily Heikes
33	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Sparge 1	Coal City Cob	5,600	AWS 77765	Emily Heikes
34	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 4	MBI	7,700	086786	Emily Heikes
35	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Sparge 1	Coal City Cob	5,600	AWS 77757	Emily Heikes
36	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Sparge 1	KRD Trucking	6,000	011458046	Emily Heikes
37	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Sparge 1	KRD Trucking	6,000	011458047	Emily Heikes

Load ID	Waste	Disposal Facility	Source	Transporter	Qty (gal)	Manifest No.	Clerk
38	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 3	MBI	7,500	086787	Emily Heikes
39	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 4	MBI	7,700	086788	Emily Heikes
40	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Sparge 1	KRD Trucking	6,200	011458048	Emily Heikes
41	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Sparge 1	KRD Trucking	6,000	011458049	Emily Heikes
42	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 4	MBI	7,500	086789	Emily Heikes
43	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Sparge 1	Wetterau Homestead	5,500	AWS 77764	Emily Heikes
44	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 4	MBI	7,700	086895	Emily Heikes
45	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 7	Neier	5,600	1704732-15240	Emily Heikes
46	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 7	Neier	5,200	1704733-15240	Emily Heikes
47	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 8	Neier	5,000	1704734-15240	Emily Heikes
48	Non-Hazardous Leachate	Advanced Waste - Chemworks	Sparge 1	Coal City Cob	6,000	AWS 77763	Emily Heikes
49	Non-Hazardous Leachate	Advanced Waste - Chemworks	Sparge 1	TDR Transport	5,200	AWS 77758	Emily Heikes
50	Non-Hazardous Leachate	Advanced Waste - Chemworks	Sparge 1	TDR Transport	5,200	AWS 77759	Emily Heikes
50					**305,300**		

Loading Date 6/14/2013

0	Non-Hazardous Leachate for MSD	MSD - Missouri River	AST	MSD Direct Discharge	13,658	2013-06-14	
1	Non-Hazardous Leachate	Advanced Waste - Cedar Rapids	Tank Battery 6	Sully	6,000	AWS 77092	Emily Heikes
2	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	MBI	7,500	086896	Emily Heikes
3	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 7	Mid America Waste Solutions	5,000	1704797-15240	Emily Heikes
4	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Tank Battery 6	Transwood Inc	5,500	011458050	Emily Heikes
5	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	MBI	7,700	086897	Emily Heikes
6	Non-Hazardous Leachate	Heritage - Covanta Tulsa	Tank Battery 7	Triad Transport	5,000	1702265-16209	Emily Heikes
7	Non-Hazardous Leachate	Advanced Waste - Cedar Rapids	Tank Battery 6	Sully	6,000	AWS 77093	Emily Heikes
8	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Tank Battery 6	Ziron Environmental	5,500	011458055	Emily Heikes

Load ID	Waste	Disposal Facility	Source	Transporter	Qty (gal)	Manifest No.	Clerk
9	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 7	Schiber	5,000	1704713-15240	Emily Heikes
10	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Tank Battery 6	Ziron Environmental	5,500	011458051	Emily Heikes
11	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Tank Battery 6	Coal City Cob	5,600	AWS 77760	Emily Heikes
12	Non-Hazardous Leachate	Advanced Waste - Kankakee Metro	Tank Battery 6	Turn Key	5,500	011449818	Emily Heikes
13	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	MBI	7,500	086898	Emily Heikes
14	Non-Hazardous Leachate	Advanced Waste - New Castle	Tank Battery 6	Kuhnle Bros	4,800	AWS 77340	Emily Heikes
15	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	MBI	7,700	086899	Emily Heikes
16	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Tank Battery 6	Coal City Cob	6,000	AWS 77761	Emily Heikes
17	Non-Hazardous Leachate	Advanced Waste - Cedar Rapids	Tank Battery 6	Transwood Inc	5,400	AWS 77094	Emily Heikes
18	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 7	Neier	5,000	1704736-15240	Emily Heikes
19	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	MBI	7,500	086900	Emily Heikes
20	Non-Hazardous Leachate	Advanced Waste - Chemworks	Tank Battery 6	Wayne Transports	6,000	AWS 77762	Emily Heikes
21	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 7	Neier	6,000	1704737-15240	Emily Heikes
22	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	MBI	7,700	086901	Emily Heikes
23	Non-Hazardous Leachate	Advanced Waste - Kankakee Metro	Tank Battery 6	Turn Key	6,000	011449819	Emily Heikes
24	Non-Hazardous Leachate	Advanced Waste - Kankakee Metro	Tank Battery 5	Turn Key	6,000	011449820	Emily Heikes
25	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	MBI	7,500	086902	Emily Heikes
26	Non-Hazardous Leachate	Advanced Waste - Cedar Rapids	Tank Battery 5	Transwood Inc	5,600	AWS 77095	Emily Heikes
27	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Sparge 1	Coal City Cob	5,400	AWS 77766	Emily Heikes
28	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	MBI	7,700	086903	Emily Heikes
29	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 7	Neier	5,500	1704738-15240	Emily Heikes
30	Non-Hazardous Leachate	Advanced Waste - New Castle	Sparge 1	Kuhnle Bros	5,200	AWS 77342	Emily Heikes
31	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 7	Neier	5,500	1704739-15240	Emily Heikes
32	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Tank Battery 1	Coal City Cob	6,000	AWS 77767	Emily Heikes
33	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 2	MBI	7,500	086904	Emily Heikes

Load ID	Waste	Disposal Facility	Source	Transporter	Qty (gal)	Manifest No.	Clerk
34	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Tank Battery 2	KRD Trucking	6,000	011458052	Emily Heikes
35	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Sparge 1	K&R	6,100	AWS 77768	Emily Heikes
36	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 2	MBI	7,700	086905	Emily Heikes
37	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Sparge 1	Coal City Cob	5,600	AWS 77769	Emily Heikes
38	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 7	Neier	5,200	1704740-15240	Emily Heikes
39	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Sparge 1	K&R	6,000	AWS 77770	Emily Heikes
40	Non-Hazardous Leachate	Advanced Waste - Cedar Rapids	Sparge 1	Transwood Inc	5,600	AWS 77096	Emily Heikes
41	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 7	Neier	5,000	1704741-15240	Emily Heikes
42	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 2	MBI	7,500	086906	Emily Heikes
43	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Sparge 1	KRD Trucking	6,000	011458053	Emily Heikes
44	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Tank Battery 2	KRD Trucking	6,200	011458054	Emily Heikes
45	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 2	MBI	7,700	086907	Emily Heikes
46	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Tank Battery 2	Coal City Cob	5,600	AWS 77771	Emily Heikes
47	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 3	MBI	7,500	086908	Emily Heikes
48	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 7	Neier	5,000	1705035-15240	Emily Heikes
49	Non-Hazardous Leachate	Advanced Waste - Chemworks	Sparge 1	TDR Transport	5,200	AWS 77772	Emily Heikes
50	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Sparge 1	KRD Trucking	6,000	011458057	Emily Heikes
51					**318,858**		

Loading Date 6/15/2013

0	Non-Hazardous Leachate for MSD	MSD - Missouri River	AST	MSD Direct Discharge	17,702	2013-06-15	
1	Non-Hazardous Leachate	Advanced Waste - Cedar Rapids	Sparge 1	Sully	5,800	AWS 77101	Emily Heikes
2	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 3	MBI	7,500	086909	Emily Heikes
3	Non-Hazardous Leachate	Advanced Waste - Cedar Rapids	Sparge 1	Sully	6,000	AWS 77097	Emily Heikes
4	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 8	Schiber	5,400	1704714-15240	Emily Heikes

Load ID	Waste	Disposal Facility	Source	Transporter	Qty (gal)	Manifest No.	Clerk
5	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 3	MBI	7,700	086910	Emily Heikes
6	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 8	Mid America Waste Solutions	5,000	1704798-15240	Emily Heikes
7	Non-Hazardous Leachate	Advanced Waste - Chemworks	Sparge 1	TDR Transport	5,200	AWS 77773	Emily Heikes
8	Non-Hazardous Leachate	Advanced Waste - Kankakee Metro	Sparge 2	Turn Key	5,500	011449821	Emily Heikes
9	Non-Hazardous Leachate	Heritage - Covanta Tulsa	Tank Battery 8	Triad Transport	4,900	1702266-16209	Emily Heikes
10	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Sparge 2	Transwood Inc	5,500	011458033	Emily Heikes
11	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 8	Heritage Transport	6,500	1705028-15240	Emily Heikes
12	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 8	SET Environmental	5,350	1705042-15240	Emily Heikes
13	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Sparge 2	Coal City Cob	6,000	AWS 77774	Emily Heikes
14	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 8	SET Environmental	5,500	1705043-15240	Emily Heikes
15	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 3	MBI	7,500	086911	Emily Heikes
16	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 3	MBI	7,700	086912	Emily Heikes
17	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 8	Neier	6,000	1705036-15240	Emily Heikes
18	Non-Hazardous Leachate	Advanced Waste - Kankakee Metro	Sparge 2	Turn Key	5,500	011449822	Emily Heikes
19	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 3	MBI	7,500	086913	Emily Heikes
20	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 8	Neier	5,500	1705037-15240	Emily Heikes
21	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 3	MBI	7,700	086914	Emily Heikes
22	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 8	Triad Transport	5,000	1705177-15240	Emily Heikes
23	Non-Hazardous Leachate	Advanced Waste - Kankakee Metro	Sparge 2	Turn Key	6,000	011449823	Emily Heikes
24	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 8	Neier	5,000	1705038-15240	Emily Heikes
25	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Sparge 2	KRD Trucking	6,000	011458058	Emily Heikes
26	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 8	Neier	5,200	1705173-15240	Emily Heikes
27	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Sparge 2	Neier	6,000	1705174-15240	Emily Heikes
28	Non-Hazardous Leachate	Advanced Waste - Chemworks	Sparge 2	Coal City Cob	6,000	AWS 77775	Emily Heikes
29	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 8	Neier	5,200	1705175-15240	Emily Heikes

Load ID	Waste	Disposal Facility	Source	Transporter	Qty (gal)	Manifest No.	Clerk
30	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Sparge 2	K&R	6,100	AWS 77776	Emily Heikes
31	Non-Hazardous Leachate	Advanced Waste - Chemworks	Sparge 2	Coal City Cob	6,000	AWS 77777	Emily Heikes
32					**203,452**		

Loading Date 6/16/2013

0	Non-Hazardous Leachate for MSD	MSD - Missouri River	Tank AST 97k	MSD Direct Discharge	19,007	2013-06-16	
1	Non-Hazardous Leachate	Advanced Waste - Cedar Rapids	Sparge 2	Sully	6,000	AWS 77098	John Powell
2	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Sparge 2	K&R	6,000	AWS 77779	John Powell
3	Non-Hazardous Leachate	Advanced Waste - Cedar Rapids	Sparge 2	Sully	5,800	AWS 77099	John Powell
4	Non-Hazardous Leachate	Advanced Waste - Chemworks	Tank Battery 3	TDR Transport	5,200	AWS 77789	John Powell
5					**42,007**		

Loading Date 6/17/2013

0	Non-Hazardous Leachate for MSD	MSD - Missouri River	Tank AST 97k	MSD Direct Discharge	17,502	2013-06-17	
1	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Tank Battery 6	Ziron Environmental	5,500	011458034 JJK	John Powell
2	Non-Hazardous Leachate for Rockford IPC	Advanced Waste - Rockford IPC	Sparge 1	Wayne Transports	6,000	011449923 JJK	John Powell
3	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	MBI	7,500	086915	John Powell
4	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Tank Battery 6	Ziron Environmental	5,500	011458059 JJK	John Powell
5	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	MBI	7,700	086916	John Powell
6	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Tank Battery 6	Transwood Inc	5,500	011458060 JJK	John Powell
7	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	SET Environmental	5,700	086894	John Powell
8	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 7	Schiber	5,000	1705948-15240	John Powell
9	Non-Hazardous Leachate	Advanced Waste - Cedar Rapids	Tank Battery 6	Sully	6,000	AWS 77100	John Powell
10	Non-Hazardous Leachate	Advanced Waste - Cedar Rapids	Tank Battery 6	Transwood Inc	5,400	AWS 77102	John Powell
11	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Tank Battery 6	K&R	6,000	AWS 77778	John Powell

Load ID	Waste	Disposal Facility	Source	Transporter	Qty (gal)	Manifest No.	Clerk
12	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	MBI	7,500	086917	John Powell
13	Non-Hazardous Leachate	Advanced Waste - Cedar Rapids	Tank Battery 6	Sully	6,000	AWS 77103	John Powell
14	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	MBI	7,700	086918	John Powell
15	Non-Hazardous Leachate	Advanced Waste - Kankakee Metro	Tank Battery 6	Turn Key	5,500	011449824 JJK	John Powell
16	Non-Hazardous Leachate for Rockford IPC	Advanced Waste - Rockford IPC	Sparge 1	Wayne Transports	6,000	011449924 JJK	John Powell
17	Non-Hazardous Leachate	Advanced Waste - Chemworks	Tank Battery 6	Coal City Cob	6,000	AWS 77780	John Powell
18	Non-Hazardous Leachate	Advanced Waste - Chemworks	Tank Battery 6	Coal City Cob	5,400	AWS 77781	John Powell
19	Non-Hazardous Leachate for Rockford IPC	Advanced Waste - Rockford IPC	Sparge 1	Wayne Transports	6,000	011449925 JJK	John Powell
20	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	MBI	7,500	086919	John Powell
21	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	MBI	7,700	086920	John Powell
22	Non-Hazardous Leachate for Rockford IPC	Advanced Waste - Rockford IPC	Sparge 1	Wayne Transports	6,000	011449926 JJK	John Powell
23	Non-Hazardous Leachate	Advanced Waste - Kankakee Metro	Tank Battery 6	Turn Key	6,000	011449829 JJK	John Powell
24	Non-Hazardous Leachate	Advanced Waste - Kankakee Metro	Tank Battery 6	Turn Key	5,500	011449825 JJK	John Powell
25	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	MBI	7,500	086921	John Powell
26	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 7	Neier	5,000	1705961-15240	John Powell
27	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	MBI	7,700	086922	John Powell
28	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 7	Neier	6,000	1705962-15240	John Powell
29	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Tank Battery 5	KRD Trucking	6,000	011458061 JJK	John Powell
30	Non-Hazardous Leachate	Heritage - Covanta Tulsa	Tank Battery 7	Triad Transport	4,900	1702267-16209	John Powell
31	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Tank Battery 5	KRD Trucking	6,000	011458062 JJK	John Powell
32	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 2	MBI	7,500	086923	John Powell
33	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 2	MBI	7,700	086924	John Powell
34	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 2	MBI	7,500	086925	John Powell
35	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 2	MBI	7,700	086926	John Powell

Load ID	Waste	Disposal Facility	Source	Transporter	Qty (gal)	Manifest No.	Clerk
36	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Sparge 2	Coal City Cob	5,600	AWS 77783	John Powell
37	Non-Hazardous Leachate	Advanced Waste - Chemworks	Sparge 2	Coal City Cob	5,600	AWS 77784	John Powell
38	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Sparge 2	Coal City Cob	5,600	AWS 77786	John Powell
39	Non-Hazardous Leachate	Advanced Waste - Chemworks	Sparge 2	TDR Transport	5,200	AWS 77785	John Powell
40	Non-Hazardous Leachate	Advanced Waste - New Castle	Sparge 2	Kuhnle Bros	5,000	AWS 77343	John Powell
41	Non-Hazardous Leachate	Advanced Waste - Chemworks	Sparge 2	TDR Transport	5,200	AWS 77788	John Powell
42	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Sparge 2	K&R	6,000	AWS 77790	John Powell
43	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Sparge 2	Transwood Inc	5,500	011458063 JJK	John Powell
44	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Sparge 2	KRD Trucking	6,000	011458025 JJK	John Powell
45					**289,302**		

Loading Date 6/18/2013

0	Non-Hazardous Leachate for MSD	MSD - Missouri River	Tank AST 97k	MSD Direct Discharge	16,901	2013-06-18	
1	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 2	MBI	7,500	086927	John Powell
2	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 2	MBI	7,700	086928	John Powell
3	Non-Hazardous Leachate	Advanced Waste - Cedar Rapids	Sparge 2	Sully	6,000	AWS 77104	John Powell
4	Non-Hazardous Leachate for Rockford IPC	Advanced Waste - Rockford IPC	Tank Battery 6	Wayne Transports	6,000	011449927 JJK	John Powell
5	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Sparge 2	Ziron Environmental	5,500	011458026 JJK	John Powell
6	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Sparge 2	Coal City Cob	5,800	AWS 77787	John Powell
7	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 2	SET Environmental	5,500	086939	John Powell
8	Non-Hazardous Leachate	Advanced Waste - Cedar Rapids	Sparge 2	Sully	6,000	AWS 77105	John Powell
9	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 2	MBI	7,500	086929	John Powell
10	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 7	Schiber	5,600	1705949-15240	John Powell
11	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 2	MBI	7,700	086930	John Powell
12	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Tank Battery 6	Ziron Environmental	5,500	011458027 JJK	John Powell

Load ID	Waste	Disposal Facility	Source	Transporter	Qty (gal)	Manifest No.	Clerk
13	Non-Hazardous Leachate	Advanced Waste - Cedar Rapids	Tank Battery 6	Transwood Inc	5,400	AWS 77106	John Powell
14	Non-Hazardous Leachate	Heritage - Covanta Tulsa	Tank Battery 7	Triad Transport	5,000	1706841-16209	John Powell
15	Non-Hazardous Leachate for Rockford IPC	Advanced Waste - Rockford IPC	Tank Battery 6	Wayne Transports	6,000	011449928 JJK	John Powell
16	Non-Hazardous Leachate	Advanced Waste - Chemworks	Tank Battery 6	Coal City Cob	6,000	AWS 77792	John Powell
17	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 4	MBI	7,500	086931	John Powell
18	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 7	Neier	6,000	1705963-15240	John Powell
19	Non-Hazardous Leachate for Rockford IPC	Advanced Waste - Rockford IPC	Tank Battery 6	Wayne Transports	6,000	011449929 JJK	John Powell
20	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 4	MBI	7,700	086932	John Powell
21	Non-Hazardous Leachate for Rockford IPC	Advanced Waste - Rockford IPC	Tank Battery 6	Wayne Transports	6,000	011449930 JJK	John Powell
22	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 7	Neier	5,000	1705964-15240	John Powell
23	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 4	MBI	7,500	086933	John Powell
24	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 4	MBI	7,700	086934	John Powell
25	Non-Hazardous Leachate	Advanced Waste - Kankakee Metro	Tank Battery 6	Turn Key	5,500	011449826 JJK	John Powell
26	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Tank Battery 3	Transwood Inc	5,500	011458028 JJK	John Powell
27	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 4	MBI	7,500	086935	John Powell
28	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Tank Battery 3	K&R	6,000	AWS 77793	John Powell
29	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 4	MBI	7,700	086936	John Powell
30	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 7	Mid America Waste Solutions	5,200	1705955-15240	John Powell
31	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 4	MBI	7,500	086937	John Powell
32	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 7	Neier	6,000	1705965-15240	John Powell
33	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 4	MBI	7,700	086938	John Powell
34	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Tank Battery 3	KRD Trucking	6,000	011458029 JJK	John Powell
35	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Tank Battery 4	Stoffel	5,500	AWS 77794	John Powell
36	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 7	Neier	5,400	1705966-15240	John Powell

Load ID	Waste	Disposal Facility	Source	Transporter	Qty (gal)	Manifest No.	Clerk
37	Non-Hazardous Leachate	Advanced Waste - Chemworks	Tank AST 316k	Wayne Transports	6,100	AWS 77795	John Powell
38	Non-Hazardous Leachate	Advanced Waste - Kankakee Metro	Tank AST 316k	Turn Key	6,000	011449827 JJK	John Powell
39	Non-Hazardous Leachate	Advanced Waste - Chemworks	Tank AST 316k	Coal City Cob	5,400	AWS 77791	John Powell
40	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Tank AST 316k	KRD Trucking	6,000	011458030 JJK	John Powell
41	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Tank AST 316k	Coal City Cob	5,600	AWS 77797	John Powell
42	Non-Hazardous Leachate	Advanced Waste - Chemworks	Tank AST 316k	Coal City Cob	6,000	AWS 77798	John Powell
43	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Tank AST 316k	KRD Trucking	6,200	011458031 JJK	John Powell
44	Non-Hazardous Leachate	Advanced Waste - Chemworks	Tank AST 316k	Coal City Cob	5,600	AWS 77799	John Powell
45	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Tank AST 316k	KRD Trucking	6,000	011458032 JJK	John Powell
46	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Tank AST 316k	Transwood Inc	5,500	011458012 JJK	John Powell
47	Non-Hazardous Leachate	Advanced Waste - Chemworks	Tank AST 316k	TDR Transport	5,200	AWS 77796	John Powell
48	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Tank AST 316k	K&R	6,000	AWS 77800	John Powell
49	Non-Hazardous Leachate	Advanced Waste - Chemworks	Tank AST 316k	TDR Transport	5,200	AWS 77801	John Powell
50	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Tank AST 316k	KRD Trucking	6,000	011458013 JJK	John Powell
51					**325,301**		

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0	Non-Hazardous Leachate for MSD	MSD - Missouri River	Tank AST 97k	MSD Direct Discharge	18,103	2013-06-19	
1	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Tank AST 316k	Coal City Cob	5,600	AWS 77803	John Powell
2	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	MBI	7,500	086940	John Powell
3	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 7	Schiber	5,500	1705950-15240	John Powell
4	Non-Hazardous Leachate	Advanced Waste - Cedar Rapids	Tank AST 316k	Sully	6,000	AWS 77107	John Powell
5	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	MBI	7,700	086941	John Powell
6	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Tank AST 316k	Ziron Environmental	5,500	011458014 JJK	John Powell
7	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	SET Environmental	6,000	086952	John Powell

Load ID	Waste	Disposal Facility	Source	Transporter	Qty (gal)	Manifest No.	Clerk
8	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Tank AST 316k	Ziron Environmental	5,000	011458015 JJK	John Powell
9	Non-Hazardous Leachate for Rockford IPC	Advanced Waste - Rockford IPC	Tank Battery 1	Wayne Transports	6,000	011449931 JJK	John Powell
10	Non-Hazardous Leachate	Advanced Waste - Cedar Rapids	Tank AST 316k	Sully	6,000	AWS 77108	John Powell
11	Non-Hazardous Leachate	Advanced Waste - Chemworks	Tank AST 316k	Coal City Cob	5,600	AWS 77804	John Powell
12	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	MBI	7,500	086942	John Powell
13	Non-Hazardous Leachate	Advanced Waste - Cedar Rapids	Tank AST 316k	Transwood Inc	5,400	AWS 77109	John Powell
14	Non-Hazardous Leachate	Advanced Waste - New Castle	Tank AST 316k	Kuhnle Bros	5,000	AWS 77344	John Powell
15	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	MBI	7,700	086943	John Powell
16	Non-Hazardous Leachate	Heritage - Covanta Tulsa	Tank Battery 7	Triad Transport	4,800	1706843-16209	John Powell
17	Non-Hazardous Leachate	Advanced Waste - Kankakee Metro	Tank AST 316k	Turn Key	5,500	011449828 JJK	John Powell
18	Non-Hazardous Leachate	Advanced Waste - Chemworks	Tank AST 316k	Wayne Transports	6,000	AWS 77805	John Powell
19	Non-Hazardous Leachate	Advanced Waste - Chemworks	Tank AST 316k	Wayne Transports	6,000	AWS 77802	John Powell
20	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 8	Neier	6,000	1705967-15240	John Powell
21	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	MBI	7,500	086944	John Powell
22	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 8	Neier	5,000	1705968-15240	John Powell
23	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	MBI	7,700	086945	John Powell
24	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Tank AST 316k	Coal City Cob	5,600	AWS 77807	John Powell
25	Non-Hazardous Leachate	Advanced Waste - Cedar Rapids	Tank AST 316k	Transwood Inc	5,600	AWS 77110	John Powell
26	Non-Hazardous Leachate	Advanced Waste - Kankakee Metro	Tank AST 316k	Turn Key	6,000	011449831 JJK	John Powell
27	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 8	Mid America Waste Solutions	5,000	1705956-15240	John Powell
28	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Tank AST 316k	Transwood Inc	5,500	011458016 JJK	John Powell
29	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	MBI	7,500	086946	John Powell
30	Non-Hazardous Leachate	Advanced Waste - Chemworks	Tank AST 316k	Wayne Transports	6,000	AWS 77806	John Powell
31	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 2	MBI	7,700	086947	John Powell
32	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Tank AST 316k	K&R	5,700	AWS 77906	John Powell

Load ID	Waste	Disposal Facility	Source	Transporter	Qty (gal)	Manifest No.	Clerk
33	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 2	MBI	7,500	086948	John Powell
34	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Tank AST 316k	KRD Trucking	6,000	011458017 JJK	John Powell
35	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 2	MBI	7,700	086949	John Powell
36	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Tank AST 316k	KRD Trucking	6,200	011458018 JJK	John Powell
37	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Tank AST 316k	Transwood Inc	5,600	011458019 JJK	John Powell
38	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 8	Neier	5,200	1705969-15240	John Powell
39	Non-Hazardous Leachate	Advanced Waste - Chemworks	Tank AST 316k	Coal City Cob	6,000	AWS 77907	John Powell
40	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 8	Neier	5,200	1705970-15240	John Powell
41	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 8	Neier	5,000	1705972-15240	John Powell
42	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 2	MBI	7,500	086950	John Powell
43	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 8	Neier	4,500	1705971-15240	John Powell
44	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Tank AST 316k	Coal City Cob	5,600	AWS 77808	John Powell
45	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Sparge 1	Transwood Inc	5,500	011458020 JJK	John Powell
46	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Sparge 1	K&R	6,100	AWS 77908	John Powell
47	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 2	MBI	7,700	086951	John Powell
48	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 8	Neier	5,400	1705973-15240	John Powell
49	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Sparge 1	KRD Trucking	6,000	011458021 JJK	John Powell
50	Non-Hazardous Leachate	Advanced Waste - Chemworks	Sparge 1	TDR Transport	5,200	AWS 77909	John Powell
51	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Sparge 1	KRD Trucking	6,000	011458022 JJK	John Powell
52					**327,103**		

Loading Date 6/20/2013

0	Non-Hazardous Leachate for MSD	MSD - Missouri River	Tank AST 97k	MSD Direct Discharge	17,502	2013-06-20	
1	Non-Hazardous Leachate	Advanced Waste - Chemworks	Sparge 1	TDR Transport	5,200	AWS 77910	Emily Heikes
2	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 3	MBI	7,500	086953	Emily Heikes

Load ID	Waste	Disposal Facility	Source	Transporter	Qty (gal)	Manifest No.	Clerk
3	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Sparge 1	Coal City Cob	5,600	AWS 77911	Emily Heikes
4	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 3	MBI	7,700	086954	Emily Heikes
5	Non-Hazardous Leachate	Advanced Waste - Chemworks	Sparge 1	Coal City Cob	6,000	AWS 77912	Emily Heikes
6	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 8	Schiber	5,500	1705951-15240	Emily Heikes
7	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Sparge 1	Ziron Environmental	5,500	011458002	Emily Heikes
8	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 3	SET Environmental	5,600	086955	Emily Heikes
9	Non-Hazardous Leachate for Rockford IPC	Advanced Waste - Rockford IPC	Tank Battery 3	Wayne Transports	6,000	011449932	Emily Heikes
10	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Sparge 1	Ziron Environmental	5,000	011458003	Emily Heikes
11	Non-Hazardous Leachate	Advanced Waste - Cedar Rapids	Sparge 1	Sully	6,000	AWS 77112	Emily Heikes
12	Non-Hazardous Leachate	Advanced Waste - Cedar Rapids	Sparge 2	Sully	6,000	AWS 77113	Emily Heikes
13	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 3	MBI	7,500	086956	Emily Heikes
14	Non-Hazardous Leachate	Heritage - Covanta Tulsa	Tank Battery 8	Triad Transport	4,800	1706844-16209	Emily Heikes
15	Non-Hazardous Leachate	Advanced Waste - Kankakee Metro	Sparge 2	Turn Key	5,500	011449833	Emily Heikes
16	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 3	MBI	7,700	086957	Emily Heikes
17	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 8	Neier	6,000	1705974-15240	Emily Heikes
18	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 8	Neier	5,000	1705975-15240	Emily Heikes
19	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 3	MBI	7,500	086958	Emily Heikes
20	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 8	Mid America Waste Solutions	5,000	1705957-15240	Emily Heikes
21	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 3	MBI	7,700	086959	Emily Heikes
22	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Sparge 2	Stoffel	5,500	AWS 77913	Emily Heikes
23	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Sparge 2	Coal City Cob	5,600	AWS 77914	Emily Heikes
24	Non-Hazardous Leachate	Advanced Waste - Kankakee Metro	Sparge 2	Turn Key	6,000	011449835	Emily Heikes
25	Non-Hazardous Leachate	Advanced Waste - Kankakee Metro	Sparge 2	Turn Key	5,500	011449836	Emily Heikes
26	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 3	MBI	7,500	086960	Emily Heikes
27	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 8	Neier	5,500	1705976-15240	Emily Heikes

Load ID	Waste	Disposal Facility	Source	Transporter	Qty (gal)	Manifest No.	Clerk
28	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Sparge 2	K&R	6,100	AWS 77915	Emily Heikes
29	Non-Hazardous Leachate	Advanced Waste - Chemworks	Sparge 2	Coal City Cob	5,600	AWS 77916	Emily Heikes
30	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 3	MBI	7,700	086961	Emily Heikes
31	Non-Hazardous Leachate	Advanced Waste - Chemworks	Sparge 2	Wayne Transports	6,100	AWS 77917	Emily Heikes
32	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Sparge 2	KRD Trucking	6,000	011458004	Emily Heikes
33	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Sparge 2	KRD Trucking	6,000	011458005	Emily Heikes
34	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 4	MBI	7,500	086962	Emily Heikes
35	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Sparge 2	KRD Trucking	6,000	011458006	Emily Heikes
36	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Sparge 2	KRD Trucking	6,200	011458007	Emily Heikes
37	Non-Hazardous Leachate	Heritage - Covanta Tulsa	Sparge 2	Triad Transport	4,600	1706845-16209	Emily Heikes
38	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 4	MBI	7,700	086963	Emily Heikes
39	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Tank AST 316k	Transwood Inc	5,500	011458008	Emily Heikes
40	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank AST 316k	Neier	5,000	1705977-15240	Emily Heikes
41	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 4	MBI	7,500	086964	Emily Heikes
42	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank AST 316k	Neier	5,400	1705978-15240	Emily Heikes
43	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank AST 316k	Neier	5,600	1705979-15240	Emily Heikes
44	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Tank AST 316k	K&R	6,100	AWS 77927	Emily Heikes
45	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Tank AST 316k	Transwood Inc	5,500	011458009	Emily Heikes
46	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 4	MBI	7,700	086965	Emily Heikes
47	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Tank AST 316k	Coal City Cob	5,600	AWS 77922	Emily Heikes
48	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank AST 316k	Neier	5,000	1705980-15240	Emily Heikes
49	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank AST 316k	Neier	5,000	1705981-15240	Emily Heikes
50	Non-Hazardous Leachate	Advanced Waste - Chemworks	Tank AST 316k	Coal City Cob	5,600	AWS 77921	Emily Heikes
51	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Tank AST 316k	KRD Trucking	6,000	011458345	Emily Heikes
52					**326,402**		

Load ID	Waste	Disposal Facility	Source	Transporter	Qty (gal)	Manifest No.	Clerk

Loading Date 6/21/2013

0	Non-Hazardous Leachate for MSD	MSD - Missouri River	Tank AST 97k	MSD Direct Discharge	800	2013-06-21	
1	Non-Hazardous Leachate	Advanced Waste - Chemworks	Tank AST 316k	TDR Transport	5,200	AWS 77919	Emily Heikes
2	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	MBI	7,500	086966	Emily Heikes
3	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Tank AST 316k	Coal City Cob	5,600	AWS 77920	Emily Heikes
4	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	MBI	7,700	086967	Emily Heikes
5	Non-Hazardous Leachate	Advanced Waste - Cedar Rapids	Tank AST 316k	Sully	6,000	AWS 77114	Emily Heikes
6	Non-Hazardous Leachate	Advanced Waste - Cedar Rapids	Tank AST 316k	Sully	6,000	AWS 77115	Emily Heikes
7	Non-Hazardous Leachate	Advanced Waste - Kankakee Metro	Tank AST 316k	Turn Key	5,500	011449839	Emily Heikes
8	Non-Hazardous Leachate	Advanced Waste - Cedar Rapids	Tank AST 316k	Transwood Inc	5,400	AWS 77116	Emily Heikes
9	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	MBI	7,500	086968	Emily Heikes
10	Non-Hazardous Leachate	Advanced Waste - Chemworks	Tank AST 316k	TDR Transport	5,200	AWS 77925	Emily Heikes
11	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	MBI	7,700	086969	Emily Heikes
12	Non-Hazardous Leachate	Advanced Waste - Chemworks	Tank AST 316k	Wayne Transports	6,000	AWS 77926	Emily Heikes
13	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	MBI	7,500	086970	Emily Heikes
14	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	MBI	7,700	086971	Emily Heikes
15	Non-Hazardous Leachate	Advanced Waste - Chemworks	Tank AST 316k	Wayne Transports	6,000	AWS 77928	Emily Heikes
16	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Tank AST 316k	Stoffel	5,500	AWS 77929	Emily Heikes
17	Non-Hazardous Leachate	Advanced Waste - Kankakee Metro	Tank AST 316k	Turn Key	6,000	011449840	Emily Heikes
18	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Tank AST 316k	Coal City Cob	5,600	AWS 77930	Emily Heikes
19	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 7	Schiber	5,600	1705952-15240	Emily Heikes
20	Non-Hazardous Leachate	Advanced Waste - Kankakee Metro	Tank AST 316k	Turn Key	5,500	011449841	Emily Heikes
21	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	MBI	7,500	086972	Emily Heikes
22	Non-Hazardous Leachate	Heritage - Covanta Tulsa	Tank Battery 7	Triad Transport	4,800	1706846-16209	Emily Heikes
23	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 7	Mid America Waste Solutions	5,000	1705958-15240	Emily Heikes

Load ID	Waste	Disposal Facility	Source	Transporter	Qty (gal)	Manifest No.	Clerk
24	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	MBI	7,700	086973	Emily Heikes
25	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 7	Neier	6,000	1705985-15240	Emily Heikes
26	Non-Hazardous Leachate	Advanced Waste - Chemworks	Tank AST 316k	Coal City Cob	5,600	AWS 77931	Emily Heikes
27	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 7	Neier	5,000	1705984-15240	Emily Heikes
28	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Tank AST 316k	KRD Trucking	6,000	011458346	Emily Heikes
29	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 7	Neier	5,500	1705983-15240	Emily Heikes
30	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 2	MBI	7,500	086974	Emily Heikes
31	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Tank AST 316k	KRD Trucking	6,200	011458347	Emily Heikes
32	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 2	MBI	7,700	086975	Emily Heikes
33	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 7	Neier	5,000	1705982-15240	Emily Heikes
34	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Tank AST 316k	K&R	6,100	AWS 77932	Emily Heikes
35	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Tank AST 316k	KRD Trucking	6,000	011458348	Emily Heikes
36	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 7	Neier	5,200	1705986-15240	Emily Heikes
37	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Tank AST 316k	Transwood Inc	5,500	011458349	Emily Heikes
38	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 2	MBI	7,500	086976	Emily Heikes
39	Non-Hazardous Leachate	Advanced Waste - Chemworks	Tank AST 316k	Coal City Cob	5,000	AWS 77933	Emily Heikes
40	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 2	MBI	7,700	086977	Emily Heikes
41	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 2	MBI	7,500	086978	Emily Heikes
42	Non-Hazardous Leachate	Advanced Waste - Chemworks	Tank AST 316k	Coal City Cob	5,600	AWS 77934	Emily Heikes
43	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Tank AST 316k	KRD Trucking	6,000	011458350	Emily Heikes
44	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Tank AST 316k	K&R	6,000	AWS 77935	Emily Heikes
45					**273,100**		

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1	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 7	SET Environmental	5,500	1709312-15240	Emily Heikes

Load ID	Waste	Disposal Facility	Source	Transporter	Qty (gal)	Manifest No.	Clerk
2	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Sparge 1	Schiber	5,000	1705953-15240	Emily Heikes
3	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 2	MBI	7,500	086979	Emily Heikes
4	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Sparge 1	Neier	5,000	1705988-15240	Emily Heikes
5	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 2	MBI	7,700	086980	Emily Heikes
6	Non-Hazardous Leachate	Advanced Waste - Cedar Rapids	Sparge 1	Sully	6,000	AWS 77117	Emily Heikes
7	Non-Hazardous Leachate	Heritage - Covanta Tulsa	Sparge 1	Triad Transport	5,000	1706849-16209	Emily Heikes
8	Non-Hazardous Leachate	Advanced Waste - Cedar Rapids	Sparge 1	Transwood Inc	5,000	AWS 77118	Emily Heikes
9	Non-Hazardous Leachate	Advanced Waste - Cedar Rapids	Sparge 1	Sully	5,800	AWS 77119	Emily Heikes
10	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Sparge 1	Neier	5,000	1705989-15240	Emily Heikes
11	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 3	MBI	7,500	086981	Emily Heikes
12	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Sparge 1	Neier	5,500	1705990-15240	Emily Heikes
13	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 3	MBI	7,700	086982	Emily Heikes
14	Non-Hazardous Leachate	Advanced Waste - Kankakee Metro	Sparge 1	Turn Key	6,000	011449842	Emily Heikes
15	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 7	SET Environmental	5,500	1709313-15240	Emily Heikes
16	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Sparge 1	Mid America Waste Solutions	5,000	1705959-15240	Emily Heikes
17	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Sparge 1	Transwood Inc	5,500	011458351	Emily Heikes
18	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 3	MBI	7,500	086984	Emily Heikes
19	Non-Hazardous Leachate	Advanced Waste - Chemworks	Sparge 1	TDR Transport	5,200	AWS 77936	Emily Heikes
20	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 3	MBI	7,700	086983	Emily Heikes
21	Non-Hazardous Leachate	Advanced Waste - Kankakee Metro	Sparge 2	Turn Key	5,500	011449843	Emily Heikes
22	Non-Hazardous Leachate	Advanced Waste - Kankakee Metro	Sparge 2	Turn Key	6,000	011449844	Emily Heikes
23	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Sparge 2	Neier	6,000	1705991-15240	Emily Heikes
24	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Sparge 2	Neier	5,400	1705992-15240	Emily Heikes
25	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Sparge 2	Neier	5,200	1705993-15240	Emily Heikes
26	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Sparge 2	K&R	6,100	AWS 77937	Emily Heikes

Load ID	Waste	Disposal Facility	Source	Transporter	Qty (gal)	Manifest No.	Clerk
26					**154,800**		

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1	Non-Hazardous Leachate	Heritage - Covanta Tulsa	Tank Battery 8	Triad Transport	5,000	1706851-16209	John Powell
2	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Sparge 2	K&R	6,000	AWS 77938	John Powell
3	Non-Hazardous Leachate	Advanced Waste - Cedar Rapids	Sparge 2	Sully	5,800	AWS 77120	John Powell
4	Non-Hazardous Leachate	Advanced Waste - Cedar Rapids	Sparge 2	Sully	6,000	AWS 77121	John Powell
5	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Tank Battery 3	K&R	5,700	AWS 77939	John Powell
5					**28,500**		

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1	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	MBI	7,500	086985	John Powell
2	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Tank Battery 6	Wetterau Homestead	5,200	AWS 77940	John Powell
3	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	MBI	7,700	086986	John Powell
4	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Tank Battery 6	Ziron Environmental	5,000	011458352 JJK	John Powell
5	Non-Hazardous Leachate	Advanced Waste - Cedar Rapids	Tank Battery 6	Sully	6,000	AWS 77122	John Powell
6	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	SET Environmental	5,900	086997	John Powell
7	Non-Hazardous Leachate	Advanced Waste - Cedar Rapids	Tank Battery 6	Sully	6,000	AWS 77123	John Powell
8	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 8	Schiber	5,800	1707986-15240	John Powell
9	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Tank Battery 6	Ziron Environmental	5,000	011458353 JJK	John Powell
10	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	MBI	7,500	086987	John Powell
11	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Tank Battery 2	Coal City Cob	5,600	AWS 77941	John Powell
12	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	MBI	7,700	086988	John Powell
13	Non-Hazardous Leachate	Advanced Waste - Kankakee Metro	Tank Battery 6	Turn Key	5,500	011449845 JJK	John Powell
14	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	MBI	7,500	086989	John Powell

Load ID	Waste	Disposal Facility	Source	Transporter	Qty (gal)	Manifest No.	Clerk
15	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 8	Mid America Waste Solutions	5,200	1707992-15240	John Powell
16	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	MBI	7,700	086990	John Powell
17	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 8	Neier	5,000	1707998-15240	John Powell
18	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	MBI	7,500	086991	John Powell
19	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	MBI	7,700	086992	John Powell
20	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 2	MBI	7,500	086993	John Powell
21	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 8	Neier	5,000	1707999-15240	John Powell
22	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Sparge 1	K&R	6,100	AWS 77942	John Powell
23	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 2	MBI	7,700	086994	John Powell
24	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 8	Neier	6,000	1708000-15240	John Powell
25	Non-Hazardous Leachate	Advanced Waste - Chemworks	Sparge 1	Coal City Cob	5,600	AWS 77945	John Powell
26	Non-Hazardous Leachate	Advanced Waste - Chemworks	Sparge 1	Wayne Transports	6,000	AWS 77943	John Powell
27	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 2	MBI	7,500	086995	John Powell
28	Non-Hazardous Leachate	Advanced Waste - Chemworks	Sparge 1	Wayne Transports	6,000	AWS 77946	John Powell
29	Non-Hazardous Leachate	Advanced Waste - Chemworks	Sparge 1	SET Environmental	5,500	AWS 77947	John Powell
30	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 2	MBI	7,700	086996	John Powell
31	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 8	Neier	5,500	1708001-15240	John Powell
32	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Sparge 1	Stoffel	5,500	AWS 77948	John Powell
33	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 8	Neier	5,000	1708002-15240	John Powell
34	Non-Hazardous Leachate	Advanced Waste - Chemworks	Sparge 1	Wayne Transports	6,000	AWS 77950	John Powell
35	Non-Hazardous Leachate	Advanced Waste - Chemworks	Sparge 1	Wayne Transports	6,000	AWS 77951	John Powell
36	Non-Hazardous Leachate	Advanced Waste - Kankakee Metro	Sparge 2	Turn Key	6,000	011449846 JJK	John Powell
37	Non-Hazardous Leachate	Advanced Waste - Kankakee Metro	Sparge 2	Turn Key	5,500	011449847 JJK	John Powell
38	Non-Hazardous Leachate	Advanced Waste - Chemworks	Sparge 2	Coal City Cob	5,600	AWS 77952	John Powell
39	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Sparge 2	KRD Trucking	6,000	011458354 JJK	John Powell

Load ID	Waste	Disposal Facility	Source	Transporter	Qty (gal)	Manifest No.	Clerk
40	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Sparge 2	KRD Trucking	6,000	011458355 JJK	John Powell
41	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Sparge 2	KRD Trucking	6,200	011458356 JJK	John Powell
42	Non-Hazardous Leachate	Advanced Waste - Chemworks	Sparge 2	TDR Transport	5,200	AWS 77949	John Powell
43	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Sparge 2	KRD Trucking	6,000	011458357 JJK	John Powell
44	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Sparge 2	K&R	6,100	AWS 77953	John Powell
45	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Sparge 2	Transwood Inc	5,500	011458358 JJK	John Powell
45					**277,700**		

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1	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 2	MBI	7,500	086998	John Powell
2	Non-Hazardous Leachate	Heritage - Covanta Tulsa	Tank Battery 7	Triad Transport	5,000	1708060-16209	John Powell
3	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 2	MBI	7,700	086999	John Powell
4	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Tank AST 316k	Coal City Cob	5,600	AWS 77954	John Powell
5	Non-Hazardous Leachate	Advanced Waste - Cedar Rapids	Tank AST 316k	Sully	6,000	AWS 77124	John Powell
6	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 7	Schiber	5,500	1707987-15240	John Powell
7	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 2	MBI	7,500	087000	John Powell
8	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Tank AST 316k	Ziron Environmental	5,000	011458359 JJK	John Powell
9	Non-Hazardous Leachate	Advanced Waste - Cedar Rapids	Tank AST 316k	Sully	6,000	AWS 77111	John Powell
10	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 3	MBI	7,700	087001	John Powell
11	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Tank AST 316k	Ziron Environmental	5,000	011458360 JJK	John Powell
12	Non-Hazardous Leachate	Advanced Waste - Chemworks	Tank AST 316k	Coal City Cob	5,600	AWS 77955	John Powell
13	Non-Hazardous Leachate	Advanced Waste - Chemworks	Tank AST 316k	TDR Transport	4,600	AWS 77957	John Powell
14	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Tank AST 316k	Transwood Inc	5,500	011458361 JJK	John Powell
15	Non-Hazardous Leachate	Advanced Waste - Kankakee Metro	Tank AST 316k	Turn Key	6,000	011449848 JJK	John Powell
16	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 3	MBI	7,500	087002	John Powell

Load ID	Waste	Disposal Facility	Source	Transporter	Qty (gal)	Manifest No.	Clerk
17	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 8	Mid America Waste Solutions	5,200	1707993-15240	John Powell
18	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Tank AST 316k	KRD Trucking	6,000	011458362 JJK	John Powell
19	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 8	Neier	5,000	1708005-15240	John Powell
20	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 3	MBI	7,700	087003	John Powell
21	Non-Hazardous Leachate	Advanced Waste - Kankakee Metro	Tank AST 316k	Turn Key	6,000	011449849 JJK	John Powell
22	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Tank AST 316k	Wetterau Homestead	5,000	AWS 77958	John Powell
23	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 8	Neier	6,000	1708006-15240	John Powell
24	Non-Hazardous Leachate	Advanced Waste - Chemworks	Tank AST 316k	Coal City Cob	5,600	AWS 77960	John Powell
25	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 3	MBI	7,500	087004	John Powell
26	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 3	MBI	7,700	087005	John Powell
27	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 8	Neier	5,000	1708007-15240	John Powell
28	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 7	Neier	5,200	1708008-15240	John Powell
29	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 3	MBI	7,500	087006	John Powell
30	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Tank AST 316k	K&R	6,100	AWS 77961	John Powell
31	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 3	MBI	7,700	087007	John Powell
32	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Tank AST 316k	KRD Trucking	6,200	011458363 JJK	John Powell
33	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 7	Neier	5,500	1708009-15240	John Powell
34	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Tank AST 316k	KRD Trucking	6,000	011458365 JJK	John Powell
35	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Tank AST 316k	Stoffel	5,500	AWS 77959	John Powell
36	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 4	MBI	7,500	087008	John Powell
37	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Tank AST 316k	Coal City Cob	5,500	AWS 77962	John Powell
38	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 7	Neier	5,000	1708010-15240	John Powell
39	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Tank AST 316k	Coal City Cob	5,600	AWS 77963	John Powell
40	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 4	MBI	7,700	087009	John Powell
41	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Tank AST 316k	Transwood Inc	5,500	011458367 JJK	John Powell

Load ID	Waste	Disposal Facility	Source	Transporter	Qty (gal)	Manifest No.	Clerk
42	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Tank AST 316k	KRD Trucking	6,000	011458366 JJK	John Powell
43	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 8	Neier	5,600	1708011-15240	John Powell
44	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 4	MBI	7,500	087010	John Powell
45	Non-Hazardous Leachate	Advanced Waste - Cedar Rapids	Tank AST 316k	Transwood Inc	5,300	AWS 77125	John Powell
46	Non-Hazardous Leachate	Advanced Waste - Chemworks	Tank AST 316k	TDR Transport	5,200	AWS 77965	John Powell
47	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Tank AST 316k	Wetterau Homestead	5,500	AWS 77966	John Powell
47					**286,000**		

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1	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Tank AST 316k	Coal City Cob	5,600	AWS 77967	John Powell
2	Non-Hazardous Leachate	Advanced Waste - Chemworks	Tank AST 316k	Wayne Transports	6,000	AWS 77968	John Powell
3	Non-Hazardous Leachate	Advanced Waste - Cedar Rapids	Tank AST 316k	Sully	6,000	AWS 77126	John Powell
4	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 4	MBI	7,500	087011	John Powell
5	Non-Hazardous Leachate	Advanced Waste - Chemworks	Tank AST 316k	Coal City Cob	5,000	AWS 77969	John Powell
6	Non-Hazardous Leachate	Advanced Waste - Cedar Rapids	Tank AST 316k	Sully	6,000	AWS 77127	John Powell
7	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 4	MBI	7,700	087012	John Powell
8	Non-Hazardous Leachate	Advanced Waste - Kankakee Metro	Tank AST 316k	Turn Key	5,500	011449850 JJK	John Powell
9	Non-Hazardous Leachate	Heritage - Covanta Tulsa	Tank Battery 7	Triad Transport	5,000	1708061-16209	John Powell
10	Non-Hazardous Leachate	Advanced Waste - New Castle	Tank AST 316k	Kuhnle Bros	5,000	AWS 77345	John Powell
11	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Tank AST 316k	Transwood Inc	5,500	011458368 JJK	John Powell
12	Non-Hazardous Leachate	Advanced Waste - Chemworks	Tank AST 316k	Wayne Transports	6,000	AWS 77970	John Powell
13	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 7	Schiber	5,400	1707988-15240	John Powell
14	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 4	MBI	7,500	087013	John Powell
15	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 4	MBI	7,700	087014	John Powell
16	Non-Hazardous Leachate	Advanced Waste - Chemworks	Tank AST 316k	Wayne Transports	6,000	AWS 77971	John Powell

Load ID	Waste	Disposal Facility	Source	Transporter	Qty (gal)	Manifest No.	Clerk
17	Non-Hazardous Leachate	Advanced Waste - Chemworks	Tank AST 316k	Wayne Transports	6,000	AWS 77972	John Powell
18	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 7	Neier	5,000	1708012-15240	John Powell
19	Non-Hazardous Leachate	Advanced Waste - Kankakee Metro	Tank AST 316k	Turn Key	6,000	011449851 JJK	John Powell
20	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	MBI	7,500	087015	John Powell
21	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 7	Neier	5,200	1708013-15240	John Powell
22	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Tank AST 316k	KRD Trucking	6,000	011458369 JJK	John Powell
23	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 7	Neier	6,000	1708014-15240	John Powell
24	Non-Hazardous Leachate	Advanced Waste - Kankakee Metro	Tank AST 316k	Turn Key	5,500	011449852 JJK	John Powell
25	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Tank AST 316k	K&R	6,100	AWS 77973	John Powell
26	Non-Hazardous Leachate	Advanced Waste - Chemworks	Tank AST 316k	Wayne Transports	6,000	AWS 77974	John Powell
27	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	MBI	7,700	087016	John Powell
28	Non-Hazardous Leachate	Advanced Waste - Chemworks	Tank AST 316k	Coal City Cob	5,500	AWS 77975	John Powell
29	Non-Hazardous Leachate	Advanced Waste - Chemworks	Tank AST 316k	TDR Transport	5,200	AWS 77976	John Powell
30	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	MBI	7,500	087017	John Powell
31	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Tank AST 316k	KRD Trucking	6,000	011458370 JJK	John Powell
32	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 7	Neier	5,500	1708015-15240	John Powell
33	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	MBI	7,700	087018	John Powell
34	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Tank AST 316k	KRD Trucking	6,200	011458371 JJK	John Powell
35	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Tank AST 316k	K&R	6,100	AWS 77977	John Powell
36	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	MBI	7,500	087019	John Powell
37	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 7	Neier	5,500	1708016-15240	John Powell
38	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Tank AST 316k	Transwood Inc	5,500	011458372 JJK	John Powell
39	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 7	Neier	5,000	1708017-15240	John Powell
40	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	MBI	7,700	087020	John Powell
41	Non-Hazardous Leachate	Advanced Waste - Chemworks	Tank AST 316k	TDR Transport	4,600	AWS 77978	John Powell

Load ID	Waste	Disposal Facility	Source	Transporter	Qty (gal)	Manifest No.	Clerk
42	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Tank AST 316k	KRD Trucking	6,000	011458373 JJK	John Powell
43	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 1	MBI	7,500	087021	John Powell
44	Non-Hazardous Leachate	Advanced Waste - Chemworks	Tank AST 316k	TDR Transport	5,200	AWS 77979	John Powell
45	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 7	Neier	5,600	1708018-15240	John Powell
46	Non-Hazardous Leachate	Advanced Waste - Cedar Rapids	Tank AST 316k	Sully	6,000	AWS 77128	John Powell
47	Non-Hazardous Leachate	Advanced Waste - Chemworks	Tank AST 316k	Coal City Cob	5,500	AWS 77964	John Powell
47					**285,700**		

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1	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 2	MBI	7,500	087023	Emily Heikes
2	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 2	MBI	7,700	087024	Emily Heikes
3	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Sparge 1	Wetterau Homestead	5,500	AWS 77980	Emily Heikes
4	Non-Hazardous Leachate	Advanced Waste - Cedar Rapids	Sparge 1	Sully	6,000	AWS 77129	Emily Heikes
5	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 2	SET Environmental	5,800	087025	Emily Heikes
6	Non-Hazardous Leachate	Heritage - Covanta Tulsa	Sparge 1	Triad Transport	5,000	1708062-16209	Emily Heikes
7	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Sparge 1	Transwood Inc	5,500	011458374	Emily Heikes
8	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 2	MBI	7,500	087026	Emily Heikes
9	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Sparge 1	Coal City Cob	5,600	AWS 77981	Emily Heikes
10	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 2	MBI	7,700	087027	Emily Heikes
11	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Sparge 1	Coal City Cob	6,000	AWS 77982	Emily Heikes
12	Non-Hazardous Leachate	Advanced Waste - Cedar Rapids	Sparge 1	Transwood Inc	5,500	AWS 77130	Emily Heikes
13	Non-Hazardous Leachate for Rockford IPC	Advanced Waste - Rockford IPC	Sparge 2	Coal City Cob	5,600	011449935	Emily Heikes
14	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 2	MBI	7,500	087028	Emily Heikes
15	Non-Hazardous Leachate	Advanced Waste - Kankakee Metro	Sparge 1	Turn Key	6,000	011449853	Emily Heikes
16	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 2	MBI	7,700	087029	Emily Heikes

Load ID	Waste	Disposal Facility	Source	Transporter	Qty (gal)	Manifest No.	Clerk
17	Non-Hazardous Leachate	Advanced Waste - Kankakee Metro	Sparge 1	Turn Key	5,500	011449854	Emily Heikes
18	Non-Hazardous Leachate	Advanced Waste - Kankakee Metro	Sparge 1	Turn Key	6,000	011449855	Emily Heikes
19	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 2	MBI	7,500	087030	Emily Heikes
20	Non-Hazardous Leachate	Advanced Waste - Chemworks	Sparge 1	SET Environmental	5,300	AWS 77983	Emily Heikes
21	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Sparge 1	Stoffel	5,500	AWS 77984	Emily Heikes
22	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Sparge 2	K&R	6,100	AWS 77985	Emily Heikes
23	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 2	MBI	2,200	087031	Emily Heikes
24	Non-Hazardous Leachate	Advanced Waste - Chemworks	Sparge 2	Coal City Cob	5,600	AWS 77986	Emily Heikes
25	Non-Hazardous Leachate for Rockford IPC	Advanced Waste - Rockford IPC	Sparge 2	Coal City Cob	5,000	011449934	Emily Heikes
26	Non-Hazardous Leachate	Advanced Waste - Cedar Rapids	Sparge 2	Sully	6,000	AWS 77131	Emily Heikes
27	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Sparge 2	Transwood Inc	5,500	011458375	Emily Heikes
28	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Tank AST 316k	KRD Trucking	6,200	011458376	Emily Heikes
29	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Tank AST 316k	KRD Trucking	6,000	011458377	Emily Heikes
30	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Tank AST 316k	K&R	6,100	AWS 77987	Emily Heikes
31	Non-Hazardous Leachate	Advanced Waste - Chemworks	Tank AST 316k	Coal City Cob	6,000	AWS 77988	Emily Heikes
32	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank AST 316k	MBI	7,200	087032	Emily Heikes
33	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank AST 316k	MBI	6,000	087033	Emily Heikes
34	Non-Hazardous Leachate	Advanced Waste - Chemworks	Tank AST 316k	Coal City Cob	5,600	AWS 77989	Emily Heikes
35	Non-Hazardous Leachate	Advanced Waste - Chemworks	Tank AST 316k	TDR Transport	5,200	AWS 77990	Emily Heikes
36	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Tank AST 316k	KRD Trucking	6,000	011458378	Emily Heikes
36					**216,600**		

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1	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank AST 316k	MBI	7,100	087034	Emily Heikes
2	Non-Hazardous Leachate	Advanced Waste - Chemworks	Sparge 2	Coal City Cob	5,600	AWS 77991	Emily Heikes

Load ID	Waste	Disposal Facility	Source	Transporter	Qty (gal)	Manifest No.	Clerk
3	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank AST 316k	MBI	6,900	087035	Emily Heikes
4	Non-Hazardous Leachate for Rockford IPC	Advanced Waste - Rockford IPC	Sparge 2	Wayne Transports	6,000	011449936	Emily Heikes
5	Non-Hazardous Leachate	Heritage - Covanta Tulsa	Tank Battery 8	Triad Transport	5,000	1708064-16209	Emily Heikes
6	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank AST 316k	SET Environmental	5,900	087036	Emily Heikes
7	Non-Hazardous Leachate	Advanced Waste - Cedar Rapids	Sparge 2	Sully	6,000	AWS 77132	Emily Heikes
8	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Sparge 2	Transwood Inc	5,500	011458379	Emily Heikes
9	Non-Hazardous Leachate for Rockford IPC	Advanced Waste - Rockford IPC	Sparge 2	Coal City Cob	5,600	011449937	Emily Heikes
10	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank AST 316k	MBI	6,900	087037	Emily Heikes
11	Non-Hazardous Leachate	Advanced Waste - Kankakee Metro	Sparge 2	Turn Key	5,500	011449856	Emily Heikes
12	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Tank AST 316k	Coal City Cob	6,000	AWS 77992	Emily Heikes
13	Non-Hazardous Leachate	Advanced Waste - Cedar Rapids	Tank AST 316k	Transwood Inc	5,500	AWS 77133	Emily Heikes
14	Non-Hazardous Leachate for Rockford IPC	Advanced Waste - Rockford IPC	Tank AST 316k	Wayne Transports	6,000	011449938	Emily Heikes
15	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank AST 316k	MBI	7,500	087038	Emily Heikes
16	Non-Hazardous Leachate	Advanced Waste - New Castle	Tank AST 316k	Kuhnle Bros	4,800	AWS 77346	Emily Heikes
17	Non-Hazardous Leachate	Advanced Waste - Chemworks	Tank AST 316k	Coal City Cob	5,600	AWS 77993	Emily Heikes
18	Non-Hazardous Leachate for Rockford IPC	Advanced Waste - Rockford IPC	Tank AST 316k	Wayne Transports	6,000	011449939	Emily Heikes
19	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank AST 316k	MBI	7,500	087039	Emily Heikes
20	Non-Hazardous Leachate	Advanced Waste - Kankakee Metro	Tank AST 316k	Turn Key	6,000	011449857	Emily Heikes
21	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank AST 316k	MBI	7,700	087040	Emily Heikes
22	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Tank AST 316k	K&R	6,100	AWS 77994	Emily Heikes
23	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Tank AST 316k	KRD Trucking	6,000	011458381	Emily Heikes
24	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank AST 316k	MBI	7,500	087041	Emily Heikes
25	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Tank AST 316k	Wetterau Homestead	5,300	AWS 77995	Emily Heikes

Load ID	Waste	Disposal Facility	Source	Transporter	Qty (gal)	Manifest No.	Clerk
26	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank AST 316k	MBI	7,700	087042	Emily Heikes
27	Non-Hazardous Leachate	Advanced Waste - Kankakee Metro	Tank AST 316k	Turn Key	5,500	011449858	Emily Heikes
28	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Tank AST 316k	Stoffel	5,500	AWS 77996	Emily Heikes
29	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Tank AST 316k	Transwood Inc	5,500	011458380	Emily Heikes
30	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Tank AST 316k	Coal City Cob	6,000	AWS 77997	Emily Heikes
31	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank AST 316k	MBI	7,500	087043	Emily Heikes
32	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Tank AST 316k	KRD Trucking	6,000	011458382	Emily Heikes
33	Non-Hazardous Leachate	Advanced Waste - Chemworks	Tank AST 316k	Coal City Cob	5,600	AWS 77998	Emily Heikes
34	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank AST 316k	MBI	7,700	087044	Emily Heikes
35	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Tank Battery 2	Transwood Inc	6,000	011458383	Emily Heikes
36	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Tank Battery 2	K&R	6,100	AWS 77999	Emily Heikes
37	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank AST 316k	MBI	7,500	087045	Emily Heikes
38	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Tank Battery 2	KRD Trucking	6,200	011458384	Emily Heikes
39	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank AST 316k	MBI	7,700	087046	Emily Heikes
40	Non-Hazardous Leachate	Advanced Waste - Liquid Environmental	Tank Battery 2	KRD Trucking	6,000	011458385	Emily Heikes
41	Non-Hazardous Leachate	Advanced Waste - Cedar Rapids	Tank Battery 2	Transwood Inc	5,500	AWS 77134	Emily Heikes
42	Non-Hazardous Leachate	Advanced Waste - Chemworks	Tank Battery 2	Coal City Cob	6,000	AWS 78000	Emily Heikes
42					**261,500**		

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1	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 8	SET Environmental	5,300	1708050-15240	John Powell
2	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 5	MBI	7,500	087047	John Powell
3	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank AST 316k	Schiber	5,500	1707991-15240	John Powell
4	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank AST 316k	Neier	5,000	1708044-15240	John Powell
5	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 5	MBI	7,700	087048	John Powell

Load ID	Waste	Disposal Facility	Source	Transporter	Qty (gal)	Manifest No.	Clerk
6	Non-Hazardous Leachate	Advanced Waste - Cedar Rapids	Tank AST 316k	Sully	6,000	AWS 77135	John Powell
7	Non-Hazardous Leachate	Advanced Waste - Cedar Rapids	Tank AST 316k	Sully	6,000	AWS 77136	John Powell
8	Non-Hazardous Leachate	Advanced Waste - New Castle	Tank AST 316k	Kuhnle Bros	5,000	AWS 77347	John Powell
9	Non-Hazardous Leachate	Advanced Waste - New Castle	Tank AST 316k	Kuhnle Bros	5,000	AWS 77348	John Powell
10	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Tank AST 316k	Coal City Cob	5,600	AWS 78001	John Powell
11	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Tank AST 316k	K&R	6,100	AWS 78002	John Powell
12	Non-Hazardous Leachate	Heritage - Covanta Tulsa	Tank AST 316k	Triad Transport	5,000	1708065-16209	John Powell
13	Non-Hazardous Leachate	Advanced Waste - Kankakee Metro	Tank AST 316k	Turn Key	5,500	011449859 JJK	John Powell
14	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 5	MBI	7,500	087049	John Powell
15	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Tank AST 316k	Coal City Cob	5,500	AWS 78003	John Powell
16	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank Battery 8	SET Environmental	5,300	1708051-15240	John Powell
17	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 5	MBI	7,700	087050	John Powell
18	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank AST 316k	Neier	6,000	1708045-15240	John Powell
19	Non-Hazardous Leachate	Heritage - Covanta Indianapolis	Tank AST 316k	Neier	5,000	1708046-15240	John Powell
20	Non-Hazardous Leachate	Advanced Waste - Kankakee Metro	Tank AST 316k	Turn Key	6,000	011449860 JJK	John Powell
21	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 5	MBI	7,500	087051	John Powell
22	Non-Hazardous Leachate for MSD	MSD - Bissell Point	Tank Battery 5	MBI	7,700	087052	John Powell
23	Non-Hazardous Leachate	Advanced Waste - Kankakee Metro	Tank AST 316k	Turn Key	6,000	011449861 JJK	John Powell
24	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Tank AST 316k	Coal City Cob	5,600	AWS 78004	John Powell
25	Non-Hazardous Leachate	Advanced Waste - Crystal Springs	Tank AST 316k	K&R	6,100	AWS 78005	John Powell
25					**151,100**		

Loading Date 6/30/2013

1	Non-Hazardous Leachate	Heritage - Covanta Tulsa	Tank Battery 5	Triad Transport	5,800	1708066-16209	Scott Fedak
1					**5,800**		

Load ID	Waste	Disposal Facility	Source	Transporter	Qty (gal)	Manifest No.	Clerk

APPENDIX E

DATA CORRELATIONS AND TRIGGER ASSESSMENTS

APPENDIX E

CORRELATIONS OF SITE METRICS WITH REACTION PREDICTION

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ATTACHMENT E-1

1 INTRODUCTION

1.1 PURPOSE

The purpose of the work presented in this Appendix was to identify those metrics that can be obtained at the site on a normal basis to predict the location and rate of movement of the reaction at the Bridgeton Landfill. Data that has been and will be gathered at the landfill and could potentially be used to monitor the location and progress of the reaction was examined in detail to determine how well it predicted behavior to date and how those data could be used for the purpose of triggering actions in the future.

1.2 SCOPE

The following data was examined:

- Temperature Monitoring Probe Readings (available since late fall 2012)
- Gas wellhead field monitoring data (available for wells since 2009 and earlier)
- Laboratory Gas Analysis from individual gas wells (available for some wells at dates starting as early as 2011 but monthly for most south quarry wells beginning in August 2012)
- Settlement rate data (grid survey comparisons beginning in January 31, 2013 and GPS digital terrain models back to early 2011 on a monthly basis)

The data used and the analyses and predictive capacity and relationships identified are presented and described in the subsequent sections of this appendix.

2 GENERAL DATA PRESENTATION

2.1 TMP MEASUREMENTS

TMP data has been gathered on weekly basis for each of the TMP units once they were installed. In some cases, most notably TMP-8, some of the thermocouple units have become inoperable with time. TMP data has been plotted with time along with the settlement rates for grid based surveys and gas well data (gas wellhead temperature) to identify correlations between these conditions and in-ground temperature. The maximum and average values for the TMP plotted were chosen to represent the TMP readings in the simplest fashion. TMP plots with settlement rate at the TMP are presented in Figures E-1 through E-14 and TMP plots with gas wellhead temperatures, for gas wells that are proximate to TMPs, are presented in Figures E-15 through E-22. TMP maximum temperatures were also included in plots for gas well constituents where they were proximate to gas wells as described in Section 2.2 of this Appendix. These figures are referred to in subsequent sections of this Appendix.

2.2 GAS WELL DATA

Gas wellhead data, i.e. well head temperature, and field analyzer measured CO_2, and CH_4, have been plotted along with laboratory gas analysis of CO, CO_2, H_2 and CH_4 with time. Nearby TMP maximum

temperature and settlement rate values at the gas wells have also been included. Figures E-23 through E-47 present plots of gas wells selected to cover a range of behaviors, locations relative to the reaction, and wells that are proximate to settlement fronts and TMP readings. These figures are referred to in subsequent sections of this Appendix.

3 ANALYSIS OF DATA

3.1 TMP DATA

The TMP data was analyzed to look at what in-ground temperatures were consistent with other signs of the reaction. The main indicators of the reaction are typically settlement at the ground surface, gas wellhead temperatures and CO.

3.1.1 COMPARISON TO SETTLEMENT RATE

Comparison of settlement and maximum temperature measured at a TMP location is illustrated in Figures E-1 through E-14. Three of the TMP's, TMP-7R, TMP-8, and TMP-9, as shown on Figures E-7 through E-9, respectively, have exhibited maximum temperatures in excess of 220 °F. As can be seen in Figures E-7 and Figure E-8, maximum TMP temperature and settlement rate are closely linked to the settlement rate having exceeded a value in the range of -0.04 to -0.045 ft per day. Figure 9, depicting TMP-9, does not show this correlation, but is located where the waste thickness is approximately 0.4 times the thickness of the other locations, so it is possible the similar rate of settlement at the location of TMP-9 is on the order of -0.016 to -0.018 ft per day, which appears to have been exceeded in December or January of this year. It should be noted that settlement at the TMP-9 location has been limited since those dates and temperatures of late have been falling. When looking at the Figures it should be noted that the survey data for settlement rate prior to December 12 was not done on a grid basis so actual settlement rates reported in December are considered less accurate than those reported on or after January 31, 2013, when all data was compared to a common grid location point to point.

The remaining TMPs have experienced a maximum temperature of 180 °F, as can be seen in the corresponding Figures.

It is not surprising that local settlement is related to exceedence of temperatures in excess of 220 °F. At this temperature, paper and other cellulose based materials can begin to pyrolyze, resulting in volume reduction. It can also be seen looking at Figure 8 that temperatures continued to rise after the onset of achieving 220 °F, which suggests that pyrolysis-related settlement behind the front is greater. As described in the March 29, 2013, letter to Mrs. Fitch of MDNR from Craig Almanza of Bridgeton Landfill[1] under the heading "Analysis of the Shape of the Zone of Accelerated Settlement", the settlement at any point in the area of advancing settlement includes settlement associated with volume reduction from areas as far away as 150 ft. This may well explain why there is apparently no substantive time delay between the achievement of the maximum TMP values of 220 °F and a settlement rate of -0.04 to -0.045 ft/day. This is consistent with mapping of

[1] Referred to hereinafter as Reference 1 and included in Appendix A of the North Quarry Contingency Plan Part 1.

the settlement front as a measure of the reaction advance using the -0.045 ft/day value that has been presented thus far in the project.

At shallower sections of the quarry it may be appropriate to reduce the level of settlement per day deemed as accelerated settlement to a value that is consistent with the heated zone in the shallower area compared to full quarry height locations. This would reflect the fact that settlement rate associated with the reaction is actually associated with the thickness of the waste being heated to a level that results in volume destruction, based on the TMP charts of temperature with depth.

3.1.2 Comparison to Gas WellHead Temperature

Gas wellhead temperature reflects the average temperature of the waste the gas has passed through for the zone around the well. In areas where the temperature varies significantly with direction and distance from the well, such as near a temperature front, the gas wellhead temperature can be very different than the waste temperature at any depth around the well. In areas that are not experiencing temperature changes in lateral directions, the gas wellhead value reflects the average temperature typically of the upper 75 feet of waste column, which in a decomposing landfill is cooler than landfill waste temperatures at greater depths but still well above the landfill bottom (>40 or 50'above bottom). As such the temperature difference between maximum and average TMP values compared to the gas wellhead temperature seen in Figures E-15 through E-22 is not unexpected.

For gas wells more than 100 feet from the Settlement Front or apparent heat front, such as GEW-10, GEW-39, GEW-56R and GEW-109, the wellhead temperature was found to be as much as 30 °F lower than the average nearby TMP value (GEW-10 and TMP10 – Figure E-15) but more typically 10 to 15 °F lower. Maximum TMP values for these same wells were 12 to 45 °F higher than the wellhead temperature of nearby wells. No correlation between temperature difference and distance from the TMP to the well were identified, given the greater differences were observed at GEW-10 which is within only 10 feet away from TMP-10. Differences between the TMP max and average values were typically greater if the well was north of the TMP (further from the advancing heat front) than south of the TMP (closer to the heat front). One could generally conclude that typically wellhead temperatures removed from the heat fronts could be in the range of 40 °F below the maximum temperature in the waste, but the data is limited. The significant difference between the TMP-10 and GEW-10 suggests that the TMP data represents a relatively small distance close to the TMP.

For gas wells closer than 100 feet from the Settlement Front (or heat front), such as GEW11, GIW7, and GIW-11 the variation between gas wellhead temperature and the TMP average values was typically less than was observed in the wells further away from the front. But the variation from the maximum TMP value was consistently close to thirty degrees. The only observed exception was GIW-7 which, being 51 feet away from TMP-7R, did not show a rise in temperature during the beginning of June 2013, when TMP-7R increased nearly 60 degrees in maximum and 20 degrees in average. GIW-7 is the only well near the heat front that is also within any proximity of a TMP. A plot for GIW12 is also included (Figure E-22) just to complete the set of wells close to TMPs.

However, GIW-12 has yet to reach a stable operating condition and therefore no conclusions can be drawn from it.

Generally speaking, the gas wellhead temperature can be shown not to directly reflect the maximum temperatures in the waste mass. In general it would be reasonable to suggest that in areas not within 100 feet of more of a settlement front, the wellhead temperature is likely within 40 to 45 °F of the maximum waste temperature. This would suggest that in the absence of settlement occurring at an elevated rate or significant CO concentrations, a wellhead temperature of up to 175 °F could, in the absence of other indicators, be acceptable and would indicate maximum waste temperatures in the vicinity of that well less than 220 °F. A gas wellhead temperature of 175 °F or higher could indicate the area had been likely been warmed by processes not consistent with biological degradation processes and would reflect maximum temperatures within the waste in the area of influence of the well that would exceed 220 °F.

3.1.3 Ability to Predict Location and Rate

TMP data is not able to predict rate or location that is closer than the spacing between TMP points. For example, if one looks at Figures E-7 and E-8, it is clear that the change in temperature from 180 to 190 to 220 was a gradual change that was consistent with the slope of the temperature line in advance of the change. It is apparent that some energy consuming activity is associated with this temperature rise that makes the transition faster, once the temperature transition to 220 °F is achieved the temperature continues to rise higher. Based on the behavior of TMP-7R and TMP-8 it appears that all one can conclude is that the front is either at a location or not. The rate of travel is not apparent from the TMP data alone. Review of data associated with TMP-13 does not indicate the rate the front may be advancing toward it based on measured temperature. All that could possibly be concluded is TMP-13 is warming at a very slow rate (See Figure E-13).

3.2 GAS WELL DATA

Gas well data was examined to determine what, if any, information was predictive of location and rate of movement of the reaction. Figures E-23 through E-47 contain gas well measurements and TMP data, when a TMP is nearby, along with settlement rate data based on the surveys performed at the site. In addition, a summary of gas well location relative to the settlement front, as currently defined by rate of settlement of -0.45 ft per day (1.35ft per 30 day month). Settlement rate data prior to January 31, 2013 is considered less accurate given the surveying methods used.

As explained in Section 3.1.2, the gas well data is influenced by proximity to the heat front, but not in an easily definable way. To explore the relationship, the locations of gas wells relative to the settlement front or in proximity to the front were identified. These are summarized in Table E-1 for settlement front locations as of July 2012 and later. Earlier settlement fronts have not been determined.

As can be seen in Table E-1, many of the gas wells that are within 50 feet of the settlement front as of April 15, 2013 have been inside of the gas front or within a limited distance of the settlement front since September 2012 or July 2012. It is also possible to examine wellhead temperatures within the settlement zone, as well as other gas make up.

Gas well constituents represent gas being collected at any time, not gas being produced at any specific location. When the gas being produced is constant with time, the gas collected should be similar to the gas being produced. When the gas being produced is changing with time, the gas being collected represents a mixture of gasses produced with gasses that are stored in pore spaces or diffusing from solids within the area of influence. In addition, as was mentioned in Section 3.1.2, the gas collected comes from an unknown tributary area and would be expected to include the gasses from any nearby heat affected zone prior to the heat of the reaction actually causing volume reduction at the well. Further, since the gas constituents are tracked as percent volume (dry) constituents not related to methanogenesis are amplified in concentration by the reduction in methane production that occurs when the waste mass is warmed over 160 °F. Once methane production is halted to temperature rise, the major gas constituents are typically CO_2, H_2. CO is also present but is not a major gas constituent (typically less than 1% or 10,000 ppm). Based on experience at other sites, CO concentrations are likely to remain elevated for some time even after temperatures begin to fall and settlement rates reduce. For this reason it is appropriate to examine well gas concentrations by looking at wells that have been inside or near the reaction area at times in the past, wells that have only recently been in or near the reaction area and wells that have never been proximate to the reaction area as separate sets of data. Screening for wells that have never been in the reaction area has been approximated by those wells not currently within 150 ft of any of the settlement fronts and wells that, since 2011, are not located in areas that have settled more than 5 feet, which excludes wells GEW 14a, GEW-18R, GEW-19A ,GEW-112 and GEW-45R possibly from the wells not within 150 feet of settlement fronts. GEW -24a, through 30 R in the southeast corner of the South Quarry were also eliminated from this set given their proximity to the reaction and the likelihood that added fill placed in this area had masked settlements.

Laboratory of gas analysis is available for only south quarry wells and most of that is for periods following August of 2012. Therefore, only gas wells in the south quarry were included in the analysis of gas well constituents. Field measurements of gas well constituents were not utilized for analysis of wells within the vicinity of the reaction area since they do not include any information on CO or H_2.

3.2.1 GAS WELLHEAD TEMPERATURE

3.2.1.1.1 Wells Inside or Proximate to the Settlement Fronts

Gas wellhead temperature inside or proximate to the settlement fronts was analyzed by looking at all data and filtering for CO values higher than a fixed value. The following presents the wellhead temperatures as they related to CO values. Gas wellhead temperatures below 100 °F were manually excluded from the analysis as being not representative of gas wells with any flow. It should be noted that some reported temperatures were as low as 0 °F.

CO Minimum	Average	Median	Standard Deviation	Sample Count
5000 ppm	171.5	180	24.7	109
4000 ppm	170	179	24.8	174
3000 ppm	162	170	26	270
2000 ppm	156	152	25.8	384

The results indicate that a gas well temperature above 170 is identified with CO values on average of more than 4000 ppm. Gas wellhead temperatures in excess of this value would suggest that significant waste alteration via heat is occurring. As represented in Figures E-24 through E-47, the data does have significant scatter, as would be expected given that each data point is a composite of gas produced from waste within the zone of influence of the well. The significant reduction in median temperature from CO concentration of 3000 ppm to 2000 ppm indicates that the threshold indicator is at least 3000 ppm. The minimal change between 4000 and 5000 ppm suggests that 4000 ppm could be used as a threshold for clearly being in the elevated head zone and gas wellhead temperatures in the range of 170 to 175, which could be considered indication of waste temperatures having reached 220 °F temperatures. Consistent with the comparisons of TMP values and wellhead temperatures discussed in Section 3.1.2, CO in excess of this value would suggest that significant waste alteration via heat is occurring.

3.2.1.1.2 Wells more than 150 feet from Any Settlement Front

An evaluation of the gas wellhead temperatures measured routinely at the site was performed for all the wells outside the settlement areas. The evaluation is reported in Table E-2. The average value of wellhead temperature was 107 °F with a maximum value of 155 °F associated with GEW-54 located in the south end of the North Quarry. Minimum readings of 19 °F were reported. These low readings bias downward the average value and are certainly not representative of the gas in the wells but likely a measurement taken with no or little flow in the well. Ignoring temperatures below 90 °F raises the average temperature to 113 °F. This suggests a temperature of 135 °F (the average plus 1 standard deviation) would represent a temperature at which nothing is occurring. Higher wellhead temperatures may warrant further scrutiny if other indicators of reaction are present.

TABLE E-2
FIELD MEASUREMENTS OF
OF GAS WELLS > 150 FT FROM SETTLEMENT
FRONTS

	CH4	CO2	O2	CH2/CO2	Init Temp
Average	40.62092	40.11428	0.452371	1.052027	105.0662
Median	43.6	38.9	0	1.131016	110
Std Dev	12.88234	10.44071	2.018484	0.31617	22.67967
Min	0.1	0.2	0	0.012422	19
Max	66.9	86.2	21.5	2.167857	155
Count	7749	7753	7753	7749	4395
Average Using only t>90deg					113.2069

3.2.2 GAS CONSTITUENTS

3.2.2.1 CO

3.2.2.1.1 Wells Inside or Proximate to the Settlement Fronts

Laboratory gas well sampling data was analyzed for wells inside the settlement front as of March 20, 2013, which represented the largest settlement front area to date. The statistical evaluation of the CO levels in the wells for gas samples obtained in February through April 2013, is presented in Table E-3. The CO levels averaged 3300 ppm but ranged from 170 to 6700 ppm. The median value was 2900 ppm. When compared to the sample set that includes all the data from the same wells back to August 2012, the average value of the time within the front was lower than the overall average value, shown in Table E-3, of 4460 ppm with approximately the same minimum value and 8900 maximum value. This clearly did not indicate any significant change with being within the reaction zone of high heat and not. It suggests either the area was already reacting for the full period or that wells proximate to the front have quite variable CO concentrations. This would suggest that CO values in excess of 4000 ppm are indicative, but not definitive of being within the settlement or heat front zone.

TABLE E-3A
ANALYSIS OF WELL INSIDE MARCH 20, 2013
SETTLEMENT FRONT - SAMPLE DATES 2/13 TO 5/13

	CO	CO2	H2	CH4	CO2/CO	CH4/CO2
Average	0.332	62.226	20.484	6.845	507.150	0.114
Min	0.017	43.000	0.000	0.150	103.125	0.002
Max	0.670	72.000	34.000	26.000	3176.471	0.433
STD Deviation	0.211	6.220	9.452	8.061	760.966	0.138
MEDIAN	0.290	63.000	23.000	3.700	206.897	0.056

TABLE E-3B
ANALYSIS OF WELLS INSIDE MARCH 20. 2013
SETTLEMENT FRONT - SAMPLE DATES 8/12 TO 5/13

	CO	CO2	H2	CH4	CO2/CO	CH4/CO2
Average	0.446	61.319	21.304	5.502	276.275	0.100
Min	0.015	35.000	0.000	0.150	78.652	0.002
Max	0.890	73.000	32.000	32.000	3176.471	0.627
STD Deviation	0.209	7.746	7.262	6.532	507.410	0.129
MEDIAN	0.450	64.000	23.000	2.800	132.653	.041

3.2.2.1.2 Wells more than 150 feet from Any Settlement Front

The laboratory gas well sampling data for the wells that had not been within a 150 of settlement front are presented in Table E-4, shown below.

TABLE E-4
LABORATORY GAS ANALYSIS
GAS WELL NOT WITHIN 150 FT OF
SETTLEMENT FRONTS

STATISTICS	C02	METHANE	HYDROGEN	CO	CO2/CO	METH/CO2
Count	46	46	47	68.00	46	46
Average	54.74	22.90	6.40	0.07	3034	0.478
Maximum	76.00	46.00	28.00	0.33	16296	1.212
Minimum	21.00	3.10	0.00	0.00	185	0.051
Median	56.50	24.00	0.00	0.01	1135	0.450
Standard Deviation	14.25	14.17	8.51	0.09	3799	0.350

The data shows that CO values within the areas that have not been within or near settlement front limits in the past are on average approximately 700 ppm, but do have numerous values in excess of this value. The average plus one standard deviation of data range could be adopted as a reasonable indication that some heating of the waste, worthy of exploration, is warranted. This would correspond to a CO value of 1600 ppm. The complete set of well samples used is provided in Attachment E-1.

3.2.2.2 H_2

3.2.2.2.1 Wells Inside or Proximate to the Settlement Fronts

The laboratory gas well sampling data for wells within or proximate to settlement fronts indicates a wide range of H_2 partial volumes, as can be seen in Table E-3. The data is so variable that it cannot be used an indicator, other than to suggest that higher than 20 percent hydrogen seems to be strongly related with significant warming. However, it does not, as is apparent in Figure E-41 (GEW-38), relate to settlement rate, maximum TMP temperature, CO level, or wellhead temperature. GEW-38 is within 100 feet of the settlement front. Figure E-34 (GEW 63) also depicts a well proximate to the settlement front. It is approximately 57 feet from the location of the front as of May 2013. It does indicate an increase in H_2, but it occurred in 2011, well in advance of any significant increase in well temperature or CO level. This can be compared to Figure E-37 (GEW-69R) which has been within the settlement front for a significant time and exhibited H_2 levels comparable to the previous two wells mentioned. Wells that have moved in and out of settlement fronts, such as GEW-12A and GEW-32R (Figures E-24 and E-27, respectively), show that H_2 values are not related to settlement rate or wellhead temperature.

Average values of H_2 within the heat front or proximate to, as reported in Tables E-3A and E-3B, are 20% to 21%. but as described above, significant variation exists. A median value of 23% was found in both the post January 2013 sample subset and the full sample of wells within the March 2013 settlement front limits. A median value of 26% was found for wells within the settlement front limits as of February through April samples. However no definitive value is apparent.

3.2.2.2.2 Wells more than 150 feet from Any Settlement Front

The laboratory gas well sampling data for the wells that had not been within a 150 of settlement front are presented in Table E-4. The data shows that H_2 values within the areas that have not been within or near settlement front limits in the past are on average approximately 6.4%, but do have numerous values in excess of this value. The median plus one standard deviation of data range is 8.5%. This is significant and is not recommended as a target for an indication that no heating is likely to occur. It is likely that the values of hydrogen are reflective of the ease in which it migrates within the waste mass and the fact that values are heavily weighted to samples only taken in the south quarry.

3.2.2.3 CH_4

3.2.2.3.1 Wells Inside or Proximate to the Settlement Fronts

Wells near, or within, the settlement fronts exhibit reduced Methane concentrations as the waste is warmed, which is to be expected given the relatively low temperature at which methanogenesis is impeded. All of the wells that eventually are in warmed areas exhibit low methane levels. While this would be predictive of the area eventually being warmed, it does not indicate when that may occur or if it would eventually be warmed to a temperature that would result in significant volume reduction of the waste. This is evident in Figures E-31 and E-33, all near but not within settlement fronts. Methane concentrations in GEW-38 (Fig.E-31) have fallen to less than 5%, while in GEW-56R (Figure E-33), located about the same distance from the front and exhibiting similar maximum TMP temperatures, the methane contractions are in excess of 20% at present. The wells have markedly different behavior and either may or may not be warmed to a maximum waste temperature of 220 °F.

Laboratory analysis of gas well samples for methane of the same well and date sets described in Section 3.2.2.1.1 shows the methane content averaged between 4% and 6%, but had significant deviations from average, with maximum values of 32% and minimum values of 0.15%. The median value was less than 4%. The data shows no specific trend other than it diminishes with time as the well spends more time in the heated zone, which, as noted above, is expected given the negative impact of increased temperature on methanogenesis. The statistical results are presented in Tables E-3A and E-3B.

3.2.2.3.2 Wells more than 150 feet from Any Settlement Front

The analysis of wells for methane concentration from laboratory gas samples indicated the average methane content was 23%, with significant variability, as can be seen in Table E-4. The standard minimum and maximum values were 3% and 46%, respectively. This suggests that methane content is not a reliable measure for determining if no reaction processes are ongoing. Field measurements of methane indicated a higher average, 40.6%, but a large range (0.1% to 67%) suggesting that field measures of methane are not definitive.

3.2.2.4 Gas Ratios

3.2.2.4.1 Wells Inside or Proximate to the Settlement Fronts

As can be seen in Tables E-3A and E-3B, the gas ratios of CO_2/CO and CH_4/ CO_2, are consistently lower than those for areas outside any reaction affected areas. However, there is still no clear value that can be identified. Other screening suggested that CO_2/CO below 115 were definitely associated with wells within the settlement fronts, but wide variation exists inside the fronts. This is apparent with the lack of significant difference between the well data sets for the periods containing the full range of data and only the months near or within the March 20. 2013 fronts.

The CH_4/ CO_2 ratio shows similar noisiness with no clear difference between sample sets.

3.2.2.4.2 Wells more than 150 feet from Any Settlement Front

The minimum ratio of CO_2/CO, using laboratory gas samples, was 165 and the median value was 480. Average and maximum values were very high given the very low levels of CO measured and the number of Non Detects (which were assigned 10000 as a ratio). Ratios of less than 115 were found to be indicative of substantial heating. The geometric mean of the values was 825 suggestive of a CO value of 700 ppm which is lower than the median 900 ppm measured. It is suggested that the median ratio of 480 would be more appropriate which suggests a CO value of greater than 1300 ppm would be present.

The ratio of Methane to CO_2 was also calculated utilizing the field measured values. As can be seen in Table E-4, the ratio varied from greater than 1.2 to a minimum of 0.045. The average less one standard deviation would be approximately 0.13. It should be noted that this metric is very noisy as far as data is concerned, as can be seen in the Figures E-24 through E-47. It is not recommended for use for any decisions.

Given the noisy nature of the field data and the fact that no field measurement of CO is possible, field data for gas ratios was not analyzed statistically.

3.3 SETTLEMENT RATE DATA

Settlement rate data has been collected at the site on approximately a monthly basis since 2012. The data collected prior to December 2012 was analyzed and reported in the January 3, 2013 submittal to the MDNR. This report identified a rate of -0.045 ft per day of elevation change as the likely measure of accelerated settlement for the site. Changes in the survey method to improve the comparison month to month were made starting in December 2012 for a portion of the South Quarry and completed by the January 31, 2013 survey. From that date on, settlement maps have been prepared on a monthly basis and the settlement front identified as the location of the boundary between areas settling faster and slower than the aforementioned rate. The demarcation has been seen to be useful in tracking the expansion of the reaction-affected areas, that is, expansion of elevated temperature into areas previously not warmed to above 220 °F.

The correlation between the settlement front and temperature is apparent in Figure E-7 and E-8. It does not appear that there is any significant time lag between the onset of maximum TMP temperatures of 220 °F and settlement rate increase above the threshold of 0.04 to 0.045 ft per day, or an equivalent rate at TMP 9 corrected for depth, as described in Section 3.1.1. In addition, while the data correlating the settlement rate to a TMP maximum temperatures is limited to the three points where the settlement front has encountered a TMP, it is consistent at all three. At the same

time the TMPs not indicating temperatures above 220 °F have not experienced high settlement rates since the use of the more accurate grid survey, which is further support for the correlation at all TMP locations.

At the present time there are 14 TMPs, of which only three have reached a maximum temperature of 220 °F. The remaining 11 TMPS are between the North Quarry and the area that has reached temperatures of 220 °F. The relationship between settlement rate and TMP maximum temperature will, if the reaction continues to progress to the north, be able to be tested and refined as needed. The relationship can continued to be tested as a timely indicator of the reaction by the insertion of TMPs in the apparent path of the progress of the reaction as appropriate based upon progression.

4 CONCLUSIONS

4.1 DETERMINATION OF THE LOCATION OF THE REACTION FRONT

The measurements that best indicate the zone of the reaction front are those measurements of temperature from the TMPs considered together with the monitoring of surface settlement. Together, identifying the rate of surface settlement relative to TMPs which have reached 220 degrees Fahrenheit, we can best identify the location of the reaction front. The current data available identifies the settlement rate for areas that are full depth of the quarry, as an elevation drop of approximately -0.45 ft per day or -1.35 ft per 30 day period. If the reaction moves into areas with waste thicknesses that are significantly less than the current 220 to 260 feet, the value should be adjusted downward to reflect the portion of the waste mass between 50 and 150 feet that is less than 60 feet above the quarry floor. These above measures are useful in identify advancing fronts and so have been proposed for the purpose of developing trigger lines for contingent future actions on site. However it should be noted that these are not relevant for identifying retreating fronts, because the heat stays in the waste long after the elevated temperatures are reached.

Following review of the extensive data available from gas wells, it appears these values are highly variable and should be considered useful as general temporal indicators. As an indicator parameter, the gas well data can be evaluated in conjunction with other relevant data. The best gas well indicators appear to be CO and wellhead temperatures. It would appear that CO values of above 4000 ppm and gas wellhead temperatures higher than 175 degrees Fahrenheit are likely good indicators that wells are within or proximate (within 50 feet of) the heat front.

Other data can be used as indications of trends, such as rising hydrogen concentrations or falling methane concentrations, but the data does not support any specific values that would be useful as a trigger mechanism.

In conclusion, the extensive data collected at Bridgeton Landfill throughout the progression of the SSE has allowed for a site-specific detailed evaluation of predictive, responsive, and trend reflecting conditions related to the SSE. Based upon this evaluation, a firm basis has been established for the selection of trigger points for identification of the location and movement of the SSE, as well as information for the assessment of general trends within the waste mass.

4.2 AREAS Not INVOLVED IN THE REACTION FRONT OR PROXIMATE TO THE FRONT

Analysis of the available data suggests that gas well CO levels under 1600 and wellhead temperatures of under 135 are indicative of the conditions at the site that are far removed from the areas that have been heated to 220 °F. If isolated wells are higher than these values they should be monitored for trends. If they are within 200 feet or less of the settlement front, then exceeding these values can be expected.

GAS WELL LOCATION in or PROXIMATE to SETTLEMENT FRONTS

	September 2012	March 2013	May 2013	February 2013	July 2012	October 2012	February 2013	April	April	November 2012	March	February 2013	March
Name	within 25 ft	inside front	inside front	within 25 ft	within 25 ft	within 25 ft	inside front	inside front, plus 50 ft	inside front	inside front	between front and 25 ft	between 25 and 50 ft of front	between 25 and 50 ft of front
Name	September 2012 - within 25 ft	March 2013 - inside front	May 2013 - inside front	February 2013 - within 25 ft	July 2012 - within 25 ft	October 2012 - within 25 ft	February 2013 - inside front	April - inside front, plus 50 ft	April - inside front	November 2012 - inside front	March - between front and 25 ft	February 2013 - between 25 and 50	March - between 25 and 50 ft of front
GEW-104				X				X	X		X	X	
GEW-12a	X					X	X			X			
GEW-15								X					X
GEW-31R					X	X							
GEW-32R					X	X	X	X		X			
GEW-33R				X		X	X	X		X	X	X	
GEW-36								X			X		
GEW-37								X			X		
GEW-38								X					
GEW-57B	X	X		X	X	X	X	X	X	X			
GEW-57R	X	X		X	X	X	X	X	X	X			
GEW-58	X	X	X	X	X	X	X	X	X	X		X	
GEW-59R	X	X	X		X	X	X	X	X	X			
GEW-60R	X			X	X	X	X	X		X			X
GEW-61R	X	X			X	X	X	X	X	X			
GEW-62R	X				X	X	X	X		X	X		
GEW-64				X	X	X		X	X		X		
GEW-65A	X	X		X	X	X	X	X	X	X		X	
GEW-66	X	X			X	X	X	X	X	X			
GEW-67	X	X			X	X	X	X		X		X	
GEW-68								X					
GEW-69R		X					X	X	X				
GEW-70R	X	X				X	X	X	X	X			
GEW-71	X	X				X	X	X	X	X			
GEW-72R		X					X	X					
GEW-74	X	X				X	X	X	X				
GEW-75	X	X				X	X	X	X	X			
GEW-76R		X					X	X	X				
GEW-79R		X					X	X	X				
GEW-82R				X				X	X		X		
GEW-83	X	X			X	X	X	X	X	X			
GEW-84	X	X				X	X	X	X	X			
GEW-85	X	X		X	X	X	X	X	X	X			
GEW-90	X	X	X			X	X	X	X	X			
GIW-5								X				X	X
GIW-6								X					
GIW-7								X					
GIW-8								X					
GIW-9								X					
HT-1	X				X	X	X	X		X	X		
TMP-15		X	X			X	X	X	X				
TMP-7R								X					
TMP-8		X	X				X	X	X				

TABLE E-1

FIGURES

TMP-1



TMP TEMPERATURE AND SETTLEMENT RATE BRIDGETON LANDFILL

FIGURE E-1

TMP-2



TMP TEMPERATURE AND SETTLEMENT RATE BRIDGETON LANDFILL

FIGURE E-2

TMP-3



TMP TEMPERATURE AND SETTLEMENT RATE
BRIDGETON LANDFILL

FIGURE E-3

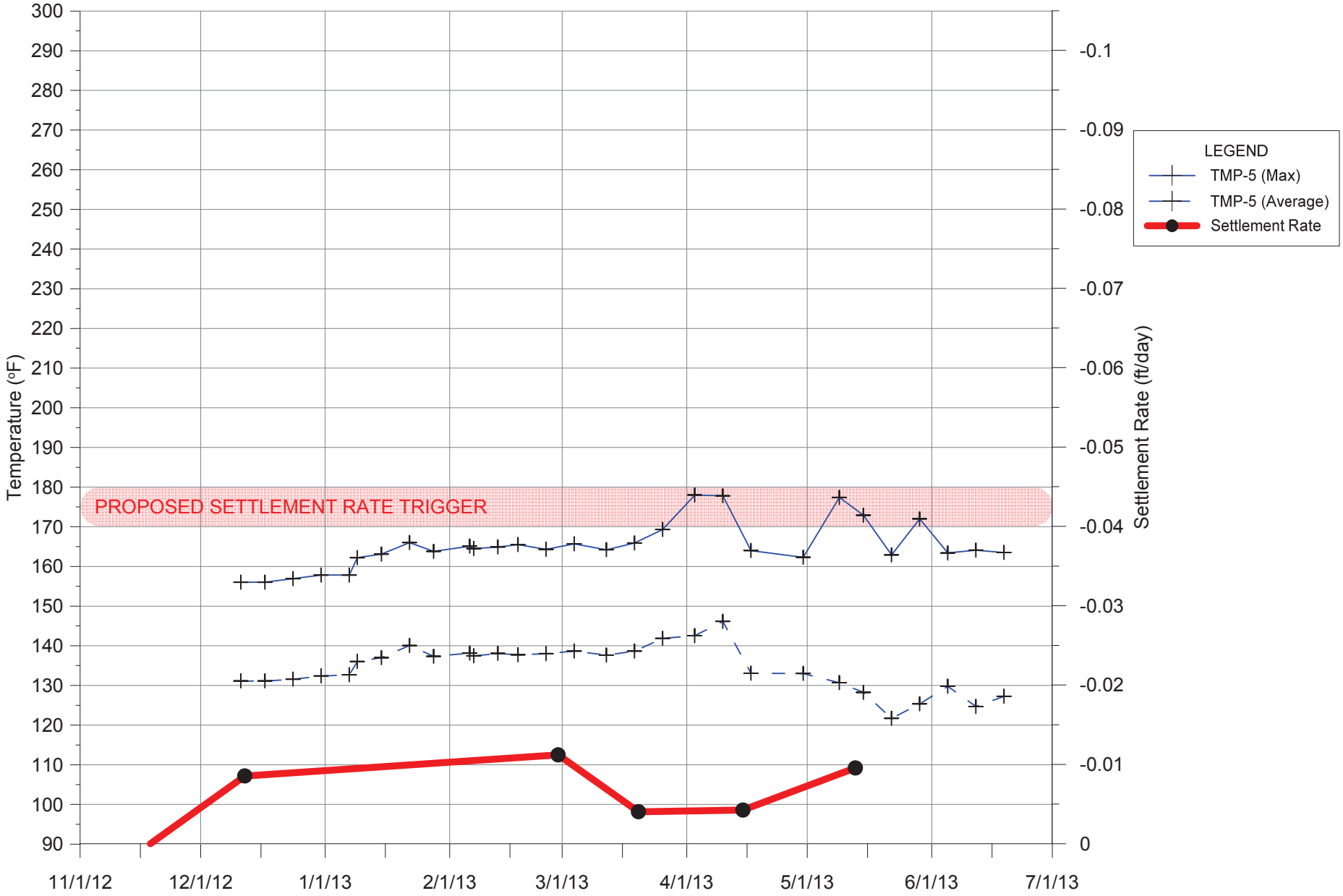
TMP-4



TMP TEMPERATURE AND
SETTLEMENT RATE
BRIDGETON LANDFILL

FIGURE E-4

TMP-5



TMP TEMPERATURE AND SETTLEMENT RATE BRIDGETON LANDFILL

FIGURE E-5

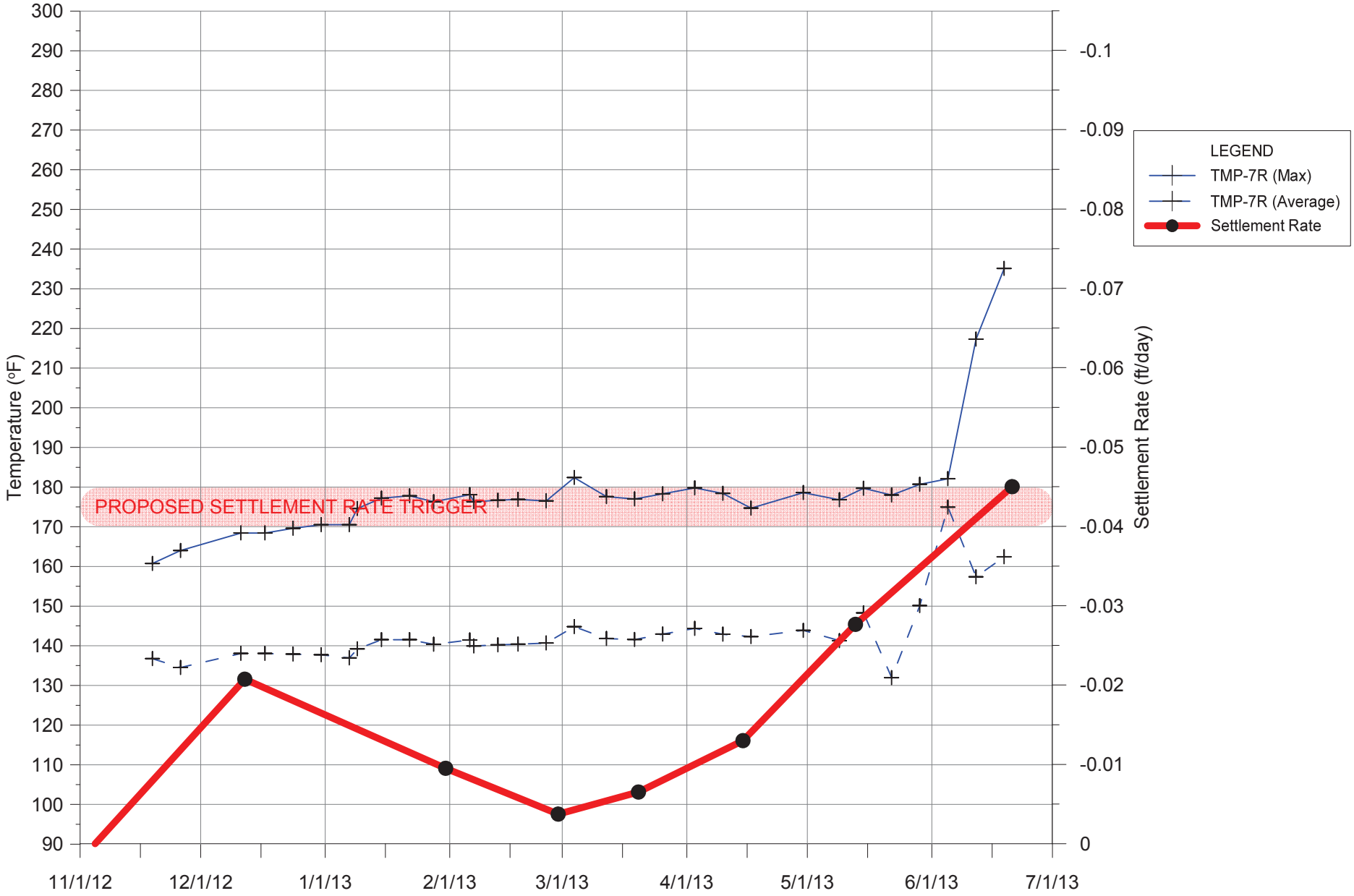
TMP-6



TMP TEMPERATURE AND SETTLEMENT RATE BRIDGETON LANDFILL

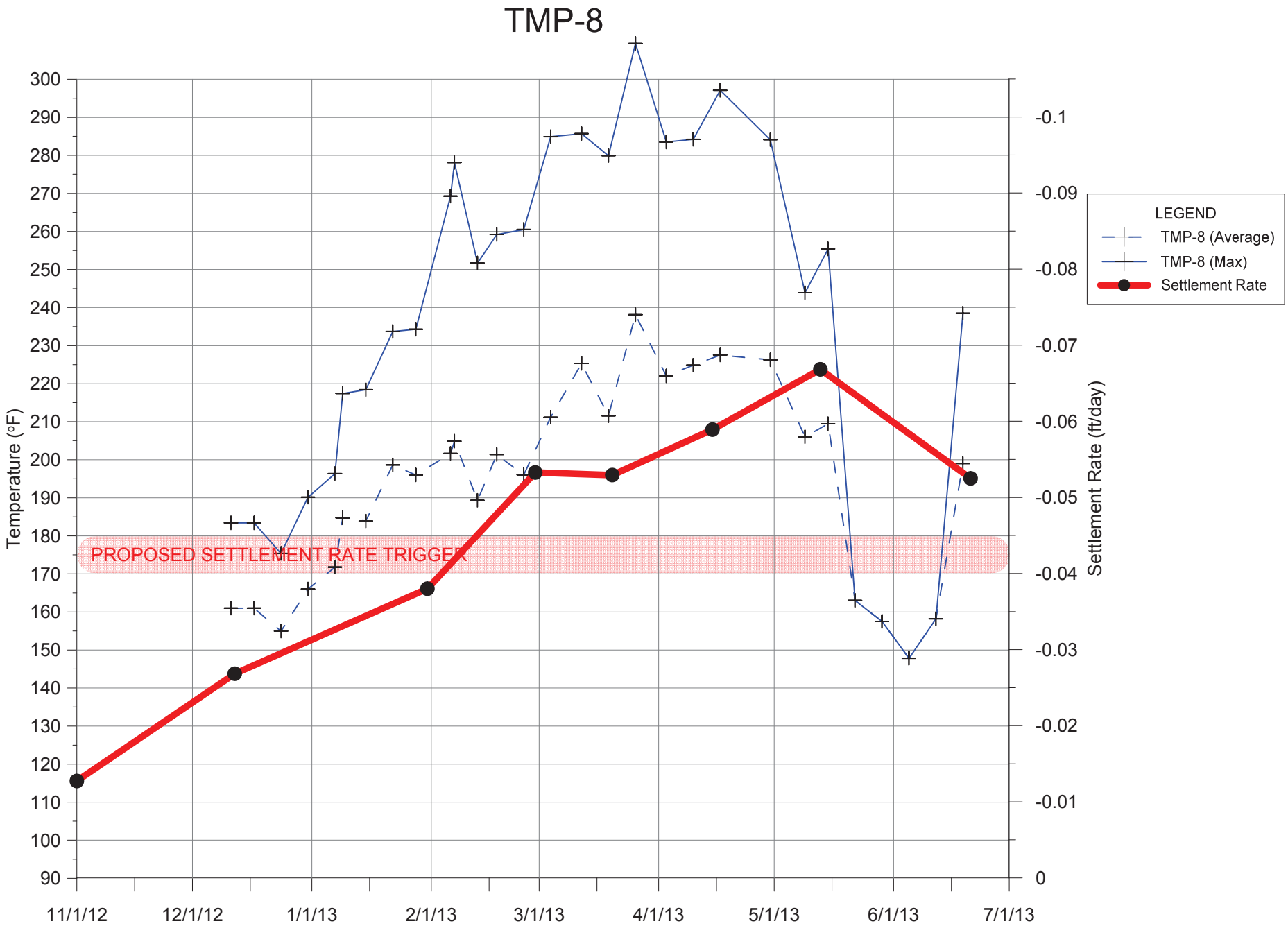
FIGURE E-6

TMP-7R



TMP TEMPERATURE AND SETTLEMENT RATE BRIDGETON LANDFILL

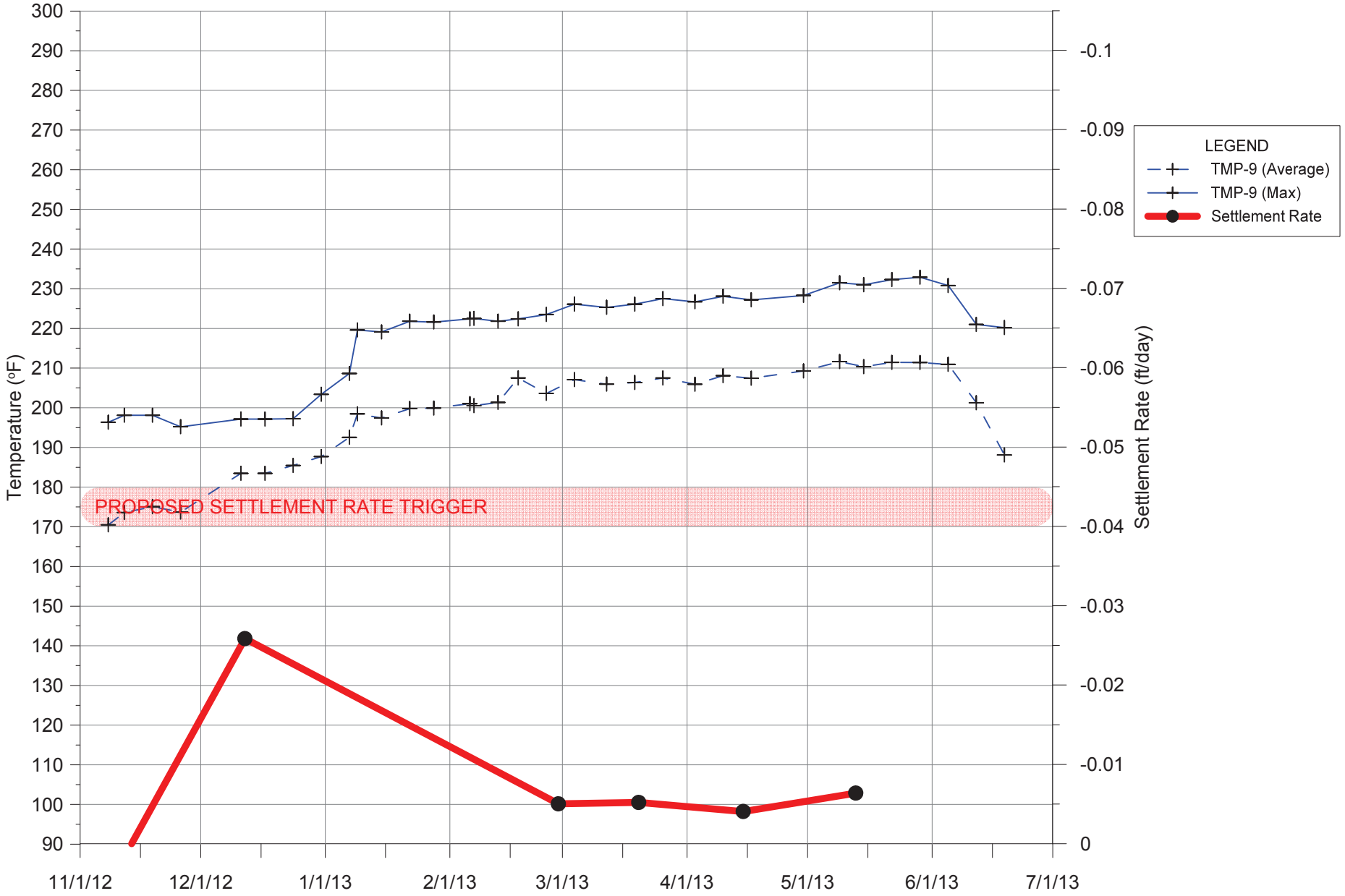
FIGURE E-7



TMP TEMPERATURE AND SETTLEMENT RATE BRIDGETON LANDFILL

FIGURE E-8

TMP-9



TMP TEMPERATURE AND SETTLEMENT RATE BRIDGETON LANDFILL

FIGURE E-9

TMP-10



TMP TEMPERATURE AND SETTLEMENT RATE BRIDGETON LANDFILL

FIGURE E-10

TMP-11



TMP TEMPERATURE AND SETTLEMENT RATE
BRIDGETON LANDFILL

FIGURE E-11

TMP-12



TMP TEMPERATURE AND SETTLEMENT RATE BRIDGETON LANDFILL

FIGURE E-12

TMP-13



TMP TEMPERATURE AND SETTLEMENT RATE BRIDGETON LANDFILL

FIGURE E-13

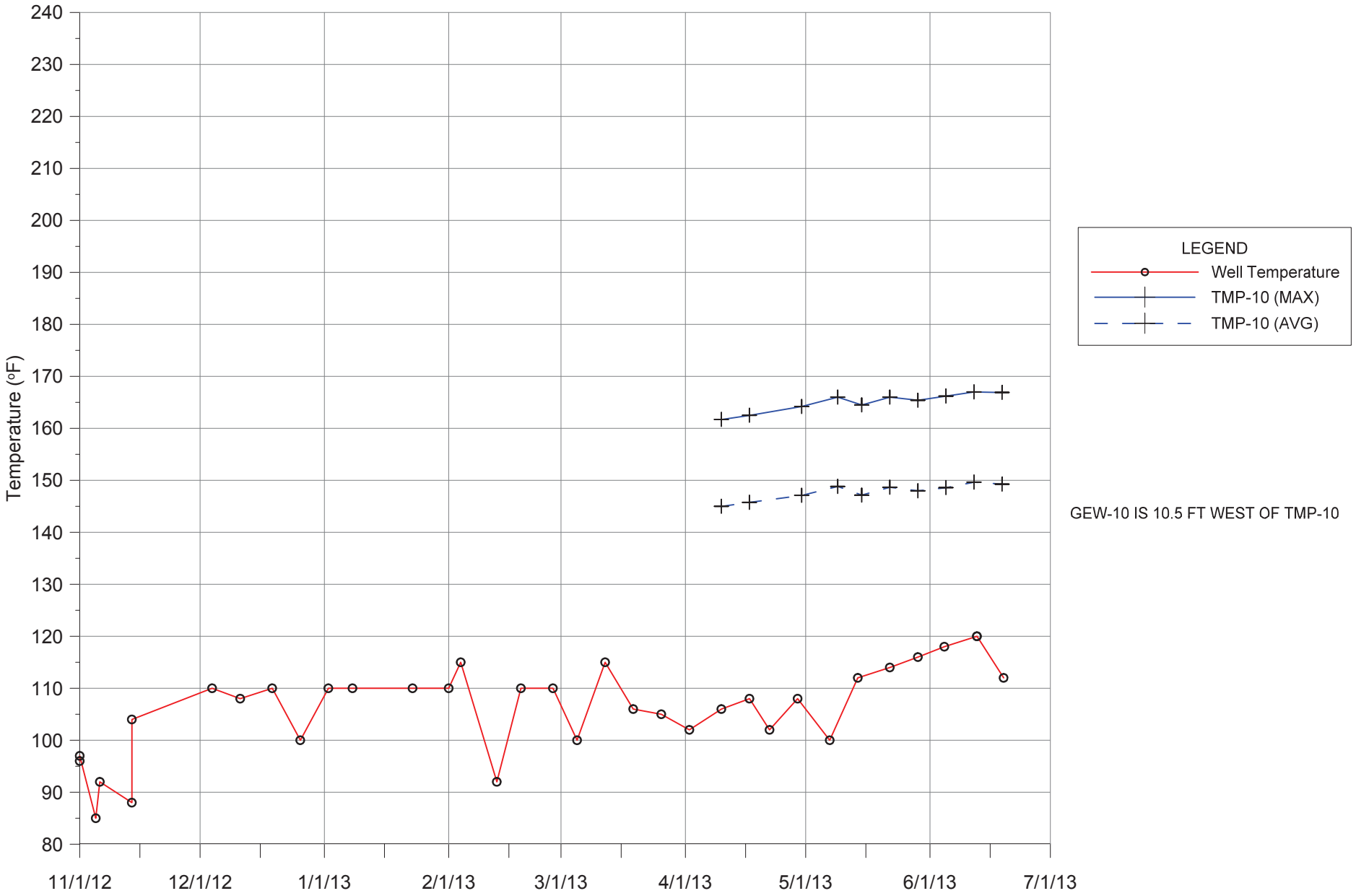
TMP-14



TMP TEMPERATURE AND SETTLEMENT RATE BRIDGETON LANDFILL

FIGURE E-14

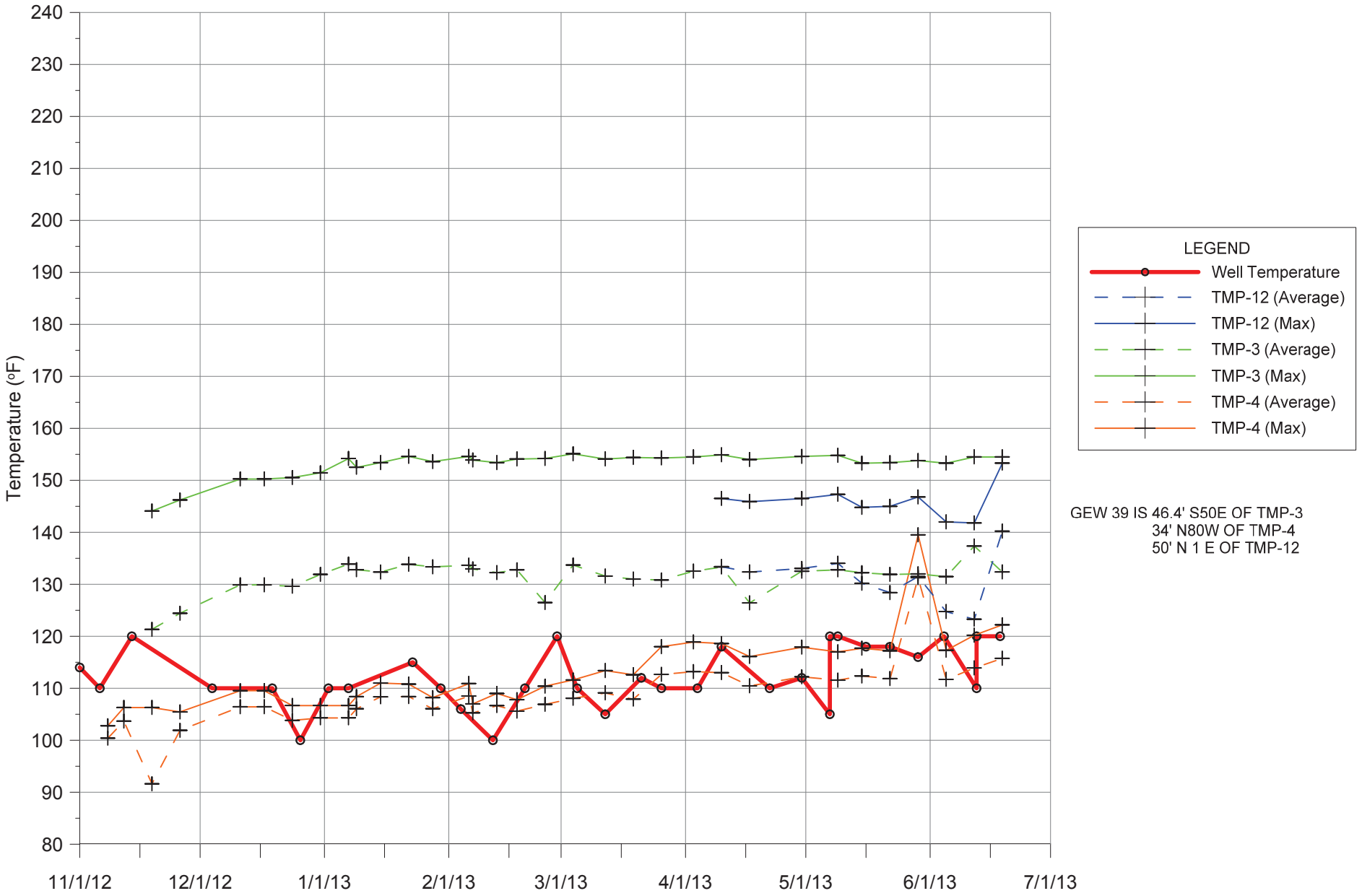
GEW-10



TEMPERATURE COMPARISON
BRIDGETON LANDFILL

FIGURE E-15

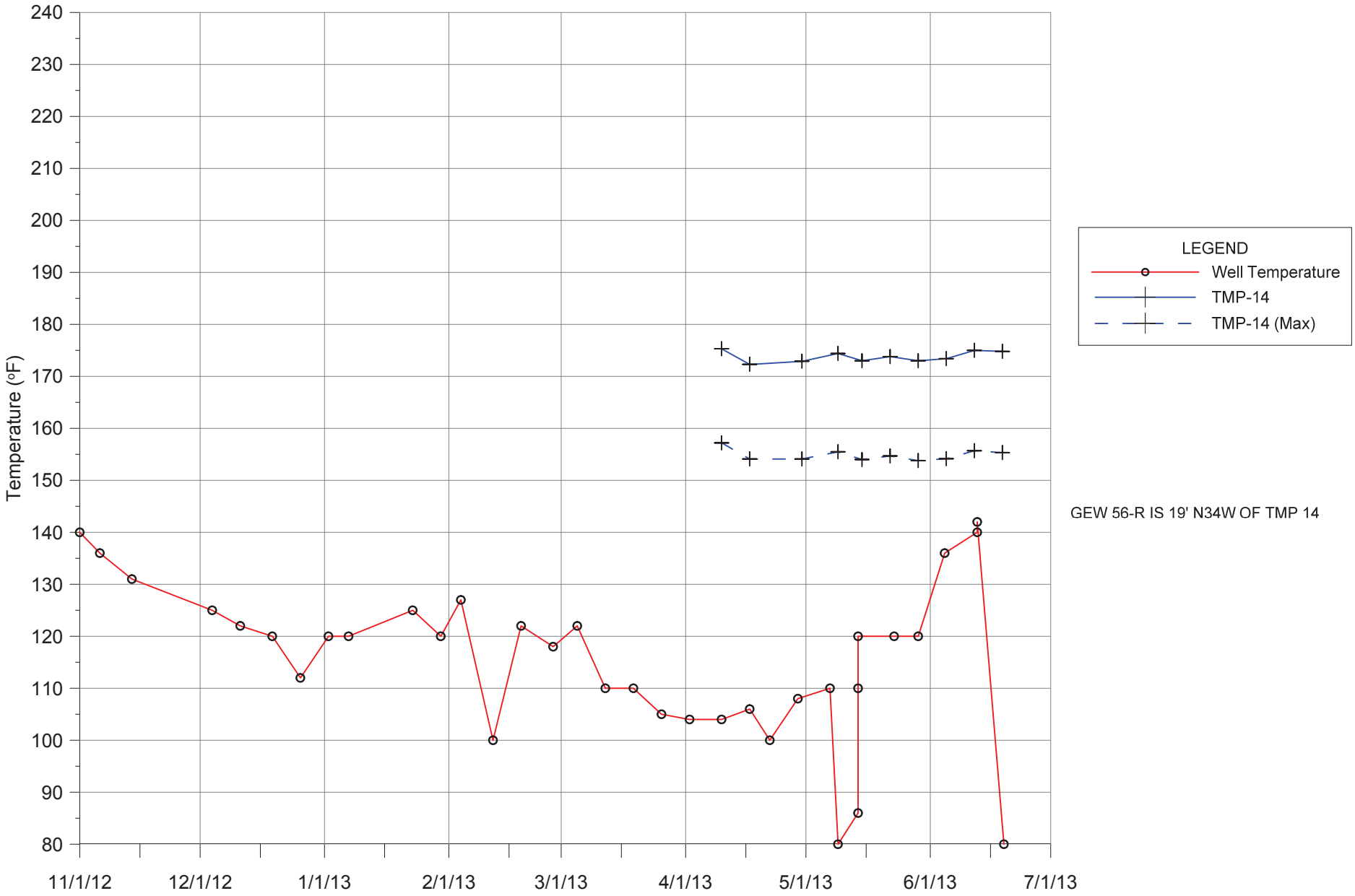
GEW-39



TEMPERATURE COMPARISON
BRIDGETON LANDFILL

FIGURE E-16

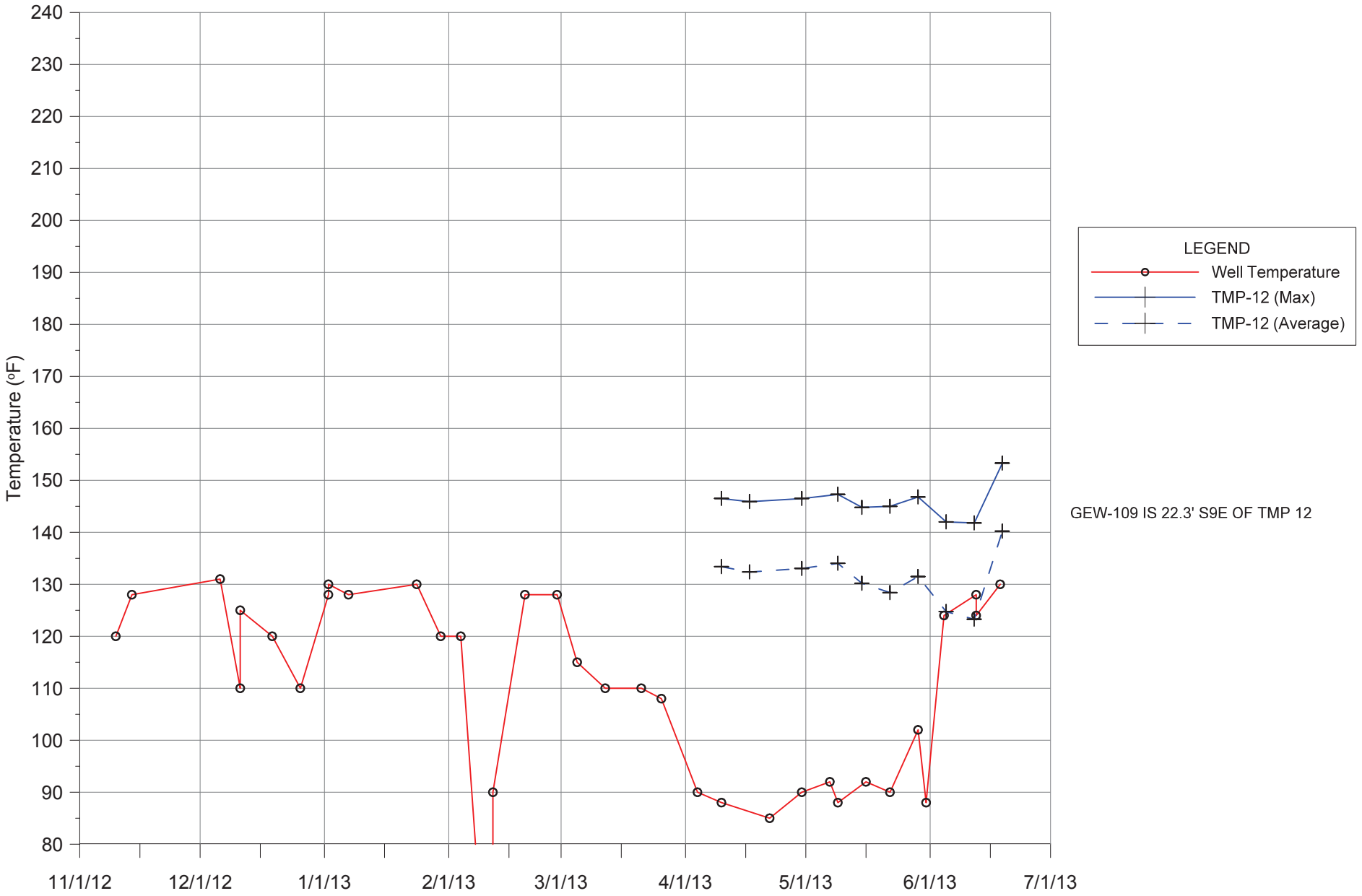
GEW-56R



TEMPERATURE COMPARISON
BRIDGETON LANDFILL

FIGURE E-17

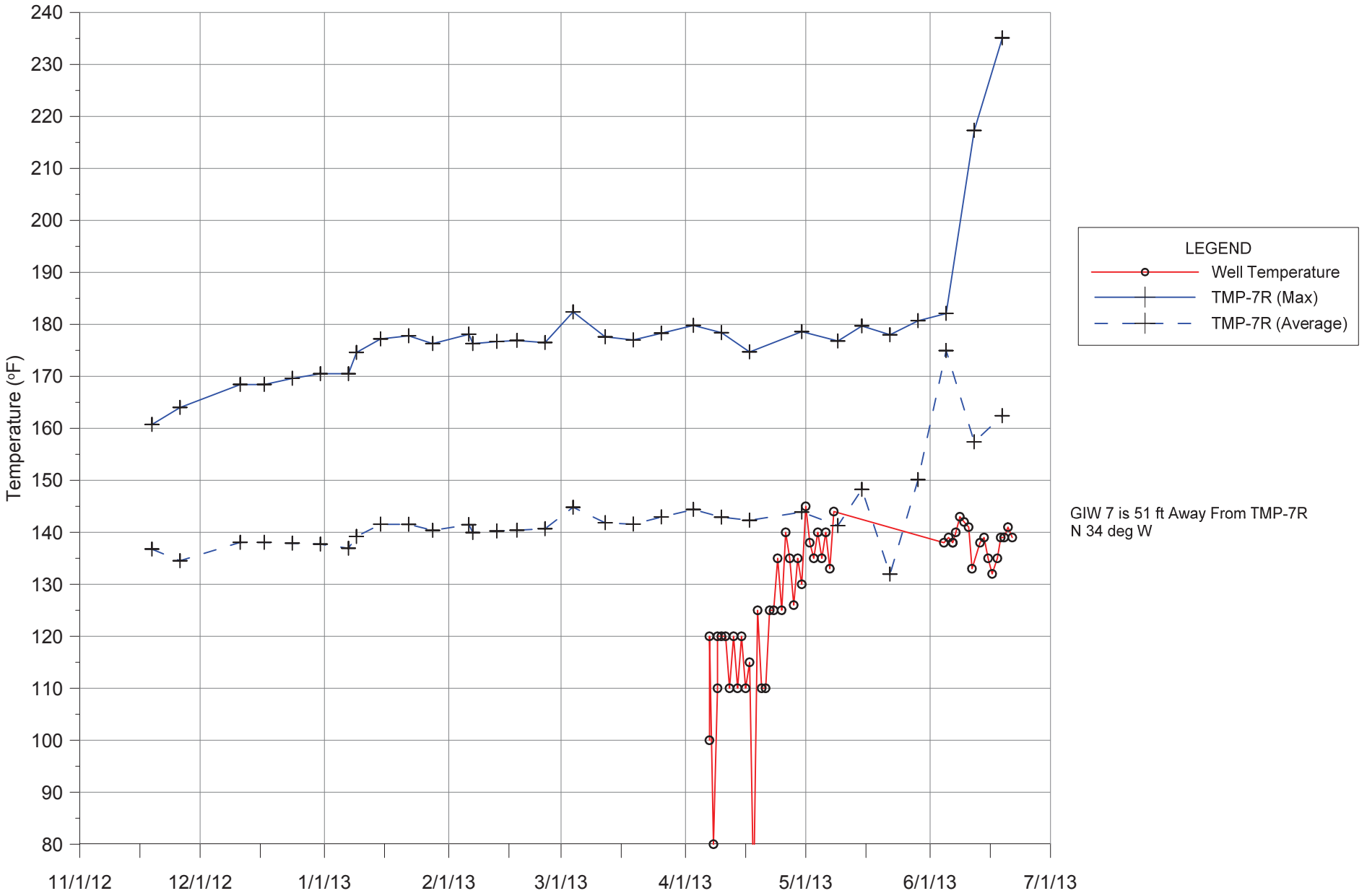
GEW-109



TEMPERATURE COMPARISON
BRIDGETON LANDFILL

FIGURE E-18

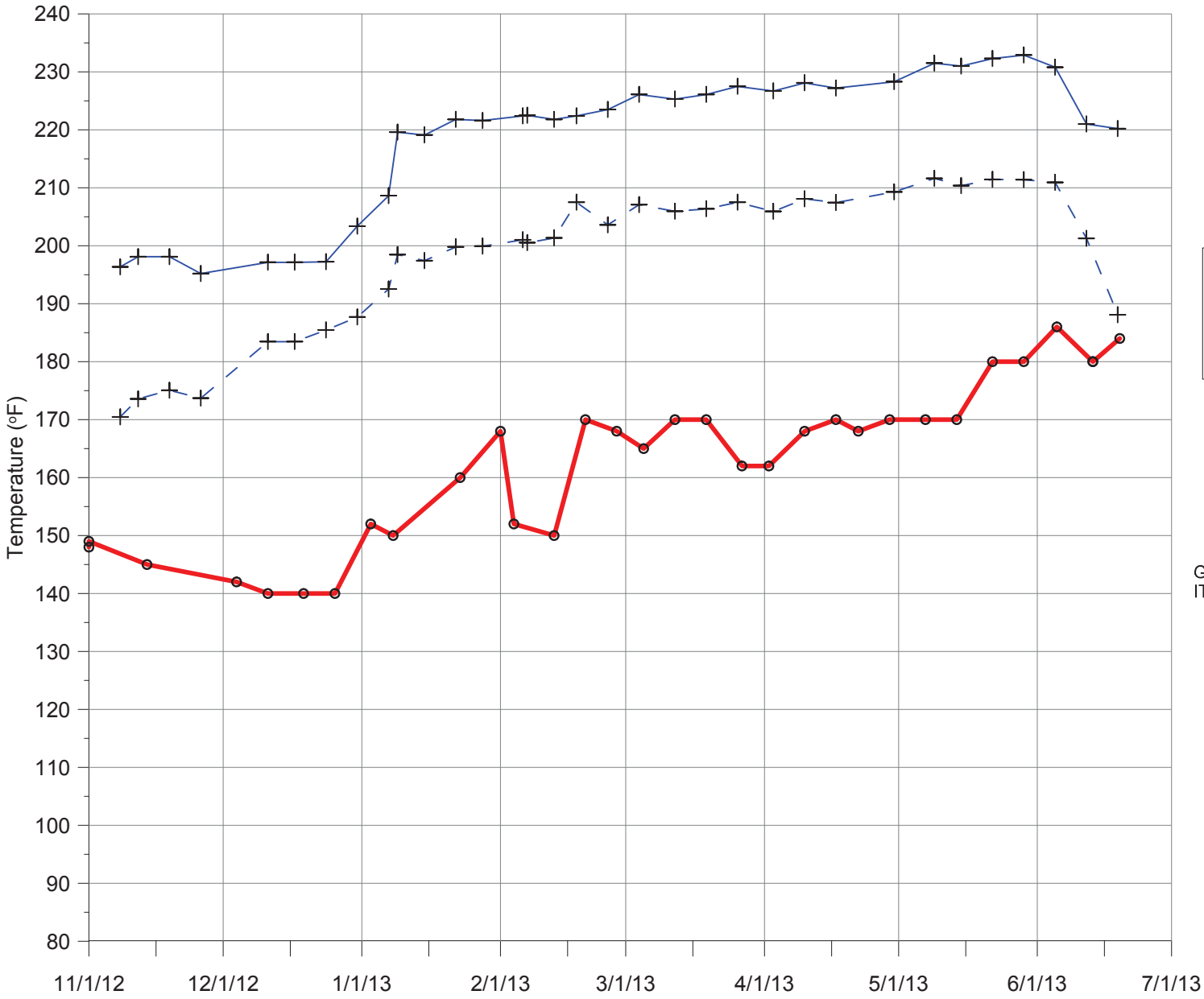
GIW-7



TEMPERATURE COMPARISON
BRIDGETON LANDFILL

FIGURE E-19

GEW-11



LEGEND
- Well Temperature
- TMP-9 (Average)
- TMP-9 (Max)

GEW-11 IS 17.1 FT N 57 DEG W OF TMP 9
IT IS 51 FEET DEEP

TEMPERATURE COMPARISON
BRIDGETON LANDFILL

FIGURE E-20

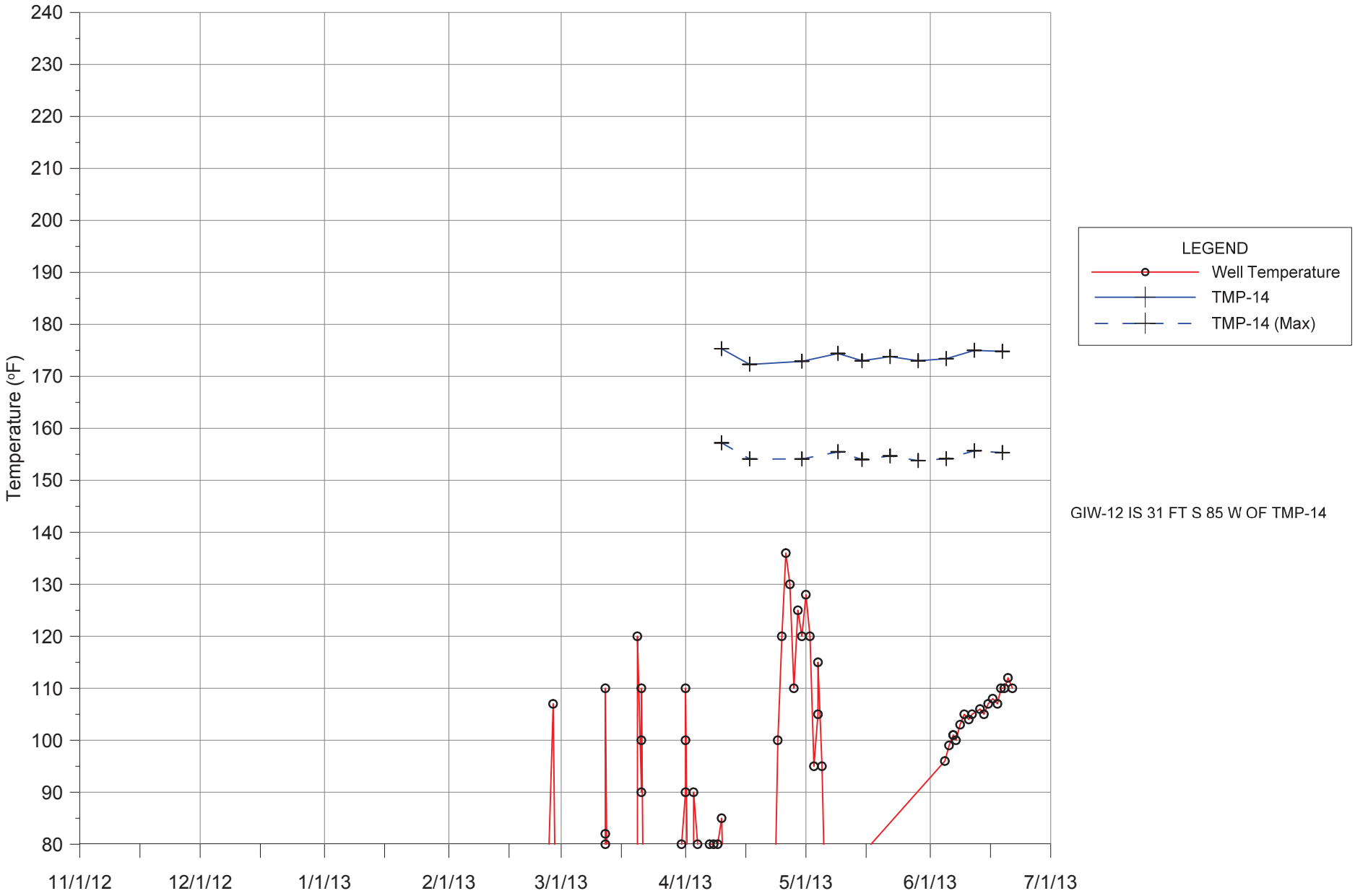
GIW-11



TEMPERATURE COMPARISON
BRIDGETON LANDFILL

FIGURE E-21

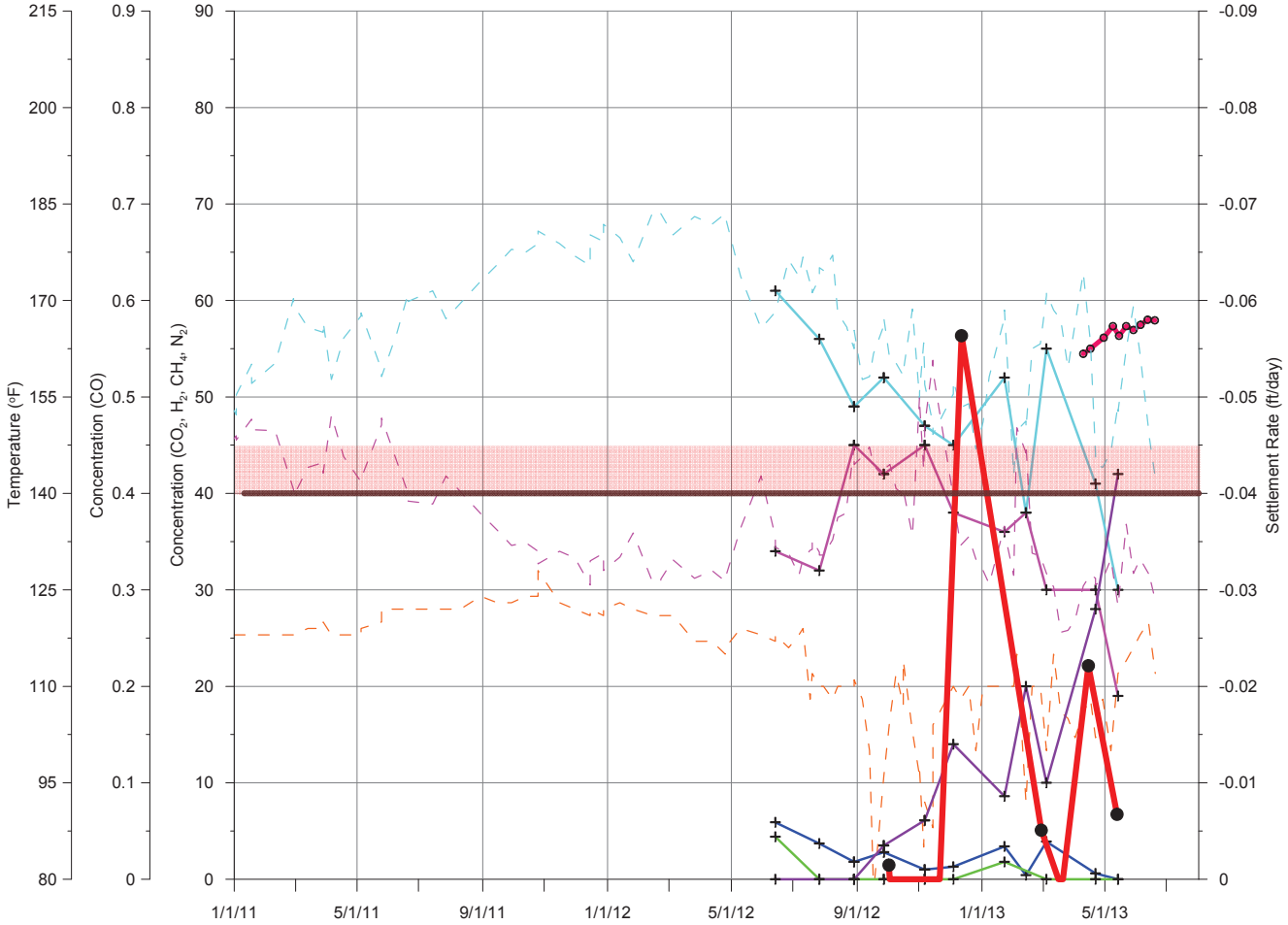
GIW-12



TEMPERATURE COMPARISON
BRIDGETON LANDFILL

FIGURE E-22

GEW-10



PROPOSED TRIGGER LEGEND
- CO
- Settlement Rate

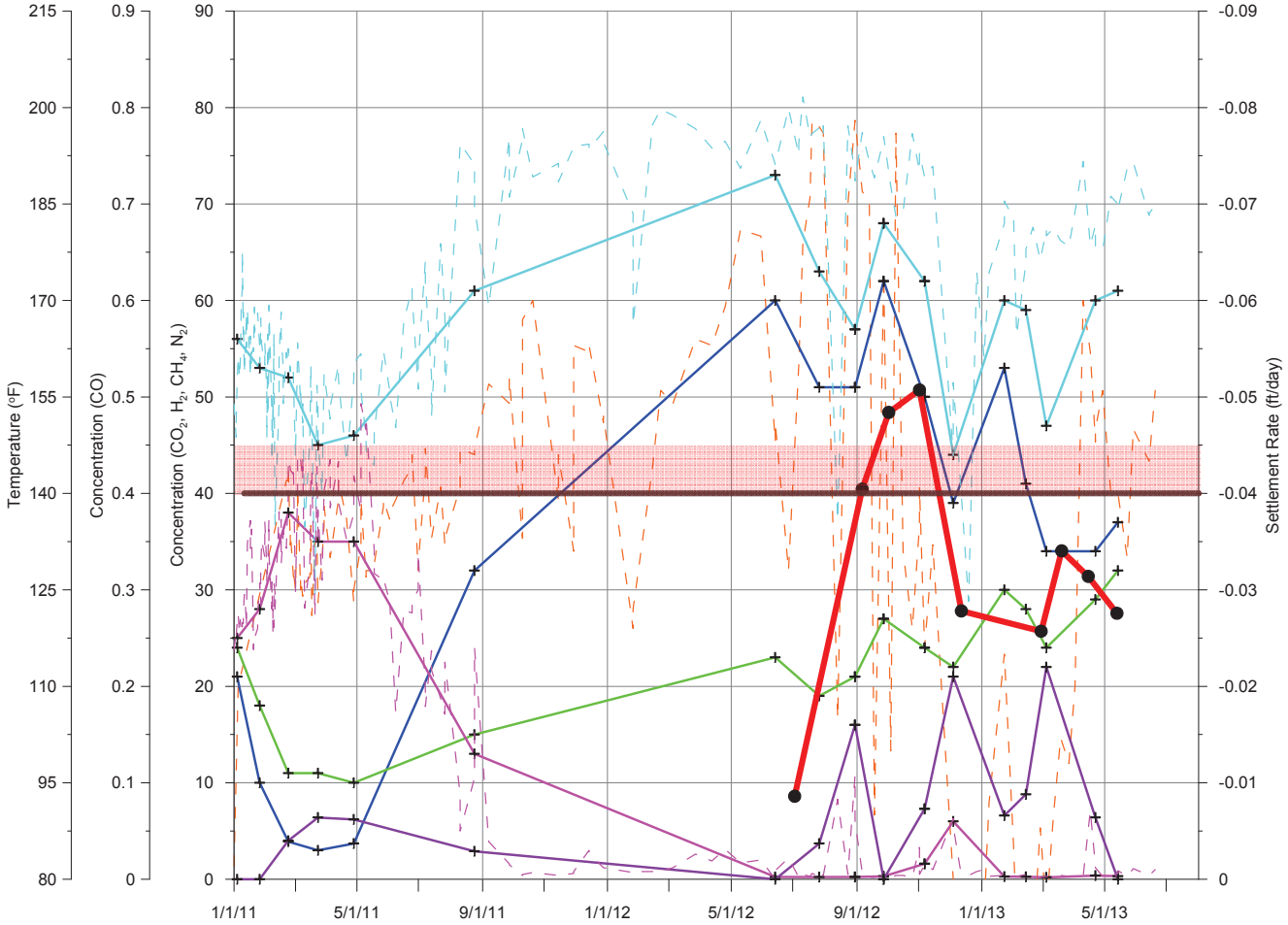
LEGEND
- Well Temperature
- CO_EDD
- CO2_EDD
- Hydrogen_EDD
- Methane_EDD
- Nitrogen_EDD
- Settlement
- TMP-10
- CO2_Multi
- Methane_Multi

Notes:
1. Concentrations are % v/v_{dry}.
2. EDD represents laboratory gas sample analysis.
3. Multi represenets field measured data.
4. Well temperatures are field measure data.

GAS CONCENTRATIONS,
TEMPERATURE, AND SETTLEMENT RATE
BRIDGETON LANDFILL

FIGURE E-23

GEW-12A



PROPOSED TRIGGER LEGEND
- CO
- Settlement Rate

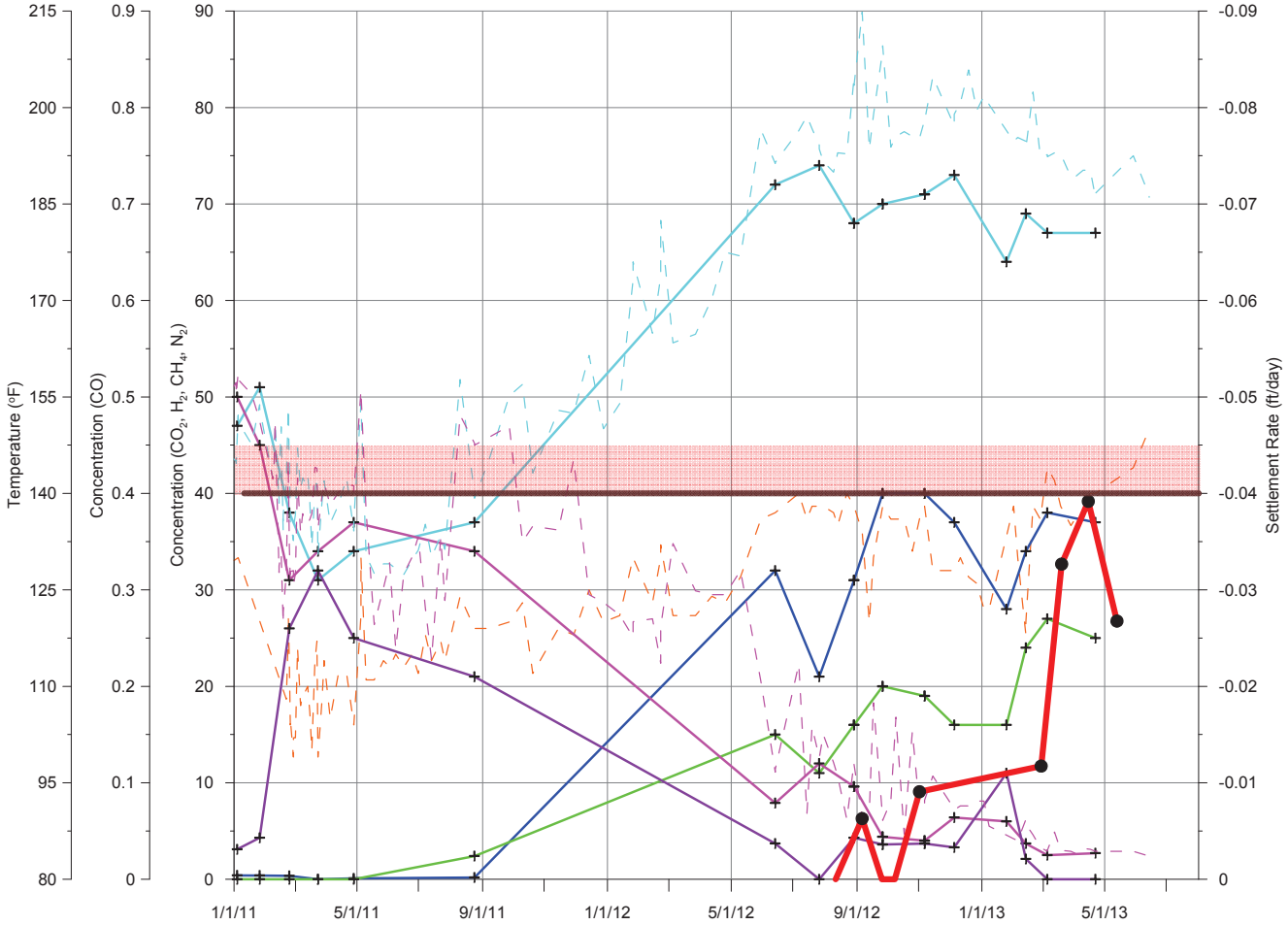
LEGEND
- Well Temperature
- CO_EDD
- CO2_EDD
- Hydrogen_EDD
- Methane_EDD
- Nitrogen_EDD
- Settlement
- CO2_Multi
- Methane_Multi

Notes:
1. Concentrations are % v/v_{dry}.
2. EDD represents laboratory gas sample analysis.
3. Multi represenets field measured data.
4. Well temperatures are field measure data.

GAS CONCENTRATIONS,
TEMPERATURE, AND SETTLEMENT RATE
BRIDGETON LANDFILL

FIGURE E-24

GEW-15



PROPOSED TRIGGER LEGEND
- CO
- Settlement Rate

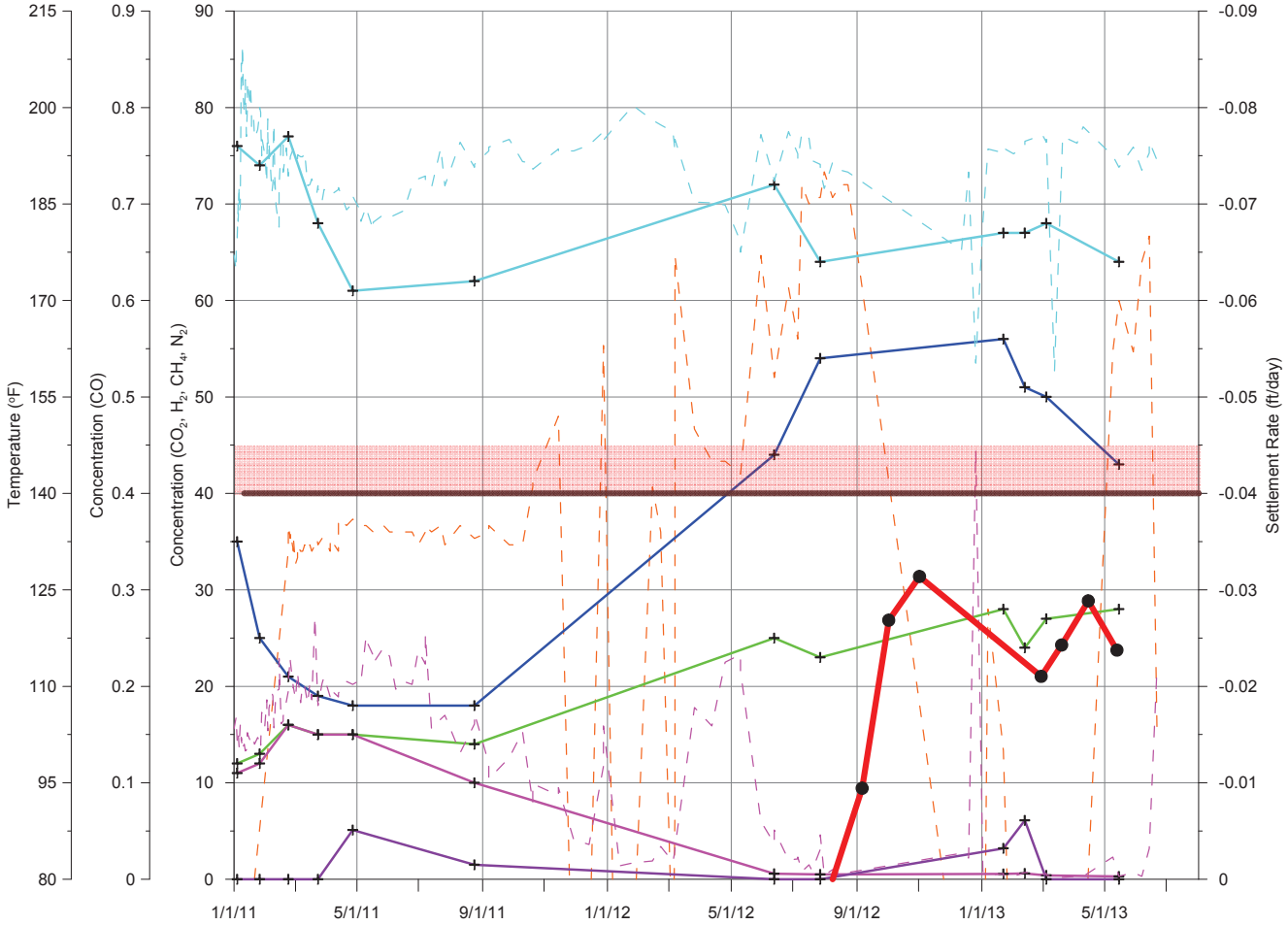
LEGEND
- Well Temperature
- CO_EDD
- CO2_EDD
- Hydrogen_EDD
- Methane_EDD
- Nitrogen_EDD
- Settlement
- CO2_Multi
- Methane_Multi

Notes:
1. Concentrations are % v/v_{dry}.
2. EDD represents laboratory gas sample analysis.
3. Multi represenets field measured data.
4. Well temperatures are field measure data.

GAS CONCENTRATIONS,
TEMPERATURE, AND SETTLEMENT RATE
BRIDGETON LANDFILL

FIGURE E-25

GEW-31R



PROPOSED TRIGGER LEGEND
- CO
- Settlement Rate

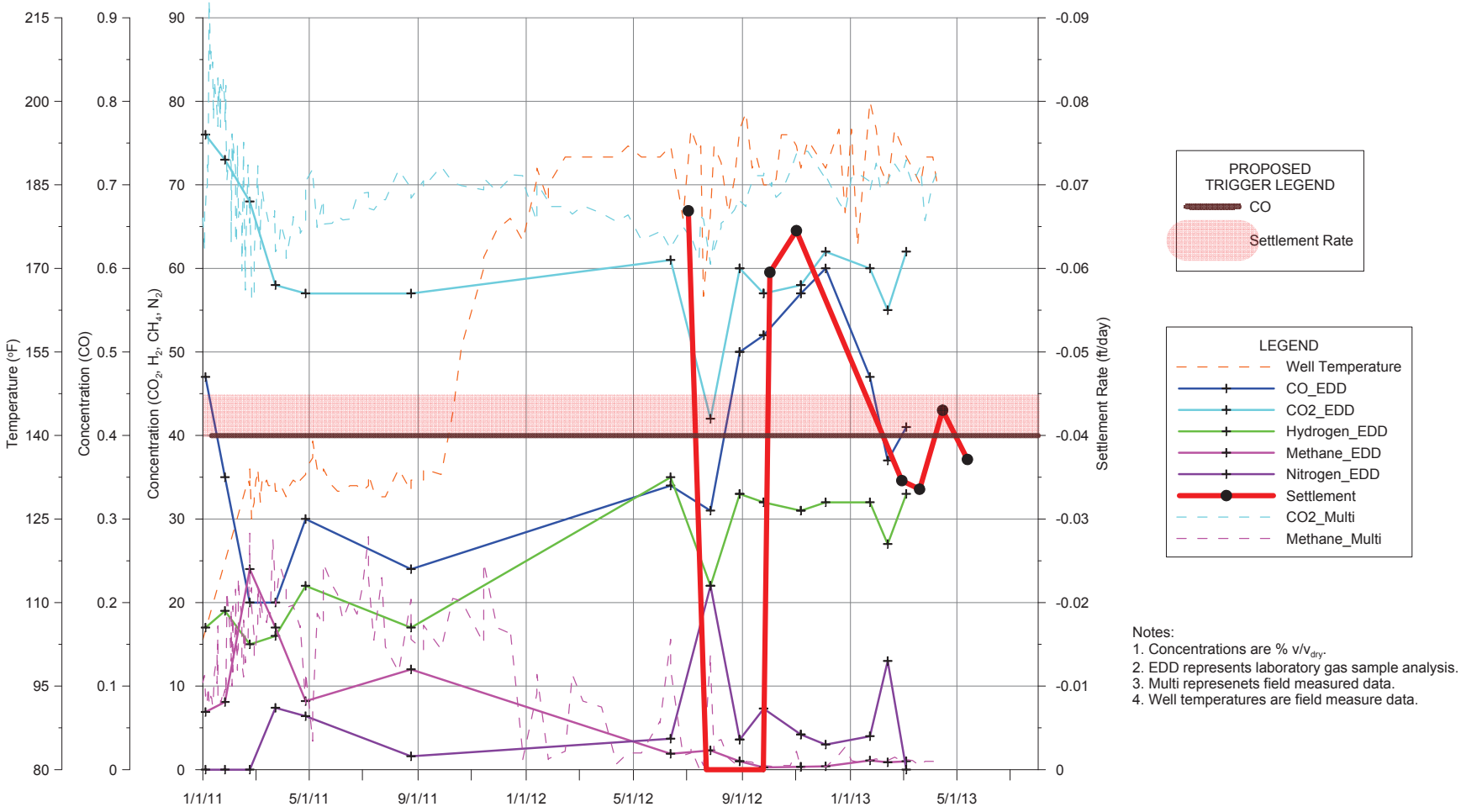
LEGEND
- Well Temperature
- CO_EDD
- CO2_EDD
- Hydrogen_EDD
- Methane_EDD
- Nitrogen_EDD
- Settlement
- CO2_Multi
- Methane_Multi

Notes:
1. Concentrations are % v/v_{dry}.
2. EDD represents laboratory gas sample analysis.
3. Multi represenets field measured data.
4. Well temperatures are field measure data.

GAS CONCENTRATIONS,
TEMPERATURE, AND SETTLEMENT RATE
BRIDGETON LANDFILL

FIGURE E-26

GEW-32R

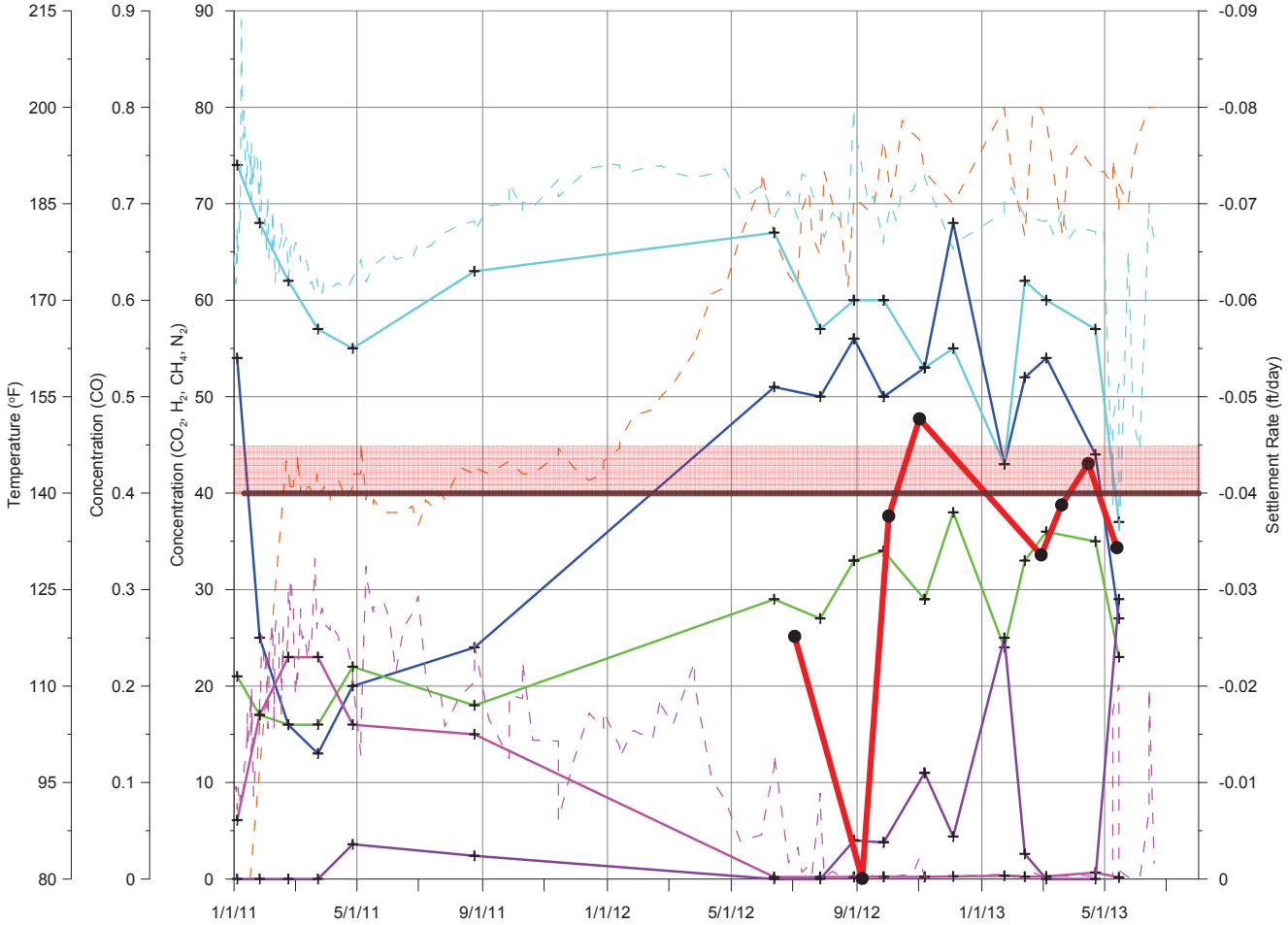


Notes:
1. Concentrations are % v/v_{dry}.
2. EDD represents laboratory gas sample analysis.
3. Multi represenets field measured data.
4. Well temperatures are field measure data.

GAS CONCENTRATIONS,
TEMPERATURE, AND SETTLEMENT RATE
BRIDGETON LANDFILL

FIGURE E-27

GEW-33R



PROPOSED TRIGGER LEGEND
- CO
- Settlement Rate

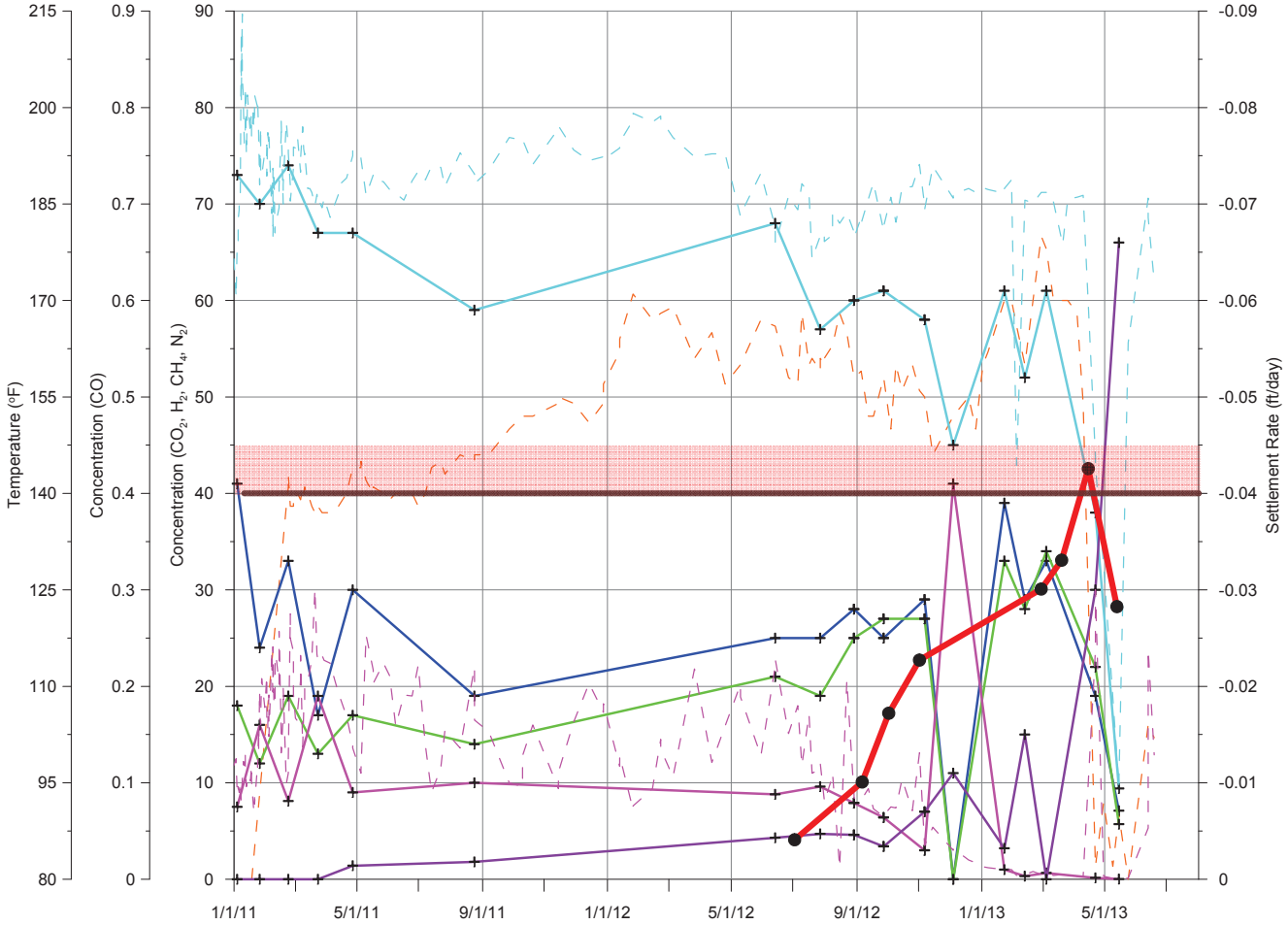
LEGEND
- Well Temperature
- CO_EDD
- CO2_EDD
- Hydrogen_EDD
- Methane_EDD
- Nitrogen_EDD
- Settlement
- CO2_Multi
- Methane_Multi

Notes:
1. Concentrations are % v/v_{dry}.
2. EDD represents laboratory gas sample analysis.
3. Multi represenets field measured data.
4. Well temperatures are field measure data.

GAS CONCENTRATIONS,
TEMPERATURE, AND SETTLEMENT RATE
BRIDGETON LANDFILL

FIGURE E-28

GEW-36



PROPOSED TRIGGER LEGEND
- CO
- Settlement Rate

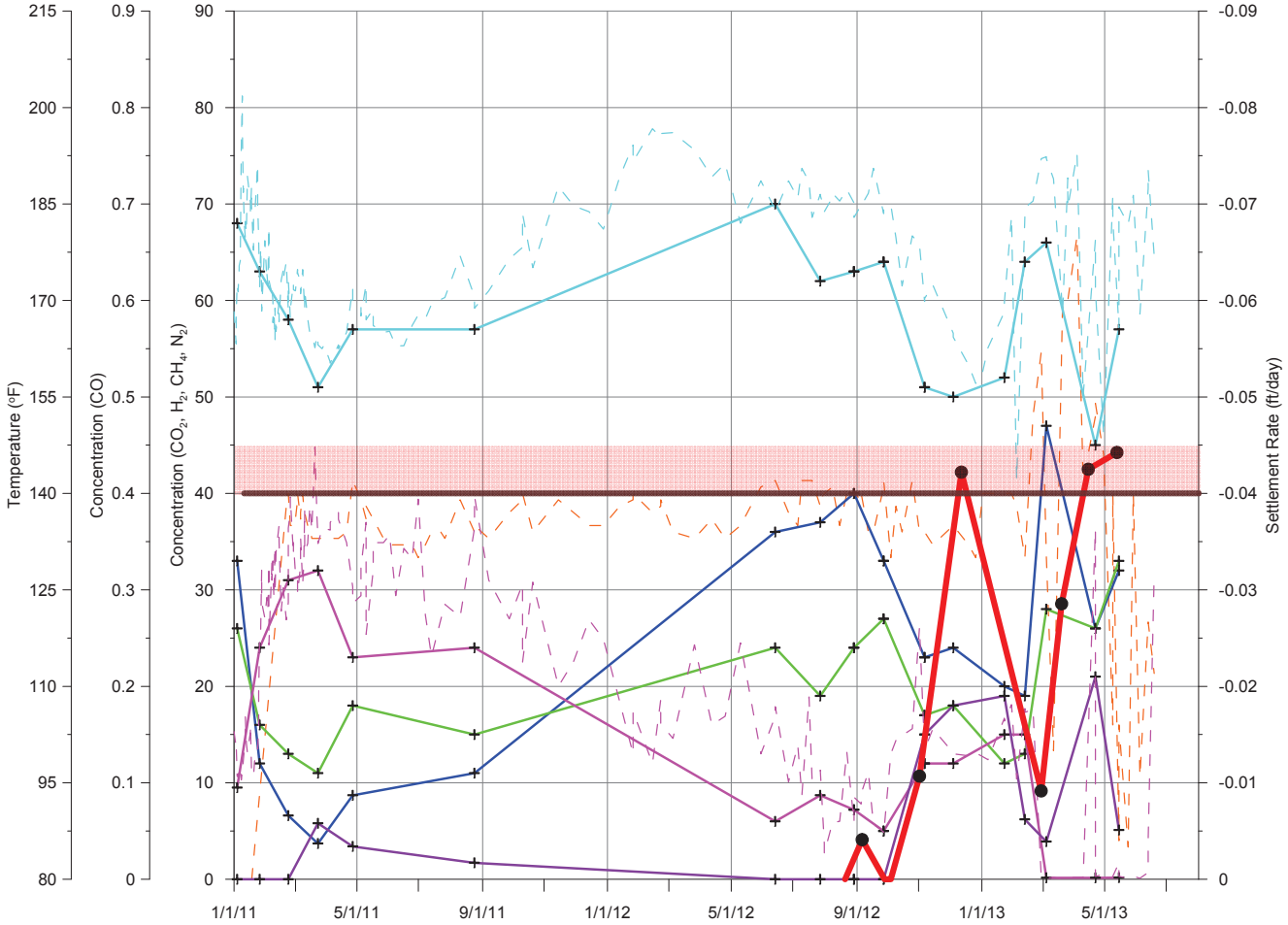
LEGEND
- Well Temperature
- CO_EDD
- CO2_EDD
- Hydrogen_EDD
- Methane_EDD
- Nitrogen_EDD
- Settlement
- CO2_Multi
- Methane_Multi

Notes:
1. Concentrations are % v/v_{dry}.
2. EDD represents laboratory gas sample analysis.
3. Multi represenets field measured data.
4. Well temperatures are field measure data.

GAS CONCENTRATIONS,
TEMPERATURE, AND SETTLEMENT RATE
BRIDGETON LANDFILL

FIGURE E-29

GEW-37



PROPOSED TRIGGER LEGEND
- CO
- Settlement Rate

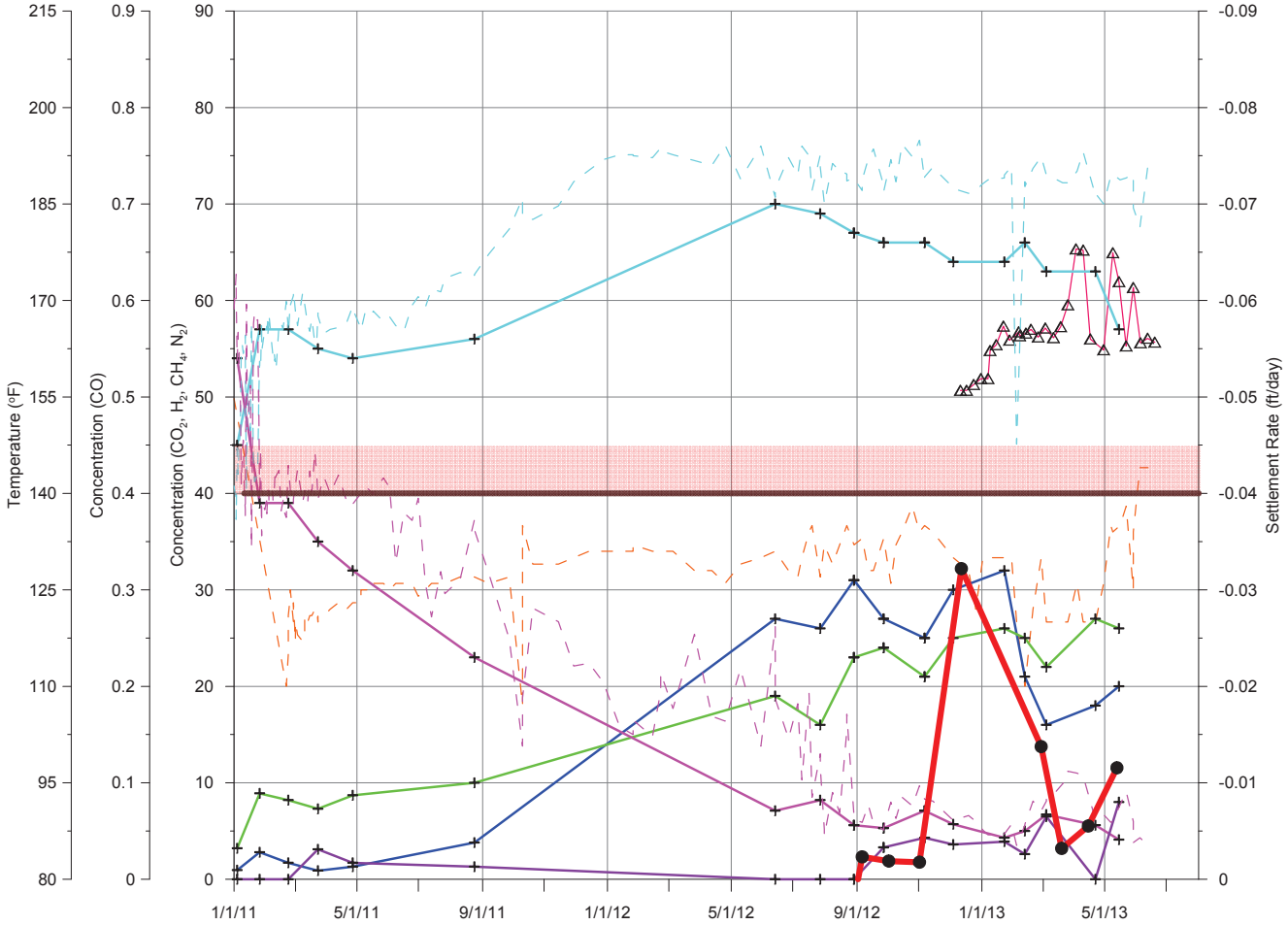
LEGEND
- Well Temperature
- CO_EDD
- CO2_EDD
- Hydrogen_EDD
- Methane_EDD
- Nitrogen_EDD
- Settlement
- CO2_Multi
- Methane_Multi

Notes:
1. Concentrations are % v/v_{dry}.
2. EDD represents laboratory gas sample analysis.
3. Multi represenets field measured data.
4. Well temperatures are field measure data.

GAS CONCENTRATIONS,
TEMPERATURE, AND SETTLEMENT RATE
BRIDGETON LANDFILL

FIGURE E-30

GEW-38



PROPOSED TRIGGER LEGEND
- CO
- Settlement Rate

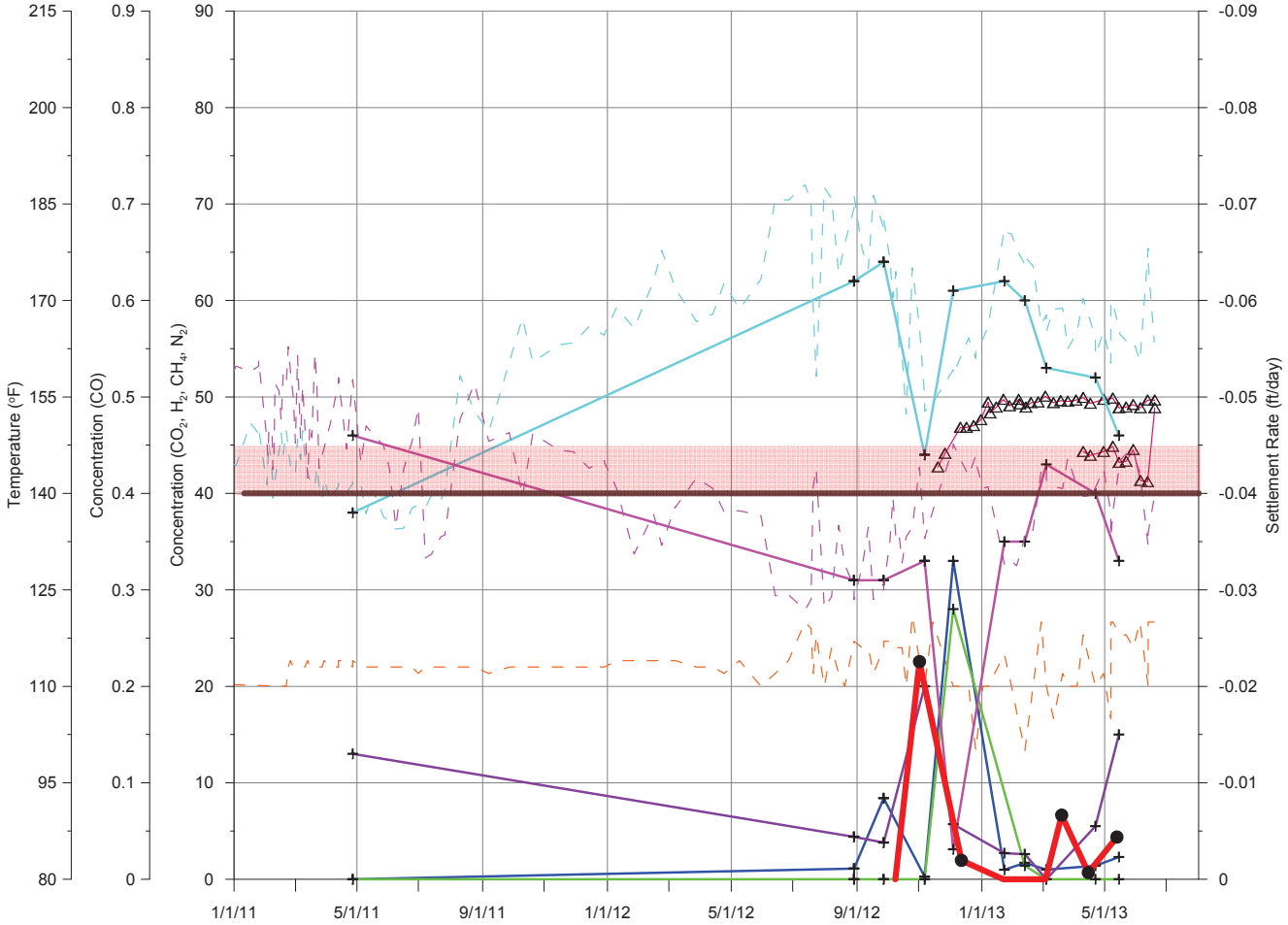
LEGEND
- Well Temperature
- CO_EDD
- CO2_EDD
- Hydrogen_EDD
- Methane_EDD
- Nitrogen_EDD
- Settlement
- CO2_Multi
- Methane_Multi
- TMP-5

Notes:
1. Concentrations are % v/v_{dry}.
2. EDD represents laboratory gas sample analysis.
3. Multi represenets field measured data.
4. Well temperatures are field measure data.

GAS CONCENTRATIONS,
TEMPERATURE, AND SETTLEMENT RATE
BRIDGETON LANDFILL

FIGURE E-31

GEW-39



PROPOSED TRIGGER LEGEND
- CO
- Settlement Rate

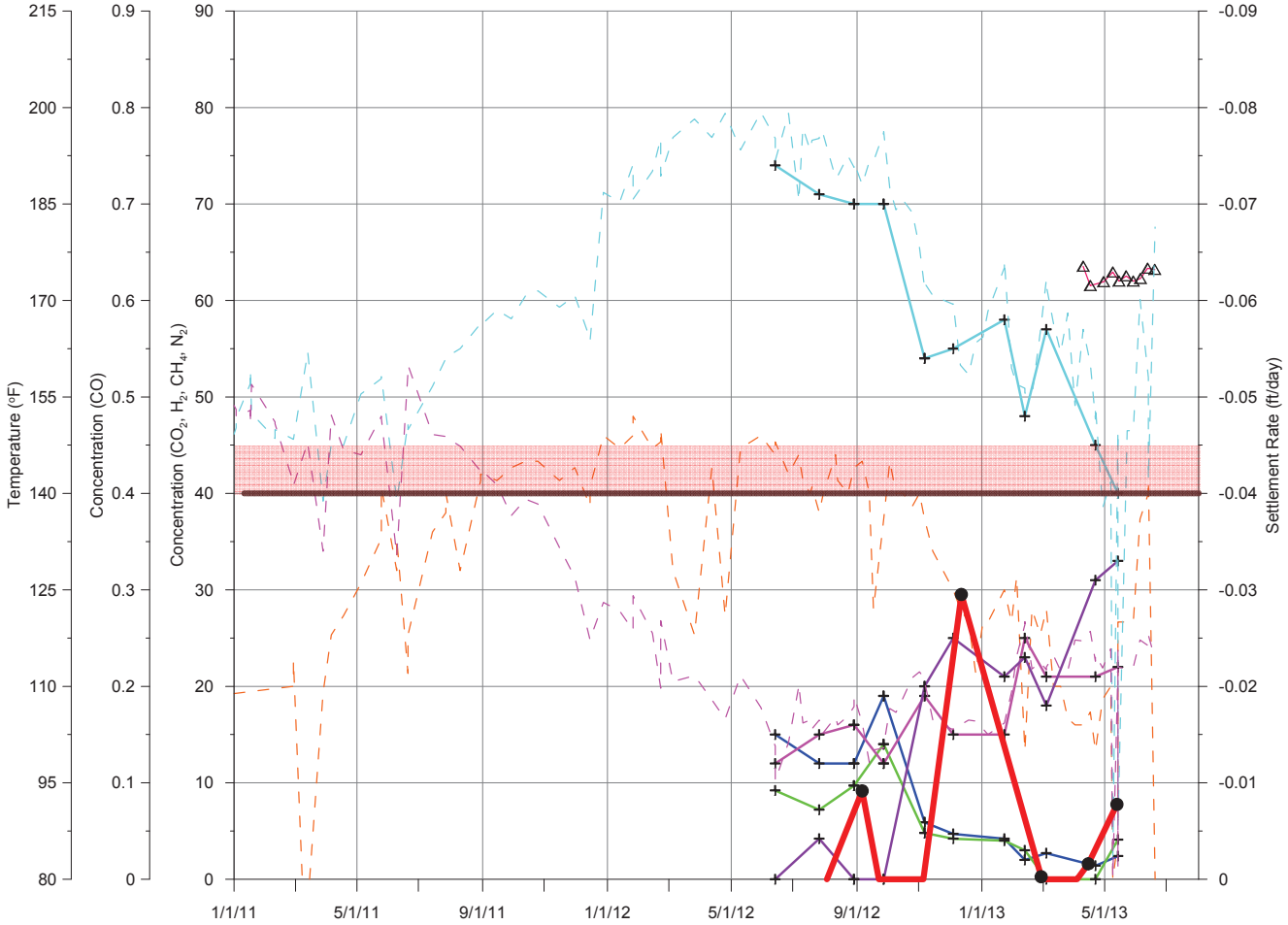
LEGEND
- Well Temperature
- CO_EDD
- CO2_EDD
- Hydrogen_EDD
- Methane_EDD
- Nitrogen_EDD
- Settlement
- CO2_Multi
- Methane_Multi
- TMP-3
- TMP-12

Notes:
1. Concentrations are % v/v_{dry}.
2. EDD represents laboratory gas sample analysis.
3. Multi represenets field measured data.
4. Well temperatures are field measure data.

GAS CONCENTRATIONS,
TEMPERATURE, AND SETTLEMENT RATE
BRIDGETON LANDFILL

FIGURE E-32

GEW-56R



PROPOSED TRIGGER LEGEND
- CO
- Settlement Rate

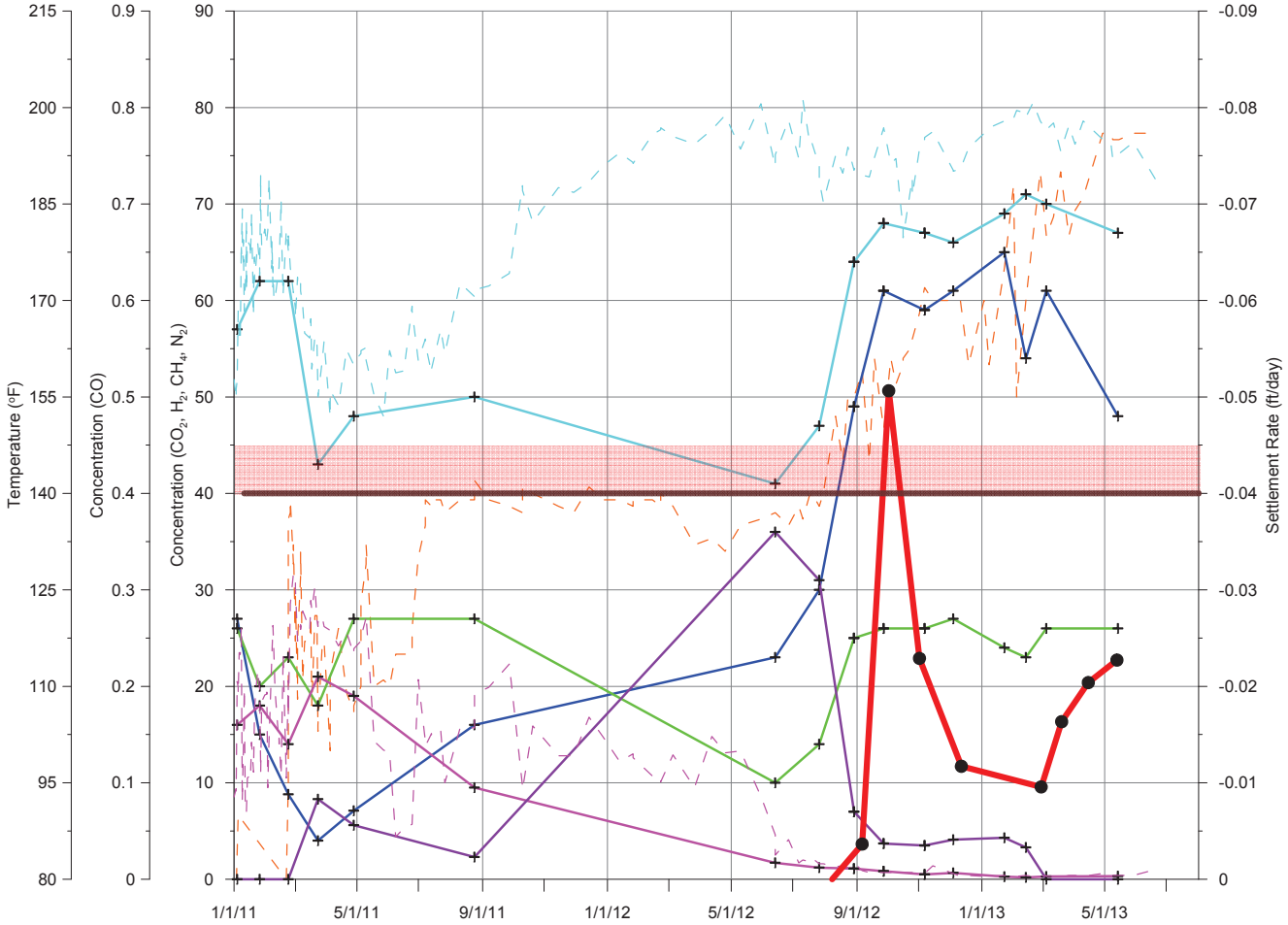
LEGEND
- Well Temperature
- CO_EDD
- CO2_EDD
- Hydrogen_EDD
- Methane_EDD
- Nitrogen_EDD
- Settlement
- CO2_Multi
- Methane_Multi
- TMP-14

Notes:
1. Concentrations are % v/v_{dry}.
2. EDD represents laboratory gas sample analysis.
3. Multi represenets field measured data.
4. Well temperatures are field measure data.

GAS CONCENTRATIONS,
TEMPERATURE, AND SETTLEMENT RATE
BRIDGETON LANDFILL

FIGURE E-33

GEW-63



PROPOSED TRIGGER LEGEND
- CO
- Settlement Rate

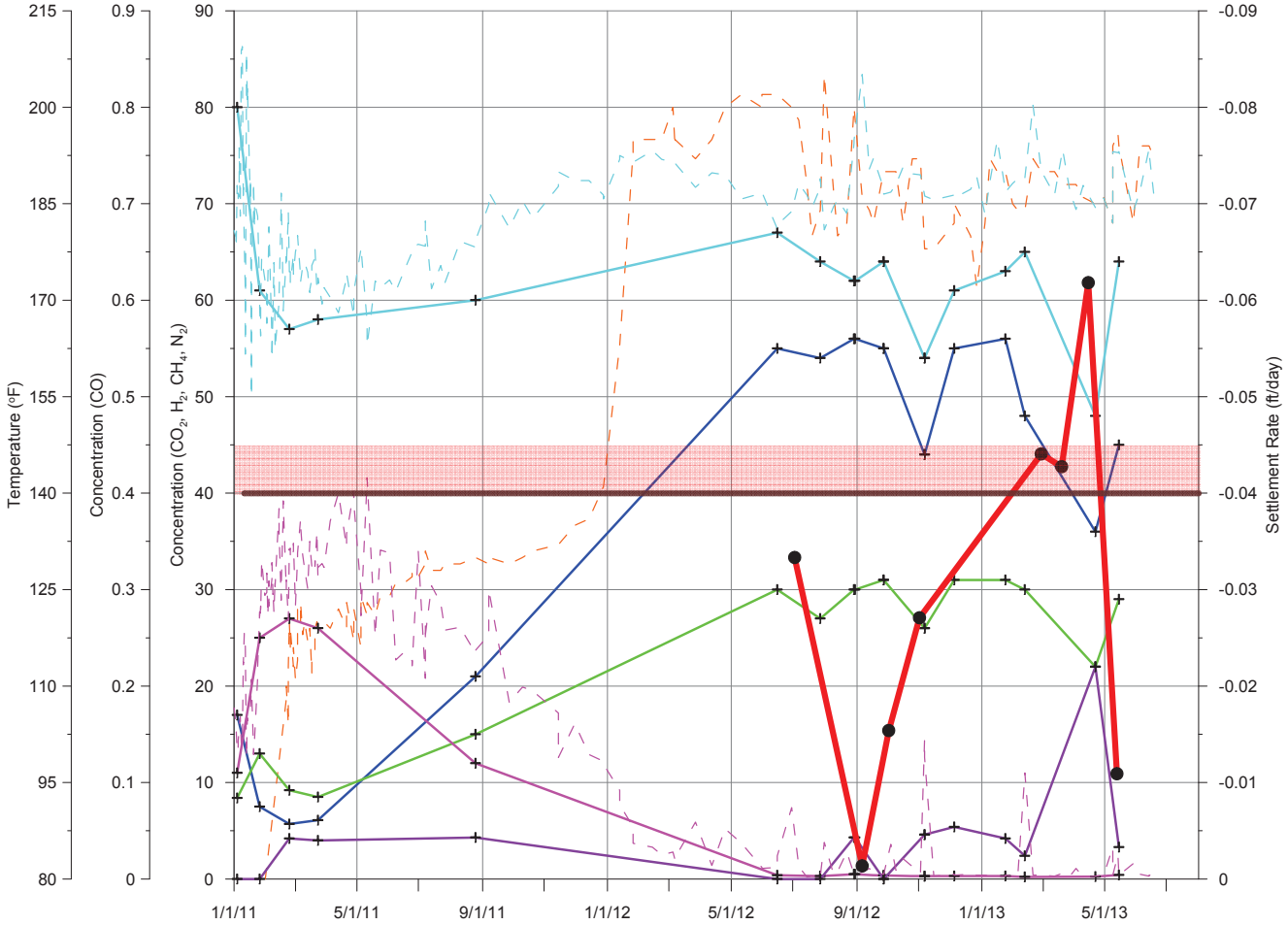
LEGEND
- Well Temperature
- CO_EDD
- CO2_EDD
- Hydrogen_EDD
- Methane_EDD
- Nitrogen_EDD
- Settlement
- CO2_Multi
- Methane_Multi

Notes:
1. Concentrations are % v/v_{dry}.
2. EDD represents laboratory gas sample analysis.
3. Multi represenets field measured data.
4. Well temperatures are field measure data.

GAS CONCENTRATIONS,
TEMPERATURE, AND SETTLEMENT RATE
BRIDGETON LANDFILL

FIGURE E-34

GEW-64



PROPOSED TRIGGER LEGEND
- CO
- Settlement Rate

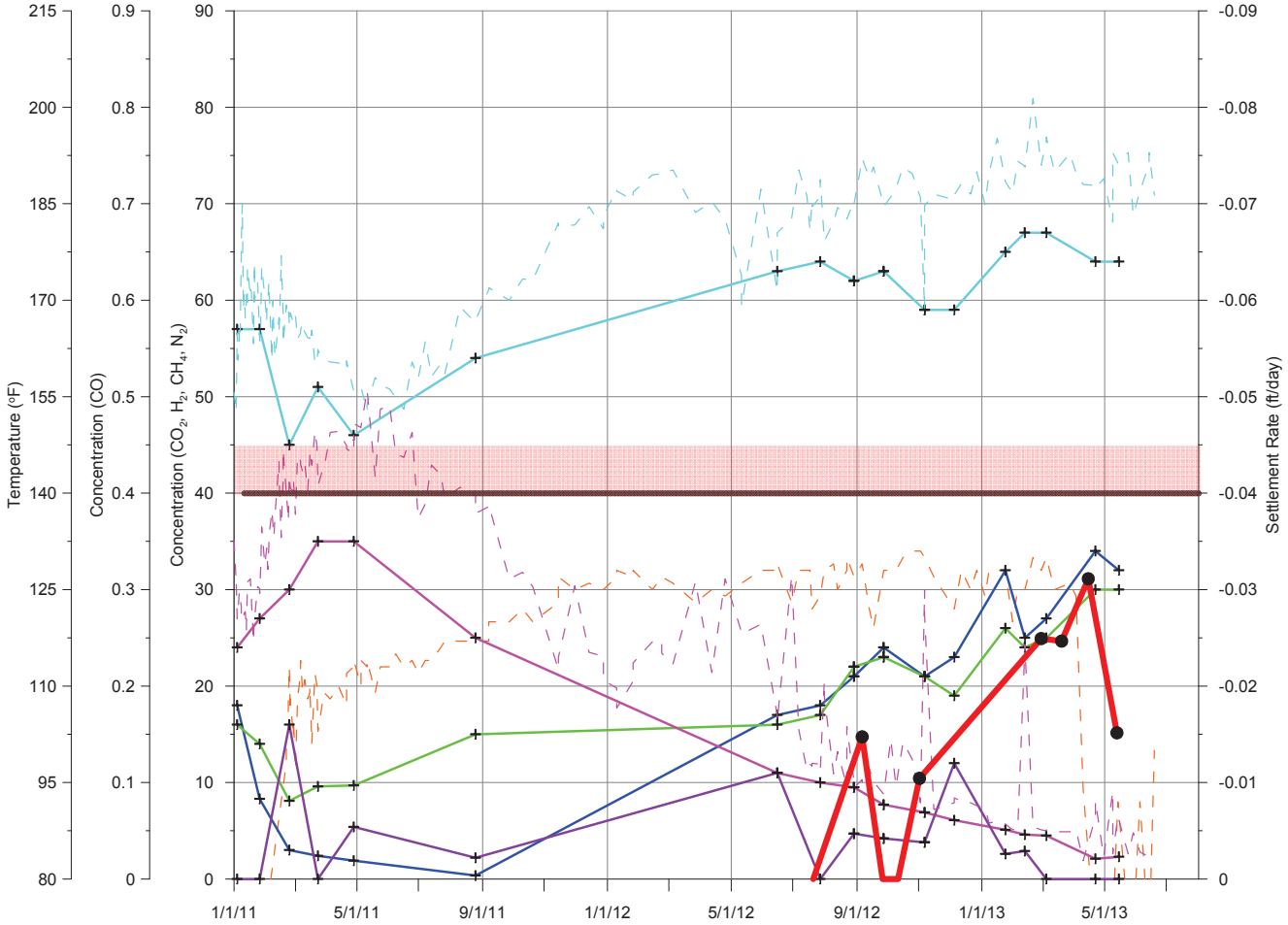
LEGEND
- Well Temperature
- CO_EDD
- CO2_EDD
- Hydrogen_EDD
- Methane_EDD
- Nitrogen_EDD
- Settlement
- CO2_Multi
- Methane_Multi

Notes:
1. Concentrations are % v/v_{dry}.
2. EDD represents laboratory gas sample analysis.
3. Multi represenets field measured data.
4. Well temperatures are field measure data.

GAS CONCENTRATIONS,
TEMPERATURE, AND SETTLEMENT RATE
BRIDGETON LANDFILL

FIGURE E-35

GEW-68



PROPOSED TRIGGER LEGEND
- CO
- Settlement Rate

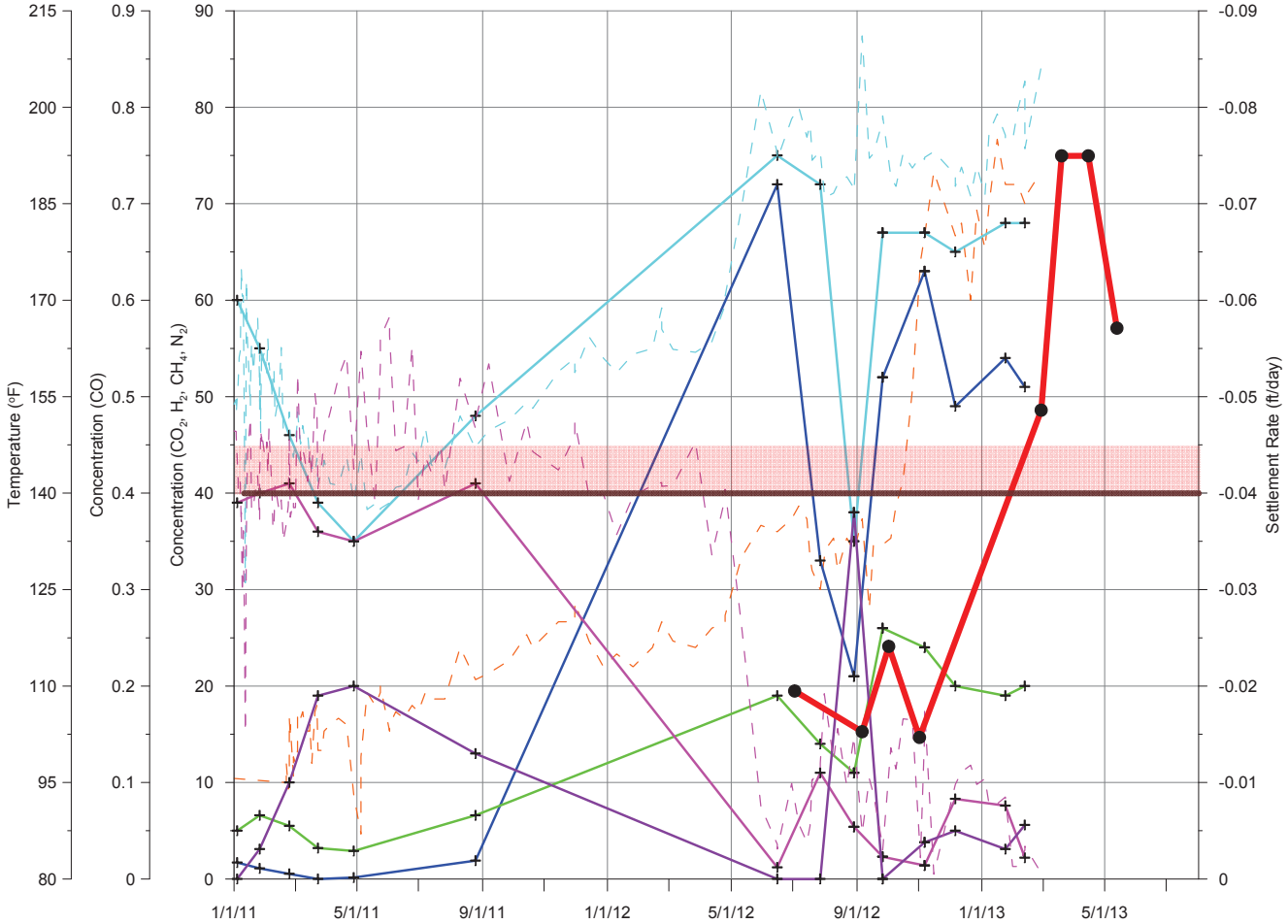
LEGEND
- Well Temperature
- CO_EDD
- CO2_EDD
- Hydrogen_EDD
- Methane_EDD
- Nitrogen_EDD
- Settlement
- CO2_Multi
- Methane_Multi

Notes:
1. Concentrations are % v/v_{dry}.
2. EDD represents laboratory gas sample analysis.
3. Multi represenets field measured data.
4. Well temperatures are field measure data.

GAS CONCENTRATIONS,
TEMPERATURE, AND SETTLEMENT RATE
BRIDGETON LANDFILL

FIGURE E-36

GEW-69R



PROPOSED TRIGGER LEGEND
- CO
- Settlement Rate

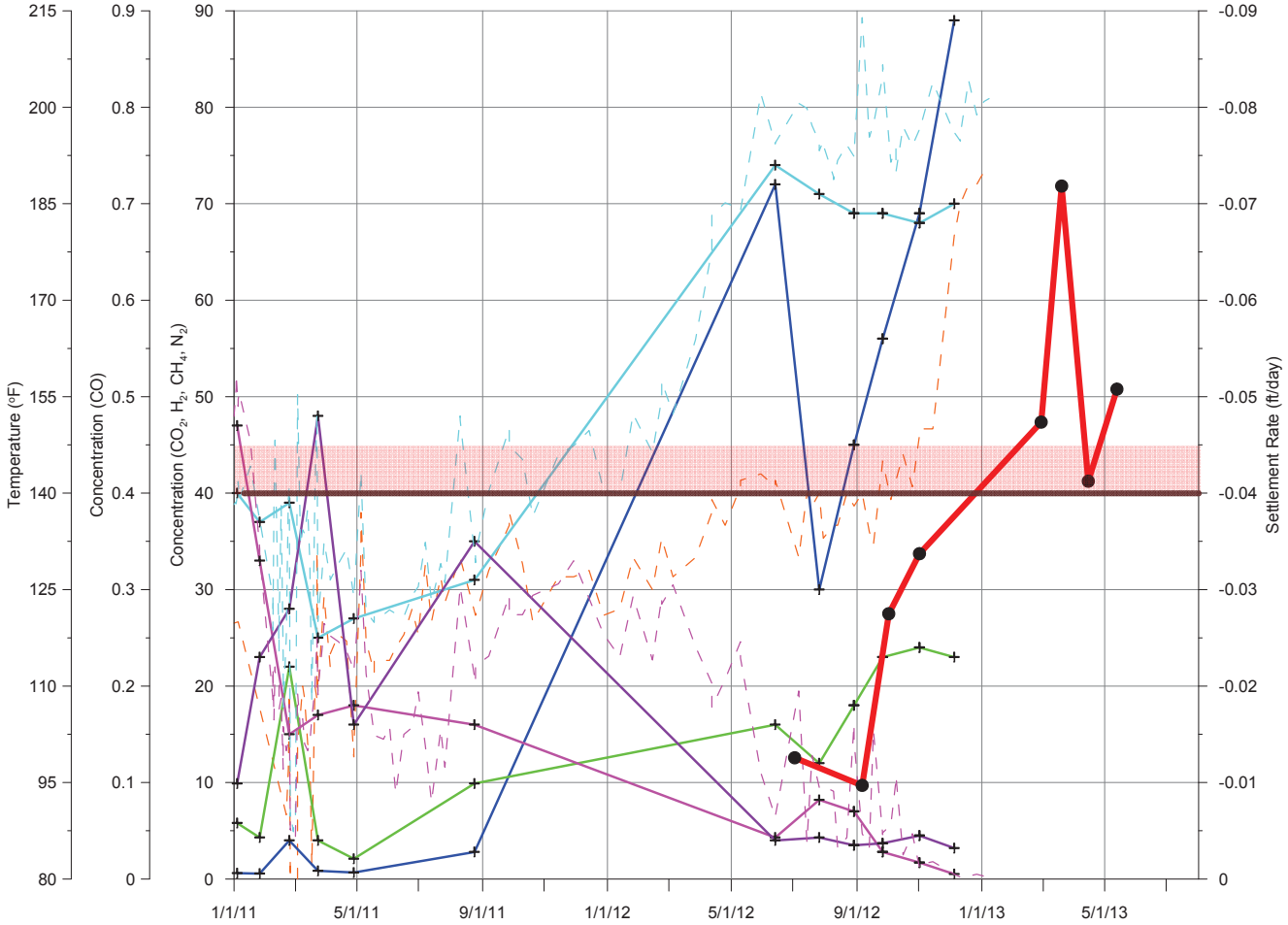
LEGEND
- Well Temperature
- CO_EDD
- CO2_EDD
- Hydrogen_EDD
- Methane_EDD
- Nitrogen_EDD
- Settlement
- CO2_Multi
- Methane_Multi

Notes:
1. Concentrations are % v/v_{dry}.
2. EDD represents laboratory gas sample analysis.
3. Multi represenets field measured data.
4. Well temperatures are field measure data.

GAS CONCENTRATIONS,
TEMPERATURE, AND SETTLEMENT RATE
BRIDGETON LANDFILL

FIGURE E-37

GEW-72R



PROPOSED TRIGGER LEGEND
- CO
- Settlement Rate

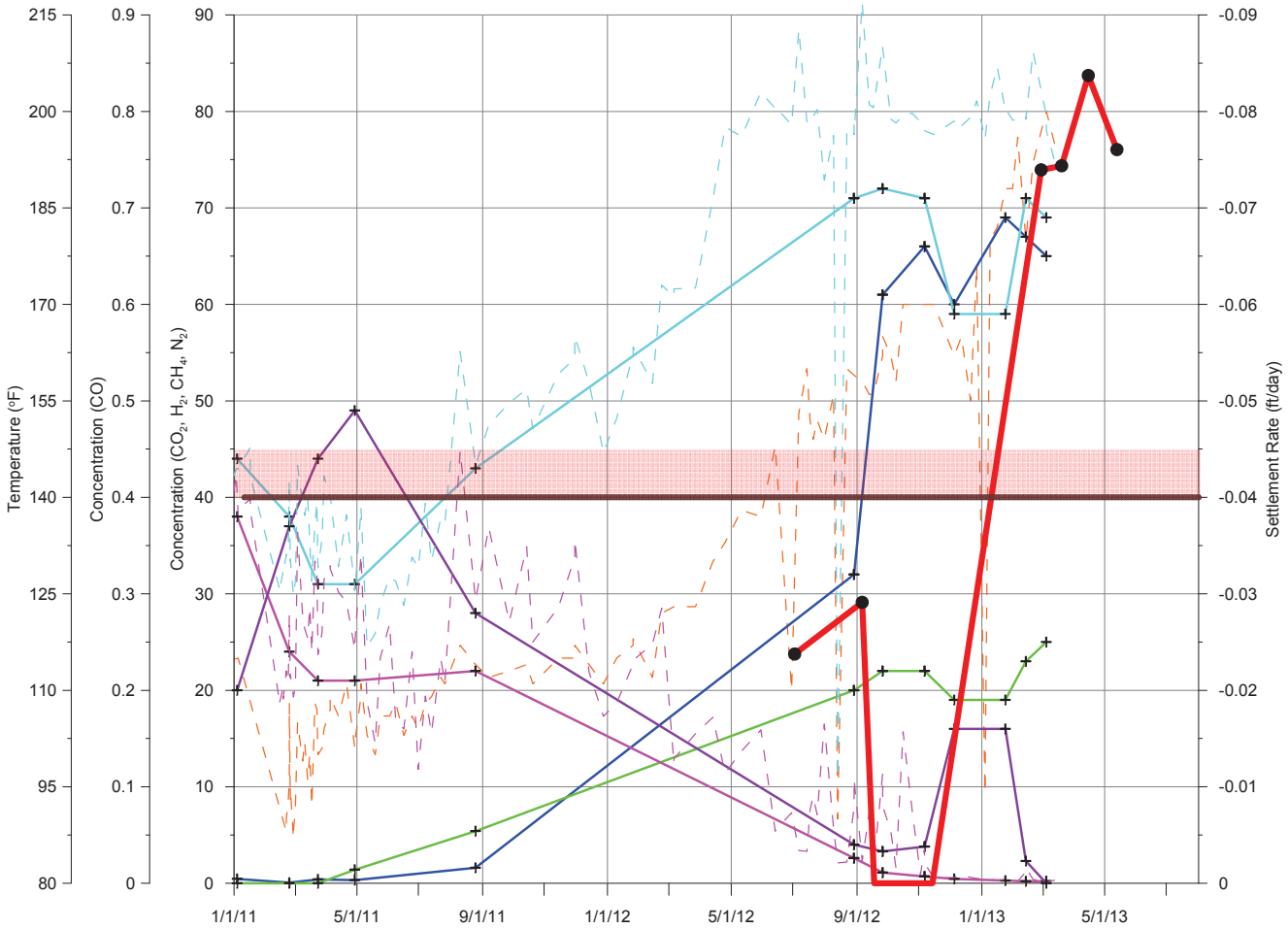
LEGEND
- Well Temperature
- CO_EDD
- CO2_EDD
- Hydrogen_EDD
- Methane_EDD
- Nitrogen_EDD
- Settlement
- CO2_Multi
- Methane_Multi

Notes:
1. Concentrations are % v/v_{dry}.
2. EDD represents laboratory gas sample analysis.
3. Multi represenets field measured data.
4. Well temperatures are field measure data.

GAS CONCENTRATIONS,
TEMPERATURE, AND SETTLEMENT RATE
BRIDGETON LANDFILL

FIGURE E-38

GEW-76R



PROPOSED TRIGGER LEGEND
- CO
- Settlement Rate

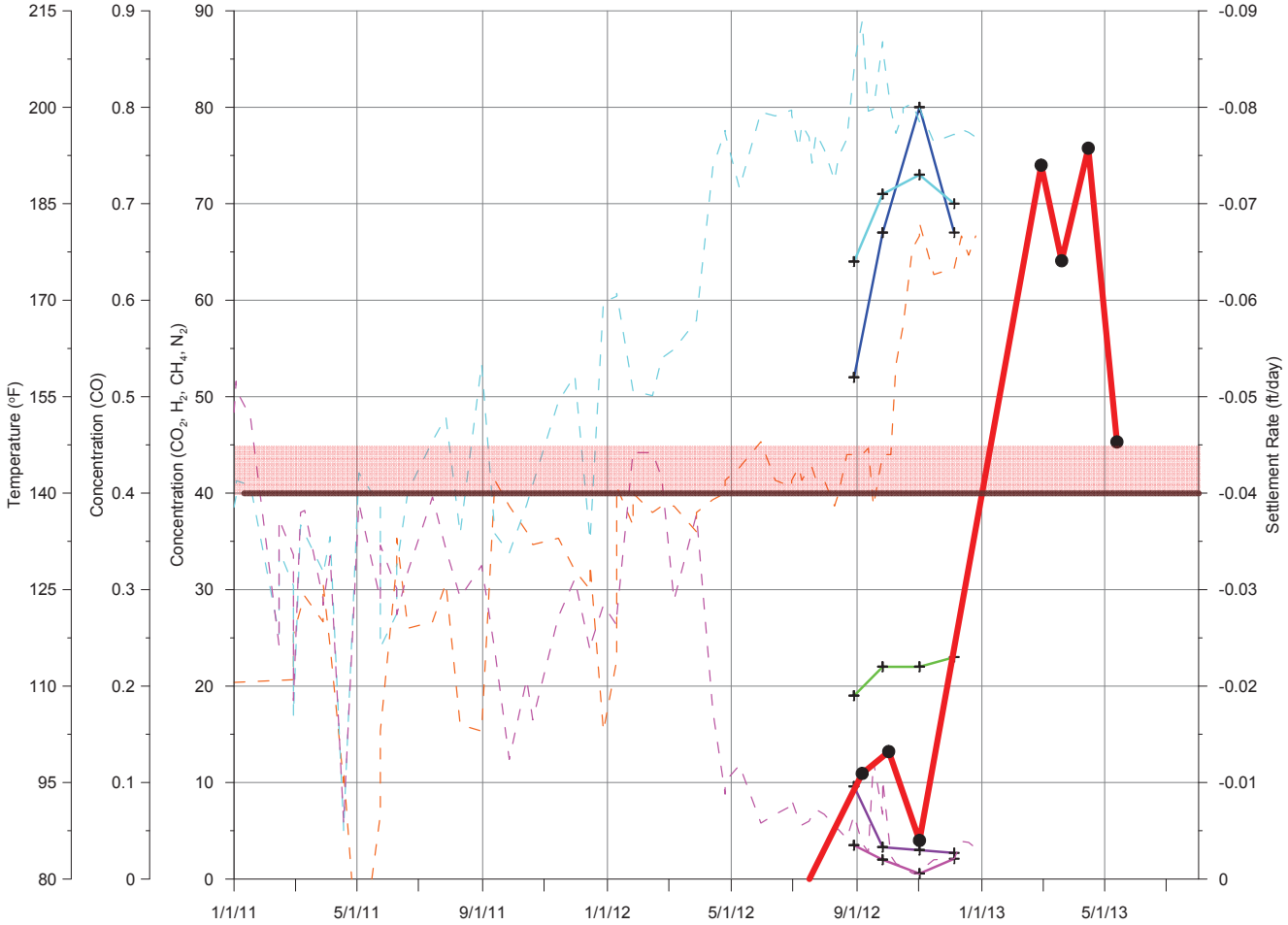
LEGEND
- Well Temperature
- CO_EDD
- CO2_EDD
- Hydrogen_EDD
- Methane_EDD
- Nitrogen_EDD
- Settlement
- CO2_Multi
- Methane_Multi

Notes:
1. Concentrations are % v/v_{dry}.
2. EDD represents laboratory gas sample analysis.
3. Multi represenets field measured data.
4. Well temperatures are field measure data.

GAS CONCENTRATIONS,
TEMPERATURE, AND SETTLEMENT RATE
BRIDGETON LANDFILL

FIGURE E-39

GEW-79R



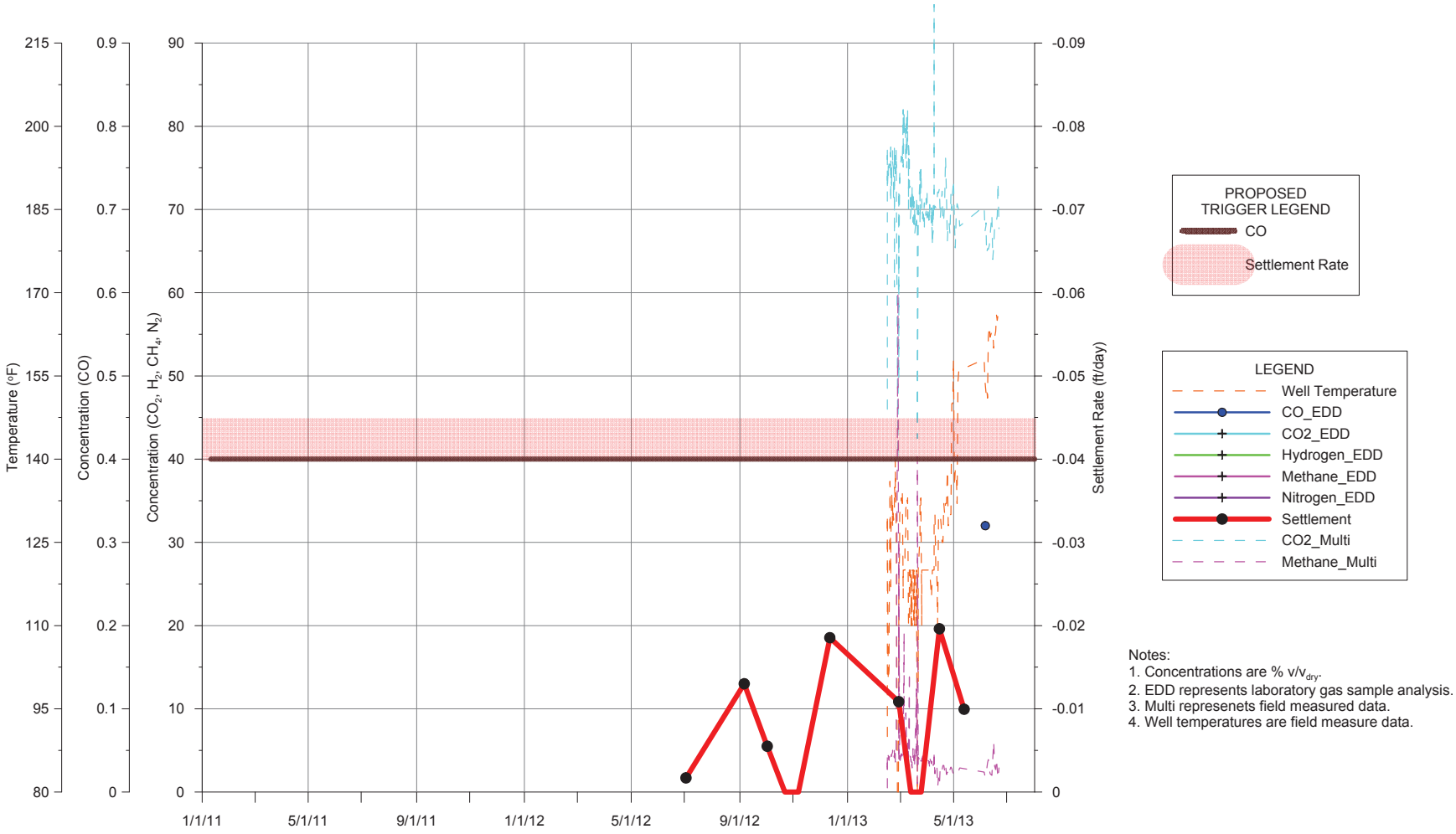
PROPOSED TRIGGER LEGEND
- CO
- Settlement Rate

LEGEND
- Well Temperature
- CO_EDD
- CO2_EDD
- Hydrogen_EDD
- Methane_EDD
- Nitrogen_EDD
- Settlement
- CO2_Multi
- Methane_Multi

Notes:
1. Concentrations are % v/v_{dry}.
2. EDD represents laboratory gas sample analysis.
3. Multi represenets field measured data.
4. Well temperatures are field measure data.

GAS CONCENTRATIONS,
TEMPERATURE, AND SETTLEMENT RATE
BRIDGETON LANDFILL

FIGURE E-40

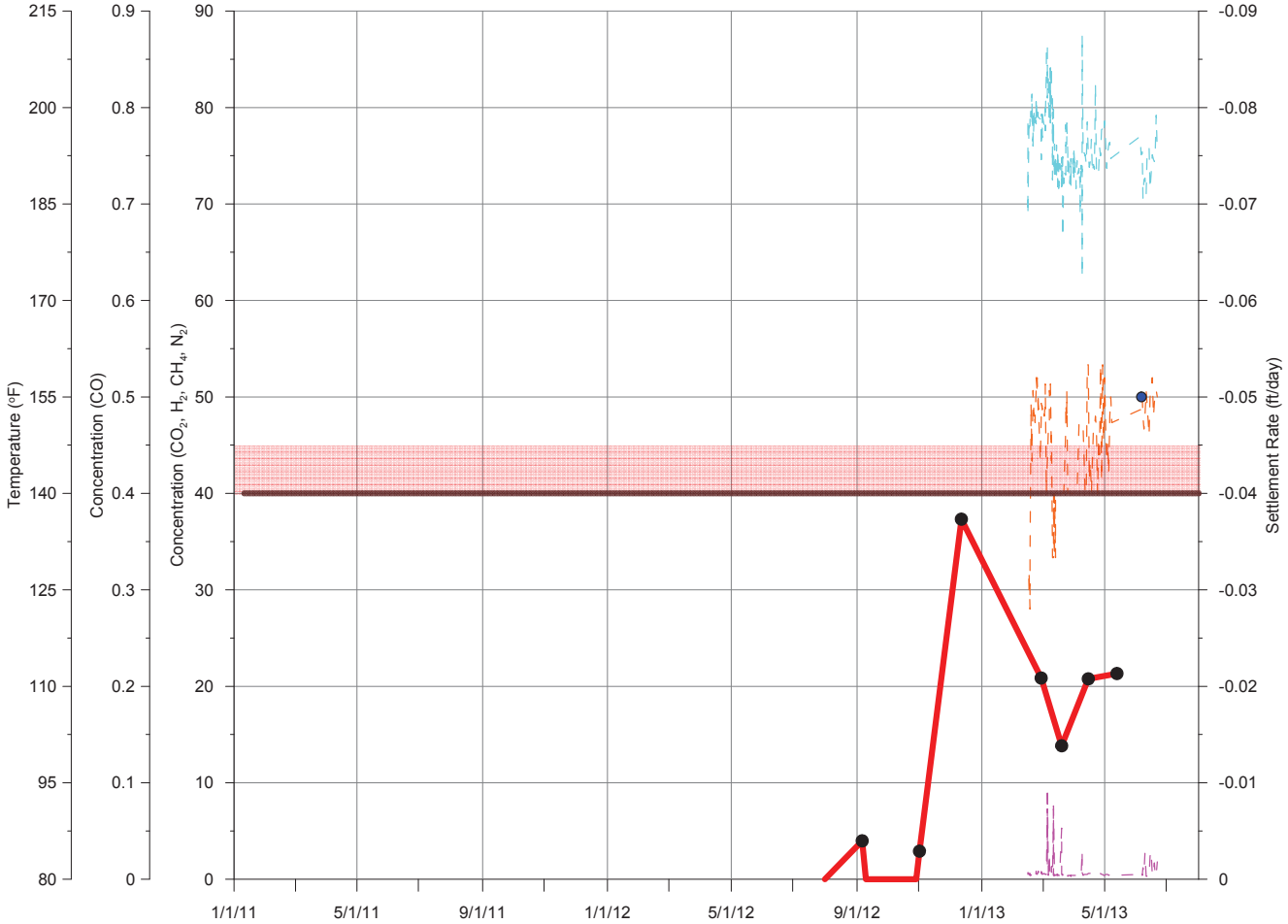


Notes:
1. Concentrations are % v/v_{dry}.
2. EDD represents laboratory gas sample analysis.
3. Multi represenets field measured data.
4. Well temperatures are field measure data.

GAS CONCENTRATIONS,
TEMPERATURE, AND SETTLEMENT RATE
BRIDGETON LANDFILL

FIGURE E-41

GIW-04



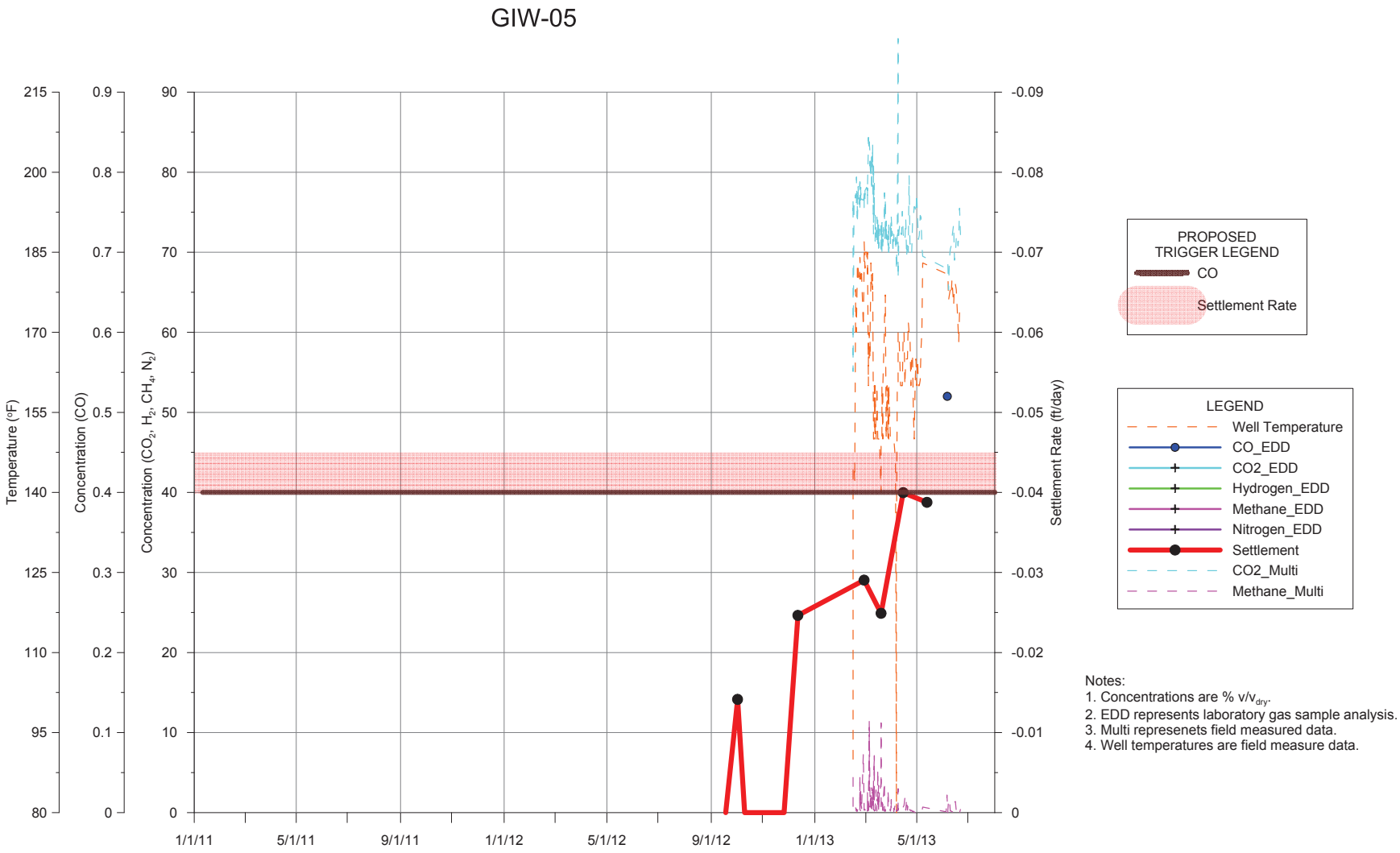
PROPOSED TRIGGER LEGEND
- CO
- Settlement Rate

LEGEND
- Well Temperature
- CO_EDD
- CO2_EDD
- Hydrogen_EDD
- Methane_EDD
- Nitrogen_EDD
- Settlement
- CO2_Multi
- Methane_Multi

Notes:
1. Concentrations are % v/v_{dry}.
2. EDD represents laboratory gas sample analysis.
3. Multi represenets field measured data.
4. Well temperatures are field measure data.

GAS CONCENTRATIONS,
TEMPERATURE, AND SETTLEMENT RATE
BRIDGETON LANDFILL

FIGURE E-42

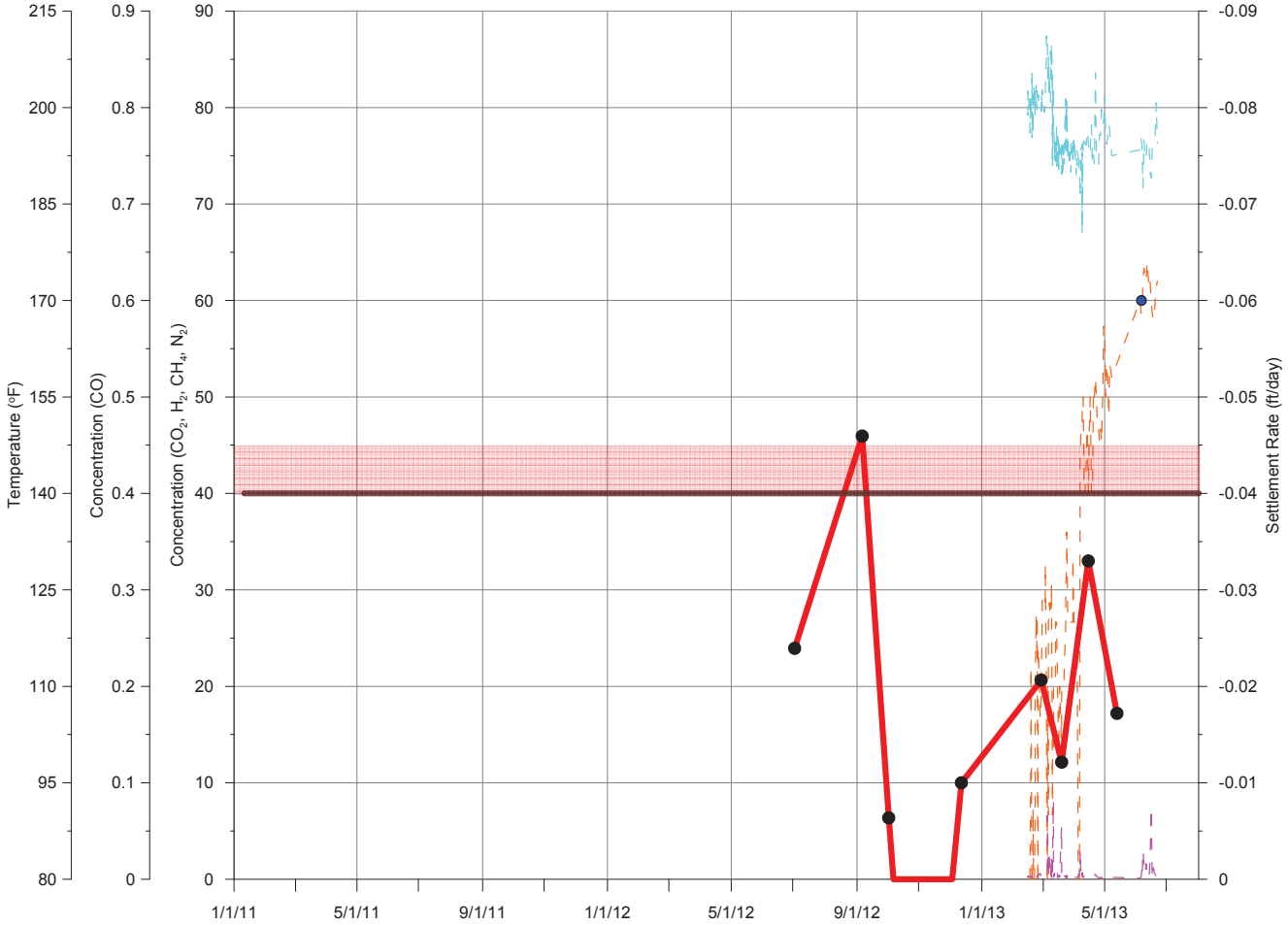


Notes:
1. Concentrations are % v/v_{dry}.
2. EDD represents laboratory gas sample analysis.
3. Multi represenets field measured data.
4. Well temperatures are field measure data.

GAS CONCENTRATIONS,
TEMPERATURE, AND SETTLEMENT RATE
BRIDGETON LANDFILL

FIGURE E-43

GIW-06



PROPOSED TRIGGER LEGEND
- CO
- Settlement Rate

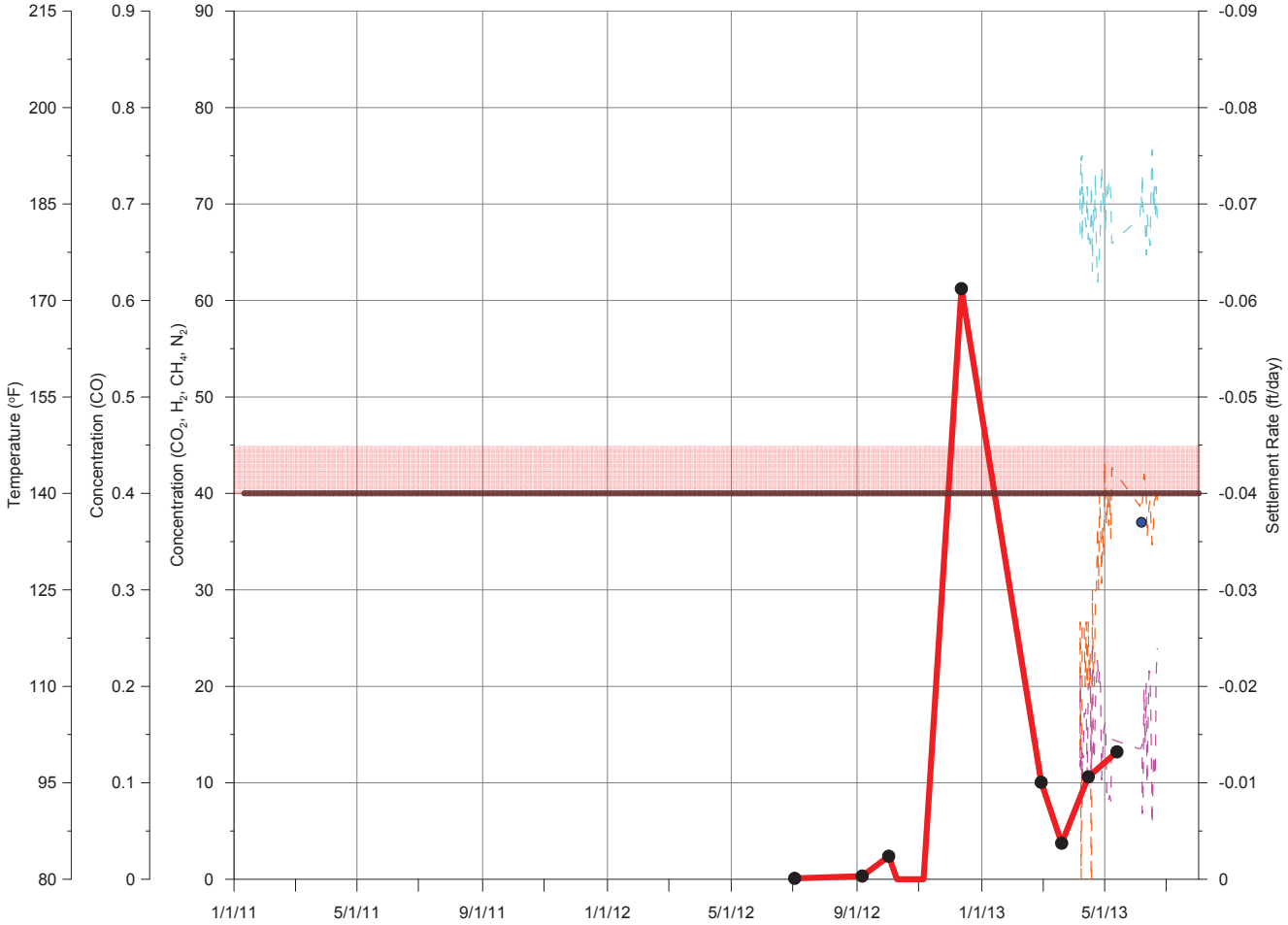
LEGEND
- Well Temperature
- CO_EDD
- CO2_EDD
- Hydrogen_EDD
- Methane_EDD
- Nitrogen_EDD
- Settlement
- CO2_Multi
- Methane_Multi

Notes:
1. Concentrations are % v/v_{dry}.
2. EDD represents laboratory gas sample analysis.
3. Multi represenets field measured data.
4. Well temperatures are field measure data.

GAS CONCENTRATIONS,
TEMPERATURE, AND SETTLEMENT RATE
BRIDGETON LANDFILL

FIGURE E-44

GIW-07



PROPOSED TRIGGER LEGEND
- CO
- Settlement Rate

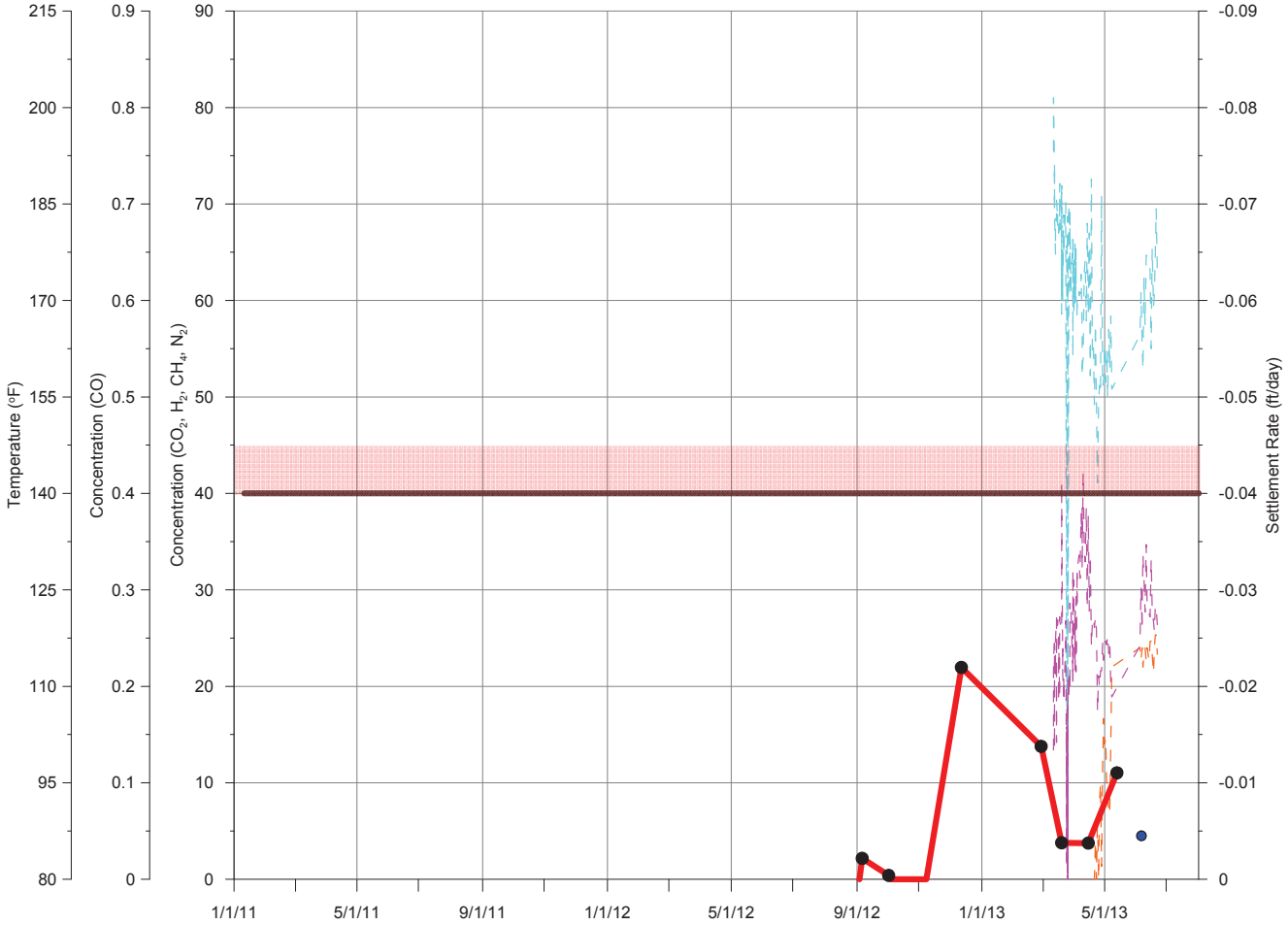
LEGEND
- Well Temperature
- CO_EDD
- CO2_EDD
- Hydrogen_EDD
- Methane_EDD
- Nitrogen_EDD
- Settlement
- CO2_Multi
- Methane_Multi

Notes:
1. Concentrations are % v/v_{dry}.
2. EDD represents laboratory gas sample analysis.
3. Multi represenets field measured data.
4. Well temperatures are field measure data.

GAS CONCENTRATIONS,
TEMPERATURE, AND SETTLEMENT RATE
BRIDGETON LANDFILL

FIGURE E-45

GIW-08



PROPOSED TRIGGER LEGEND
- CO
- Settlement Rate

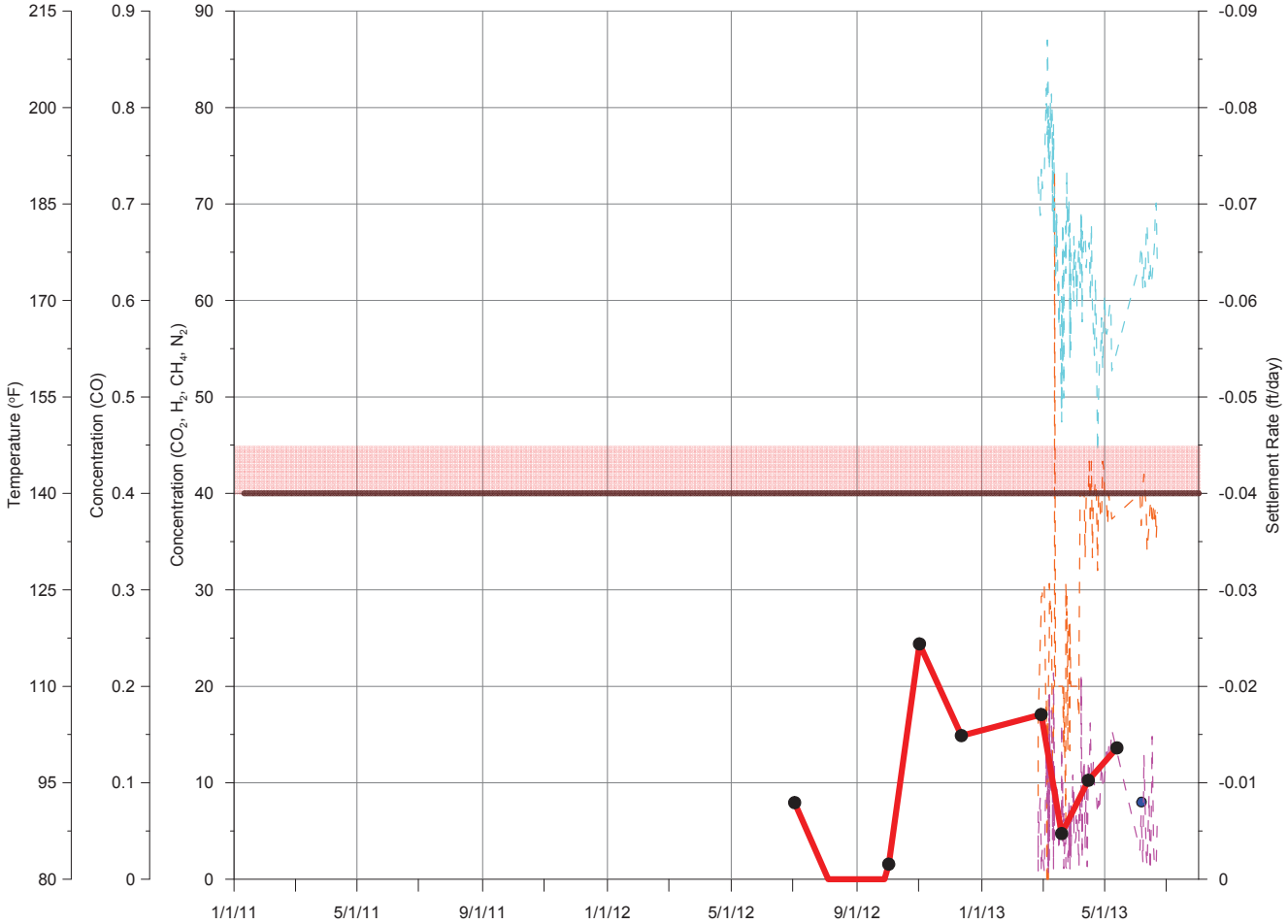
LEGEND
- Well Temperature
- CO_EDD
- CO2_EDD
- Hydrogen_EDD
- Methane_EDD
- Nitrogen_EDD
- Settlement
- CO2_Multi
- Methane_Multi

Notes:
1. Concentrations are % v/v_{dry}.
2. EDD represents laboratory gas sample analysis.
3. Multi represenets field measured data.
4. Well temperatures are field measure data.

GAS CONCENTRATIONS,
TEMPERATURE, AND SETTLEMENT RATE
BRIDGETON LANDFILL

FIGURE E-46

GIW-09



PROPOSED TRIGGER LEGEND
- CO
- Settlement Rate

LEGEND
- Well Temperature
- CO_EDD
- CO2_EDD
- Hydrogen_EDD
- Methane_EDD
- Nitrogen_EDD
- Settlement
- CO2_Multi
- Methane_Multi

Notes:
1. Concentrations are % v/v_{dry}.
2. EDD represents laboratory gas sample analysis.
3. Multi represenets field measured data.
4. Well temperatures are field measure data.

GAS CONCENTRATIONS,
TEMPERATURE, AND SETTLEMENT RATE
BRIDGETON LANDFILL

FIGURE E-47

ATTACHMENT E-1

		Wells used for Lab Gas Analysis of GAS WELLS not within 150 ft of a reaction							
	Row Labels	**Max of Carb**	**Max of Meth**	**Max of Hydr**	**Max of Nitrog**	**Max of Oxygen/A**	**Max of Ca**	**co2/co**	**Meth/CO2**
6/7/2013	GEW-01						0		
6/7/2013	GEW-02						0		
6/6/2013	GEW-03						0		
6/7/2013	GEW-04						0		
6/7/2013	GEW-05						0		
6/7/2013	GEW-06						0		
6/7/2013	GEW-07						0		
6/7/2013	GEW-08						0		
6/6/2013	GEW-09						0		
6/13/2012	GEW-10	61	34	4.4	0	0	0.059	1033.9	0.557377
7/26/2012	GEW-10	56	32	0	0	0	0.037	1513.5	0.571429
8/29/2012	GEW-10	49	45	0	0	0	0.018	2722.2	0.918367
9/27/2012	GEW-10	52	42	0	3.5	0	0.028	1857.1	0.807692
11/6/2012	GEW-10	47	45	0	6.1	1.7	0.01	4700	0.957447
12/4/2012	GEW-10	45	38	0	14	1.7	0.013	3461.5	0.844444
1/23/2013	GEW-10	52	36	1.8	8.6	0.92	0.034	1529.4	0.692308
2/13/2013	GEW-10	38	38	0	20	3.5	0.0042	9047.6	1
3/5/2013	GEW-10	55	30	0	10	1.5	0.039	1410.3	0.545455
4/22/2013	GEW-10	41	30	0	28	0	0.006	6833.3	0.731707
5/14/2013	GEW-10	30	19	0	42	8.3	0	10000	0.633333
4/22/2013	GEW-110	62	8.8	19	8.8	0	0.094	659.57	0.141935
5/14/2013	GEW-110	67	5.3	21	4.4	0	0.17	394.12	0.079104
2/12/2013	GEW-20a	41	17	0	33	8.5	0.02	2050	0.414634
3/6/2013	GEW-20a	21	6.7	0	57	16	0.017	1235.3	0.319048
4/25/2013	GEW-20a	36	4.3	3.7	43	12	0.092	391.3	0.119444
5/14/2013	GEW-20a	37	6.3	0	42	11	0.084	440.48	0.17027
2/12/2013	GEW-22R	76	14	7.6	2	0.53	0.15	506.67	0.184211
3/6/2013	GEW-22R	73	13	8.3	4	0	0.17	429.41	0.178082
4/25/2013	GEW-22R	53	5.9	8.8	25	7	0.16	331.25	0.111321
5/14/2013	GEW-22R	74	8.1	14	0	0	0.19	389.47	0.109459
2/12/2013	GEW-23a	65	25	6.6	3.2	0.64	0.084	773.81	0.384615
3/6/2013	GEW-23a	65	23	6.9	3.9	0	0.089	730.34	0.353846

4/25/2013	GEW-23a	70	16	10	0	0	0.15	466.67	0.228571
5/14/2013	GEW-23a	57	14	8.5	16	4.3	0.091	626.37	0.245614
4/27/2011	GEW-39	38	46	0	13	0.83	0	10000	1.210526
8/29/2012	GEW-39	62	31	0	4.4	0	0.011	5636.4	0.5
9/27/2012	GEW-39	64	31	0	3.8	0	0.084	761.9	0.484375
11/6/2012	GEW-39	44	33	0	20	1.4	0.0027	16296	0.75
12/4/2012	GEW-39	61	3.1	28	5.7	1.6	0.33	184.85	0.05082
1/23/2013	GEW-39	62	35	0	2.7	0.69	0.0098	6326.5	0.564516
2/12/2013	GEW-39	60	35	1.4	2.6	0.6	0.017	3529.4	0.583333
3/5/2013	GEW-39	53	43	0	0	0	0.01	5300	0.811321
4/22/2013	GEW-39	52	40	0	5.5	0	0.014	3714.3	0.769231
5/15/2013	GEW-39	46	33	0	15	3.1	0.023	2000	0.717391
4/27/2011	GEW-40	33	40	0	22	0.98	0	10000	1.212121
6/6/2013	GEW-40						0		
4/27/2011	GEW-41R	29	32	0	33	1.1	0	10000	1.103448
6/1/2013	GEW-41R			0	0	0	0		
4/27/2011	GEW-42R	33	35	0	32	1.2	0	10000	1.060606
6/7/2013	GEW-44						0		
6/7/2013	GEW-47R						0.01		
6/7/2013	GEW-48						0		
6/7/2013	GEW-49						0		
6/7/2013	GEW-50						0		
6/7/2013	GEW-51						0		
6/7/2013	GEW-52						0		
6/7/2013	GEW-53						0.0044		
6/7/2013	GEW-54						0.0044		
6/6/2013	GEW-55						0		
2/12/2013	GEW-77	68	6.9	20	3.4	0.95	0.29	234.48	0.101471
3/6/2013	GEW-77	68	6.4	23	0	0	0.31	219.35	0.094118
4/25/2013	GEW-77	67	4.9	25	0	0	0.31	216.13	0.073134
5/14/2013	GEW-77	66	4.7	25	0	0	0.29	227.59	0.071212
2/12/2013	GEW-80	73	11	11	3	0.85	0.18	405.56	0.150685
3/6/2013	GEW-80	74	10	13	0	0	0.21	352.38	0.135135
4/25/2013	GEW-80	71	8.1	17	0	0	0.23	308.7	0.114085
5/14/2013	GEW-80	71	7.9	17	0	0	0.21	338.1	0.111268

wells used for analysis of lab. gas for GAS Wells not within 150 ft of settlement fronts

6/6/2013	GIW-13						0.086		

APPENDIX F

VERIFICATION PROCEDURES FOR TMP MEASUREMENTS

Procedures for Verification of TMP Readings

General

The strings of T type thermocouples at the site are quality controlled strings of thermocouple 20 gauge Copper/Constantan thermocouple wire, with factory fabricated sealed junctions at the ends in the ground. The resistance of the wire, in ohms per foot, is 0.298. The thermocouple wire is coated with Teflon, which provides protection up to 500° F. The thermocouple itself is rated to 750° F. At the ground surface the thermocouple wires (two per thermocouple unit within the TMP location) are connected to a rotary switch that is inside a NEMA weatherproof rated enclosure mounted above the ground surface. A readout device, purchased from Omega Engineering of the HH800 series is connected to the rotary switch to take readings. Resistance readings can also be taken for each unit through the rotary switch, which is low resistance. Temperature readings are actually voltage differences across the two sides of the thermocouple wire and are read to the nearest microvolt to achieve readings accurate to ±2° F. User manuals for the Omega readout device and the Fluke brand multimeter (model 175 true-RMS multimeter being used to measure resistance) are provided as Attachments A and B.

Temperature Data Information

The Omega readout device is set up to read temperature measurements through a T type connection. The readout display is set to output measurements in degrees Fahrenheit. These readings are currently recorded in a log book on a weekly basis. A spreadsheet is created with recorded data and temperatures are compared to previously recorded data. The same data logging process is performed for resistivity readings, only on a monthly basis, or more frequently if needed.

Potential Problem in Obtaining Accurate Readings

The following things can result in poor quality readings:

1. Not setting the thermocouple readout device to the correct setting. The device must be set to a type T thermocouple type. Failure to have the correct setting results in very different temperatures being associated with the voltage difference being converted by the readout device to temperature.
2. Not have clean connectors to the leads to the switch. This increases the resistivity at the readout end and can lead to erroneous readings. Make sure the contact surfaces are clean and dry.
3. Condensate or corrosion can occur within the rotary switch. This results in incorrect readings by raising resistance or even providing continuity across multiple thermocouples. The enclosure containing the switch must be well ventilated and dry. If condensate or corrosion is present the switch can be cleaned or replaced. Resistance readings at periodic intervals and whenever questionable readings are obtained can identify these problems.

4. Damage associated with abrasion or stretching or breaking of the thermocouple wire or its insulation can occur. This will result in either resistance that exceeds the nominal values foot of wire due to work hardening of the wire, very high resistance due to wire breakage or very low resistance do to insulation damage at shallower depth than the tips. Resistance readings at periodic intervals and whenever questionable readings are obtained can identify these problems.

Instrument Reading Verification

Verify Resistance Readings

Resistance readings should be taken at monthly intervals for each thermocouple probe. A multimeter calibrated with a quality resister of 50 ohm should be used. Additional readings should be taken whenever readings appear questionable or a large change in readings occurs. Values will be plotted with depth and units exceeding 1.3 times the theoretical resistance are considered marginal. Units with 1.65 times the nominal resistance values, corrected for the switch, will be considered unacceptable for use.

If readings are high, the switch unit should be inspected and the resistance at the thermocouple lead (for one or two units that read high) be checked bypassing the switch. If the switch is seen to be the issue it should be cleaned or replaced to reduce the measured resistance in the switch to a few ohms or less.

Verifying Temperature Readings

If the resistance readings are acceptable, the temperature readings should be repeated within 24 hours to identify they are representative. This verification should include double checking the readout is set to the correct thermocouple type (in this case, a T type). A temperature measurement device should be calibrated using an ice bath technique or other approved method. To perform this type of calibration, a type T connection can be made to the readout device using the same thermocouple wires that are used in the TMPs. The bare wires at the end are twisted together and directly submerged in the center of the ice bath. The wire should be slowly rotated inside the ice bath to obtain the correct calibration temperature. Readings should stabilize at 32° F if done properly. Instructions for making an ice bath are included as Attachment C.

Identifying Unacceptable readings

Readings that do not stabilize to within 4 degrees over a period of 30 seconds and show rapid fluctuation are not acceptable and should be indicated as readings failed to stabilize. In some cases this has been associated with problems with corrosion or moisture in the rotary switch and the switch should be cleaned or replaced. Verification that the switch is the problem can be obtained by reading the problem unit without the rotary switch, connecting directly to the leads.

ATTACHMENT A

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HH806U/HH806AU

MULTILOGGER THERMOMETER

M4502/0711

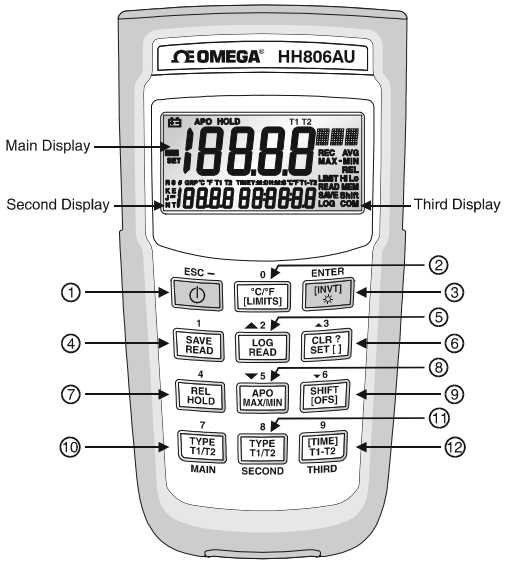
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INTRODUCTION

The instrument is a portable digital thermometer that measures external thermocouples of type K, J, R, S, T, E, N. The thermocouples types comply with the N.I.S.T. – ITS 90 standard reference temperature/voltage tables. The thermometer features a dual thermocouple input, an adjustable T/C offset and an USB interface for uploading data to a PC using optional software and cable.

SAFETY INFORMATION

WARNING
To avoid electrical shock, do not use this instrument when working voltages at the measurement surface over 24V AC or DC.

WARNING
To avoid damage or burns, do not make temperature measurement in microwave ovens.

CAUTION
Repeated sharp flexing can break the thermocouple leads. To prolong lead life, avoid sharp bends in the leads, especially near the connector.

SPECIFICATIONS

ELECTRICAL

Temperature Scale: Celsius or Fahrenheit user-selectable
Measurement Range:

K-TYPE (0.1°)	-200°C to 1372°C (-328°F to 2501°F)
J-TYPE (0.1°)	-210°C to 1200°C (-346°F to 2192°F)
T-TYPE (0.1°)	-200°C to 400°C (-328°F to 752°F)
E-TYPE (0.1°)	-210°C to 1000°C (-346°F to 1832°F)
R-TYPE (1°)	0°C to 1767°C (32°F to 3212°F)
S-TYPE (1°)	0°C to 1767°C (32°F to 3212°F)
N-TYPE (0.1°)	-50°C to 1300°C (-58°F to 2372°F)

*Based on the ITS-90 temperature standard.
According to temperature standard ITS-90.

Accuracy:
K/J/T/E-TYPE
±(0.05% rdg + 0.3°C) on -50°C to 1372°C
±(0.05% rdg + 0.7°C) on -50°C to -210°C
±(0.05% rdg + 0.6°F) on -58°F to 2501°F
±(0.05% rdg + 1.4°F) on -58°F to -346°F
N-TYPE
±(0.05% rdg + 0.8°C) on -50°C to 0°C
±(0.05% rdg + 0.4°C) on 0°C to 1300°C
±(0.05% rdg + 1.6°F) on -58°F to 32°F
±(0.05% rdg + 0.8°F) on 32°F to 2372°F
R/S-TYPE
±(0.05% rdg + 2°C) on 0°C to 1767°C
±(0.05% rdg + 4°F) on 32°F to 3212°F
Temperature Coefficient:
0.1 times the applicable accuracy specification per °C from 0°C to 18°C and 28°C to 50°C (32°F to 64°F and 82°F to122°F).
Input Protection:
24V dc or 24V ac rms maximum input voltage on any combination of input pins.
Reading Rate: 2.5 time per second.

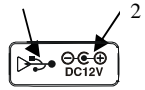
ENVIRONMENTAL

Ambient Operating Ranges:
0°C to 50°C (32°F to 122°F) <80% R.H.
Storage Temperature:
-20°C to 60°C (-4°F to 140°F) <70% R.H.

GENERAL

Display:
There are three display areas on the HH806 series LCD (liquid crystal display). The Main and Second displays are 4 ½ digits with a maximum reading of 19999. These are used for displaying the value of T1 or T2. The Third display is for the date, time, or the differential value of T1 to T2.
Overload: "----.-" or "OL" is display.
Battery: 1.5V x 4 PCS (SIZE AAA) UM-4 R03.
Battery Life: 120 hours typical with carbon zinc battery.
Dimensions: 160mm(H) x 83mm(W) x 38mm(D).
Weight: Approx. 365g including batteries.
Supplied Thermocouple:
1 meter (40") type K insulated beaded wire thermocouple Maximum insulation temperature is 482°C (900°F). Thermocouple accuracy is ±1.1°C or 0.4% of reading (whichever is greater) from 0°C to 1250°C.
Wire Communication Protocol:
2400 baud rate. (HH806U)
19200 baud rate. (HH806A)

External Connections:
1. USB Port
2. DC power JACK(12V)



OPERATING INSTRUCTIONS

1. OPERATIONAL MODE

There are three operation modes-Normal, Shift, and Setup Mode.

NORMAL MODE:

This is the default mode, the operating functions for the normal mode are printed on the top of each button in white.

SHIFT MODE:

The operating functions for the shift mode are printed in gray on the buttons. While in the normal mode, press the SHIFT button to switch to shift mode. At the lower-right corner of the display, the word "Shift" is displayed to indicate shift mode. To switch back to normal mode, press the SHIFT button again.

SETUP MODE:

Press the set[ ] button in normal mode to switch to setup mode, the indicator "SET" is shown on the left side of the display. To switch back to normal mode, press SET[ ] button.

2. NORMAL MODE

The following functions can only be used in the normal mode.

(1) "⏻" Power Button

The "⏻" button turns the thermometer on or off. When the meter is in MAX/MIN record mode, the power off function is disabled.

(2) "[LIMITS]" Button (only Main display)

The limits function will alert the user when a measurement exceeds a specified limit. To set the limit values, refer to limits function in the setup mode. Press the [LIMITS] button to activate the limits function; the word "LIMIT" should be displayed on the LCD.

When the value of the main display exceeds the Hi limit, the word "Hi" will be displayed and the thermometer will beep in a pulsed tone. If the value of the main display is lower then the Lo limit, the word "Lo" will be displayed and the thermometer will beep in a continuous tone. To exit the limits function, press the [LIMITS] button.

(3) "☼" Button

The backlight function is represented by this button "☼". Pressing the button will turn on or off the LCD backlight. The backlight will turn off automatically after.

(4) "SAVE/READ" Button

The read data function works in conjunction with the save function in the shift mode, it is used for reading saved data. The save function can be activated in shift mode. Press the SAVE/READ button to read saved data; the word "READ" should be displayed on the LCD. To navigate around the save data table, press the overlay "SECOND" button until the "#" sign is displayed on the second display. The location of the read pointer within the saved data table will be displayed. The arrow buttons on the overlay are used for scrolling through the saved data. Press the smaller arrows "▲" or "▼" to step through the data one at a time. Press the larger arrows "▲" or "▼" to step through the data ten at a time. Pressing the overlay "ESC" button deactivates the read data function.

(5) "LOG/READ" Button

The read log function works in conjunction with the log function. It is used for reading logged data. The log function can be activated in the shift mode. Press the LOG/READ button to activate the log read function; the word "READ" is displayed on the LCD. Press the overlay SECOND button to rotate through following display menus: T1, T2, GRP, and #. T1 and T2: Displays the T1 or T2 saved data. GRP: Displays the current group number. #: Displays the current location of the read pointer within a selected group. The arrow buttons on the overlay are used for scrolling through the data and groups. Press the smaller arrows "▲" or "▼" to step through the logged data or groups one at a time. Press the larger arrows "▲" or "▼" to step through the data or groups ten at a time. To navigate the logged data and groups, press the overlay SECOND button until GRP appears in the second display panel. Then select the group using the arrows. Press the SECOND button again until the "#" sign is displayed. The location of the read pointer in the selected group will be displayed. Use the arrows to scroll through the data. Pressing the overlay "ESC" button deactivates the read data function.

(7) HOLD Mode (only Main display)

When HOLD mode is selected, the thermometer holds the present readings and stops all further measurements. To activate the data hold mode, press the HOLD button, and "HOLD" is displayed on the LCD. Pressing the HOLD button again cancels the function, and the instrument will automatically resume measurements.

(8) MIN/MAX with Time record Mode (only Main display)

The MIN/MAX function records the highest and lowest value recorded, and it calculates the average reading, and the differences of MAX to MIN. Press MIN/MAX button to enter the MIN/MAX recording mode. The beeper emits a tone when a new minimum or maximum measurement is recorded. Press the MIN/MAX button again to rotate through the current readings: MAX: The highest measurement recorded. MIN: The lowest measurement recorded. MAX-MIN: The difference of the highest and the lowest measurement. AVG: The average values of the measurements.

This mode works in conjunction with the hold function, pressing the HOLD button will stop the recording and measurements (Previously recorded readings are not erased). Press HOLD button again to resume recording and measurements. To prevent accidental loss of MIN, MAX and AVG data, the MIN/MAX function can only be cancelled by pressing and holding down the MIN MAX key for more then 2 seconds. The automatic power-off feature, and the power, °C/°F, REL, SET, Hi/Lo Limits, TYPE, T1/T2 buttons are also disabled.

(10) "T1/T2" Button (Main display)

The input selection button [T1/T2] selects the input for the main display, T1 thermocouple or T2 thermocouple. Press the T1/T2 button to switch between the two inputs. When meter is turned on, it is set to the display that was last in use.

(11) "T1/T2" Button (Second display)

The input selection button [T1/T2] selects the input for the second display, T1 thermocouple or T2 thermocouple. Press the T1/T2 button to switch between the two inputs. When meter is turned on, it is set to the display that was last in use.

(12) "T1-T2/TIME" Button (Third display)

The input selection button [T1-T2] selects the system time and date, or the differential between the two thermocouples (T1-T2) for the third display. Press the T1-T2 button to switch the display options. When meter is turned on, it is set to the display that was last in use.

3. SHIFT MODE

The following functions can only be used in the shift mode.

(2) "°C/°F" Button

Press the °C/°F button to select the temperature scale, readings can be displayed in Celsius (°C) or Fahrenheit (°F). When the thermometer is turned on, it is set to the temperature scale that was last in use.

(4) "SAVE" Button

The save function stores the T1, T2 data in a nonvolatile memory. Press the SAVE button to save the current data, the word SAVE is displayed to indicate the data has been saved. The built in memory can store up to 128 data (HH806U)/256 data (HH806AU). The data can be read using the read function in the normal mode.

(5) "LOG" Button (HH806U)

The data log function continuously records the data according to a specified time interval. The time interval can be set using the interval setup function [INVT] in the set up mode. Press the LOG button to activate the log function; the indicators "LOG" and "MEM" will be displayed on the LCD. There are 16 groups that are used for storing the log data, and each group uses 64 data slots. If the current log session exceeds 64 data, the log function will automatically use the next group to store the following data. A maximum of 1024 data point can be saved in one log session. Press the LOG button again to exit the data log function.

"LOG" Button (HH806AU)

The data log function continuously records the data according to a specified time interval. The time interval can be set using the interval setup function [INVT] in the set up mode. Press the LOG button to activate the log function; the indicators "LOG" and "MEM" will be displayed on the LCD. There are 16 groups that are used for storing the log data. A maximum of 16,000 data point can be saved in one log session. Pressing the LOG button again to exit the data log function.

(6) "CLR ?" Button

The CLR function clears all the saved and logged data in memory. When the CLR button is pressed, indicator "MEM" is displayed and the "CLR" on upper-right of LCD will blink. Pressing the "ENTER" button printed on the overlay in white will clear all saved and logged data. Press "ESC" button to exit this function without clearing data.

(7) "REL" Button (Main display)

The relative value function can be used for comparing the saved reference value with other measurements. Press the "REL" button to store the current measurement as the reference value, and "REL" should be displayed on the right part of the LCD. The next measurement will display the current value compared to the reference value. Press "REL" button again to clear the reference value and deactivate the relative value measurement function.

(8) "APO" Button

Press the APO button to turn the "Auto power off" function on or off. When this function is enabled, the indicator "APO" is shown at the upper left part of the LCD. When APO (Auto power off) is enabled, it will automatically turn the thermometer off no button is pressed for a period longer than the set time interval (the default time for APO is 5 minutes). Press power button to resume operation.

(10) "TYPE" Button (Main display)

Press this button to change the type of thermocouple in the main display (K/J/T/E/R/S/N). If the inputs of the main and second display are the same, then pressing this button will change the thermocouple type for both displays.

(11) "TYPE" Button (Second display)

Press this button to change the type of thermocouple in the second display (K/J/T/E/R/S/N). If the inputs of the main and second display are the same, then pressing this button will change the thermocouple type for both displays.

4. SETUP MODE

The following functions can only be use in the setup mode.

(2) "[LIMITS]" Button (Hi/Lo limit setting)

Press the LIMITS button to enter the Hi/Lo limit setup function. The words "LIMIT" and "Hi" will be flash on the LCD along with the previous value for the Hi limit. Enter the new Hi limit value using the number keys printed in white on the overlay. The resolution of Hi/Lo limit setup is 1 count. The "-" button (same button as the ESC) can be used to enter negative values. Press the "ENTER" button to confirm the new limit. You will then be prompted to enter a new Lo limit value. Enter the new value and then press enter to finish setup of limits.

(3) "[INVT]" Button (Interval time setting)

To setup the time interval for the log function, press the [INVT] button. The indicator "INV" will blink on

the top-right of the LCD and the previous interval is displayed. Press the number buttons printed in white on the overlay to change the time interval. Setting is from left to right of the following format (HH:MM:SS). Press the overlay "ENTER" button to confirm. To exit this function, press the ESC button.

HH: interval Hour (0~23)
MM: interval Minute (0~59)
SS: interval Second (0~59)
MAX: 23:59:59
MIN: 00:00:01

(8) "APO" Button (Auto power off time setting, min. 1 minute)

Use this function to change the time for the auto power off (APO) function. Press the APO button in setup mode, and the indicator "APO" and the current time will flash on the LCD. The default time for APO is 5 minutes. Press the number button printed in white on the overlay to set the APO time. Press the overlay "ENTER" button to confirm. To exit this function without changing the setting, press the ESC button.

MAX: 19999 minutes
MIN: 0001 minutes

(9) "[OFS]" Button (Thermocouple offset adjust)

When the main display input is T1 and a thermocouple is connected, the instrument can adjust the offset of the thermocouple. The same can be done for T2 when on the main display. In the setup mode, press this button to enter the thermocouple Offset Setup Function (OFS) and the indicator CAL should be displayed on the top-right of the LCD and the current setting is also shown. Press the number buttons printed in white on the overlay to change the offset of the thermocouple. The resolution of the setup is 0.1°. Press the "-" button to set a negative value. Press the overlay "ENTER" button to confirm. MAX: ±1999.9 °C/°F.

(12) "[TIME]" Button (System time setting)

To set the system time, press the [TIME] button in the setup mode. The third display should show the current date and time with the year flashing. Enter the new value from left to right in the following format YY:MM:DD and HH:MM:SS. Press the number buttons printed in white on the overlay to set the system date and time. Press the "ENTER" button to confirm. Exit this function by pressing ESC button.

Error messages:

When the meter appears wrong messages such as Err-01, Err-02 and Err-03.

Err-01: In the "SAVE" mode, if memory is full, the lower right display will show Err-01. If you would like to record the new value. Please clear all old records.

Err-02: In the "LOG" mode, if memory is full, the lower right display will show Err-02. If you would like to record the new value. Please clear all old records.

Err-03: In the "READ LOG" and "READ SAVE" mode, when the main display shows 6028 and the lower right display shows "OL, Err-03". Which means that there might appear two situations:

1. There is no data in the memory.
2. The memory is ful l, and the meter will warn the user this is the last sample.

OPERATOR MAINTENANCE

WARNING

To avoid possible electrical shock, disconnect the thermocouple connectors from the thermometer before removing the cover.

Battery Replacement

1. Power is supplied by 4pcs 1.5V (AAA SIZE) UM-4 R03.
2. The "  " appears on the LCD display when replacement is needed. To replace battery remove screw from back of meter and lift off the battery cover.
3. Remove the battery from battery contacts and replace.
4. When not in use for long periods remove battery.
5. Do not store in locations with high temperatures, or high humidity.

Cleaning

Periodically wipe the case with a damp cloth and detergent, do not use abrasives or solvents.

***Software Operation manual is in the Software disk.**

WARRANTY/DISCLAIMER

OMEGA ENGINEERING, INC. warrants this unit to be free of defects in materials and workmanship for a period of **13 months** from date of purchase. OMEGA's WARRANTY adds an additional one (1) month grace period to the normal **one (1) year product warranty** to cover handling and shipping time. This ensures that OMEGA's customers receive maximum coverage on each product.

If the unit malfunctions, it must be returned to the factory for evaluation. OMEGA's Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective, it will be repaired or replaced at no charge. OMEGA's WARRANTY does not apply to defects resulting from any action of the purchaser, including but not limited to mishandling, improper interfacing, operation outside of design limits, improper repair, or unauthorized modification. This WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of having been damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of OMEGA's control. Components in which wear is not warranted, include but are not limited to contact points, fuses, and triacs.

OMEGA is pleased to offer suggestions on the use of its various products. However, OMEGA neither assumes responsibility for any omissions or errors nor assumes liability for any damages that result from the use of its products in accordance with information provided by OMEGA, either verbal or written. OMEGA warrants only that the parts manufactured by the company will be as specified and free of defects. OMEGA MAKES NO OTHER WARRANTIES OR REPRESENTATIONS OF ANY KIND WHATSOEVER, EXPRESSED OR IMPLIED, EXCEPT THAT OF TITLE, AND ALL IMPLIED WARRANTIES INCLUDING ANY WARRANTY OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY DISCLAIMED. LIMITATION OF LIABILITY: The remedies of purchaser set forth herein are exclusive, and the total liability of OMEGA with respect to this order, whether based on contract, warranty, negligence, indemnification, strict liability or otherwise, shall not exceed the purchase price of the component upon which liability is based. In no event shall OMEGA be liable for consequential, incidental or special damages.

CONDITIONS: Equipment sold by OMEGA is not intended to be used, nor shall it be used: (1) as a "Basic Component" under 10 CFR 21 (NRC), used in or with any nuclear installation or activity; or (2) in medical applications or used on humans. Should any Product(s) be used in or with any nuclear installation or activity, medical application, used on humans, or misused in any way, OMEGA assumes no responsibility as set forth in our basic WARRANTY/DISCLAIMER language, and, additionally, purchaser will indemnify OMEGA and hold OMEGA harmless from any liability or damage whatsoever arising out of the use of the Product(s) in such a manner.

RETURN REQUESTS / INQUIRIES

Direct all warranty and repair requests/inquiries to the OMEGA Customer Service Department. BEFORE RETURNING ANY PRODUCT(S) TO OMEGA, PURCHASER MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM OMEGA'S CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS). The assigned AR number should then be marked on the outside of the return package and on any correspondence.

The purchaser is responsible for shipping charges, freight, insurance and proper packaging to prevent breakage in transit.

FOR **WARRANTY** RETURNS, please have the following information available BEFORE contacting OMEGA:

1. Purchase Order number under which the product was PURCHASED,
2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems relative to the product.

FOR **NON-WARRANTY** REPAIRS, consult OMEGA for current repair charges. Have the following information available BEFORE contacting OMEGA:

1. Purchase Order number to cover the COST of the repair,
2. Model and serial number of the product, and
3. Repair instructions and/or specific problems relative to the product.

OMEGA's policy is to make running changes, not model changes, whenever an improvement is possible. This affords our customers the latest in technology and engineering.

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- Refractometers
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- Air, Soil & Water Monitors
- Industrial Water & Wastewater Treatment
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ATTACHMENT B

FLUKE®

Models 175, 177 & 179

True RMS Multimeters

Users Manual

May 2003 Rev. 1, 10/08
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Lifetime Limited Warranty

Each Fluke 20, 70, 80, 170 and 180 Series DMM will be free from defects in material and workmanship for its lifetime. As used herein, “lifetime” is defined as seven years after Fluke discontinues manufacturing the product, but the warranty period shall be at least ten years from the date of purchase. This warranty does not cover fuses, disposable batteries, damage from neglect, misuse, contamination, alteration, accident or abnormal conditions of operation or handling, including failures caused by use outside of the product’s specifications, or normal wear and tear of mechanical components. This warranty covers the original purchaser only and is not transferable.

For ten years from the date of purchase, this warranty also covers the LCD. Thereafter, for the lifetime of the DMM, Fluke will replace the LCD for a fee based on then current component acquisition costs.

To establish original ownership and prove date of purchase, please complete and return the registration card accompanying the product, or register your product on http://www.fluke.com. Fluke will, at its option, repair at no charge, replace or refund the purchase price of a defective product purchased through a Fluke authorized sales outlet and at the applicable international price. Fluke reserves the right to charge for importation costs of repair/replacement parts if the product purchased in one country is sent for repair elsewhere.

If the product is defective, contact your nearest Fluke authorized service center to obtain return authorization information, then send the product to that service center, with a description of the difficulty, postage and insurance prepaid (FOB Destination). Fluke assumes no risk for damage in transit. Fluke will pay return transportation for product repaired or replaced in-warranty. Before making any non-warranty repair, Fluke will estimate cost and obtain authorization, then invoice you for repair and return transportation.

THIS WARRANTY IS YOUR ONLY REMEDY. NO OTHER WARRANTIES, SUCH AS FITNESS FOR A PARTICULAR PURPOSE, ARE EXPRESSED OR IMPLIED. FLUKE SHALL NOT BE LIABLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES OR LOSSES, INCLUDING LOSS OF DATA, ARISING FROM ANY CAUSE OR THEORY. AUTHORIZED RESELLERS ARE NOT AUTHORIZED TO EXTEND ANY DIFFERENT WARRANTY ON FLUKE’S BEHALF. Since some states do not allow the exclusion or limitation of an implied warranty or of incidental or consequential damages, this limitation of liability may not apply to you. If any provision of this warranty is held invalid or unenforceable by a court or other decision-maker of competent jurisdiction, such holding will not affect the validity or enforceability of any other provision.

Fluke Corporation
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Everett, WA 98206-9090
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P.O. Box 1186
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Visit the Fluke website at: www.fluke.com
Register your Meter at: register.fluke.com

2/02

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⚠⚠ Warning. Read before using the Meter:

To avoid possible electrical shock or personal injury, follow these guidelines:

- ⇒ **Use the Meter only as specified in this manual or the protection provided by the Meter might be impaired.**
- ⇒ **Do not use the Meter or test leads if they appear damaged, or if the Meter is not operating properly. If in doubt, have the Meter serviced.**
- ⇒ **Always use the proper terminals, switch position, and range for measurements.**
- ⇒ **Verify the Meter's operation by measuring a known voltage.**
- ⇒ **Do not apply more than the rated voltage, as marked on the Meter, between the terminals or between any terminal and earth ground.**
- ⇒ **Use caution with voltages above 30 V ac rms, 42 V ac peak, or 60 V dc. These voltages pose a shock hazard.**
- ⇒ **Replace the battery as soon as the low battery indicator ( ) appears.**
- ⇒ **Disconnect circuit power and discharge all high-voltage capacitors before testing resistance, continuity, diodes, or capacitance.**
- ⇒ **Do not use the Meter around explosive gas or vapor.**
- ⇒ **When using the test leads, keep your fingers behind the finger guards.**
- ⇒ **Remove test leads from the Meter before opening the Meter case or battery door.**

Symbols

~	AC (Alternating Current)		Fuse
⎓	DC (Direct Current)	CE	Conforms to European Union directives
⎓ ~	DC/AC	CSA	Canadian Standards Association
⏚	Earth ground	⧈	Double insulated
⚠	Important Information; see manual	C-UL-US	Underwriters Laboratories, Inc. Meter in accordance with IEC 61010-1. 54CJ
	Battery (Low battery when shown on display.)	N10140	Conforms to relevant Australian standards
TÜV GS	Inspected and licensed by TÜV (Technischer Überwachungs Verein) Product Services	VDE	VDE (Verband Deutscher Electroniker)

Models 175, 177 & 179
True RMS Multimeters

The Fluke **Model 175**, **Model 177**, and **Model 179** are battery-powered, true-RMS multimeters (hereafter "the Meter") with a 6000-count, 3 3/4-digit display and a bar graph. This manual applies to all three models. All figures show the Model 179.

These meters meet CAT III and CAT IV IEC 61010 standards. The IEC 61010 safety standard defines four overvoltage categories (CAT I to IV) based on the magnitude of danger from transient impulses. CAT III meters are designed to protect against transients in fixed-equipment installations at the distribution level; CAT IV meters are designed to protect against transients from the primary supply level (overhead or underground utility service).

The Meter measures or tests the following:

- AC / DC voltage & current
- Resistance
- Voltage & current frequency
- Temperature (Model 179 only)
- Diodes
- Continuity
- Capacitance

Contacting Fluke

To contact Fluke, call:

1-888-993-5853 in USA
1-800-363-5853 in Canada
+31 402-678-200 in Europe
+81-3-3434-0181 in Japan
+65-738-5655 in Singapore
+1-425-446-5500 from anywhere in the world

Visit Fluke's web site at www.fluke.com.

Register your Meter at http://register.fluke.com.

"Warning" and "Caution" Statements

A "⚠⚠ **Warning**" identifies hazardous conditions and actions that could cause bodily harm or death.

A "**Caution**" identifies conditions and actions that could damage the Meter, the equipment under test, or cause permanent loss of data.

Unsafe Voltage

To alert you to the presence of a potentially hazardous voltage, when the Meter detects a voltage ≥30 V or a voltage overload (**OL**), the ϟ symbol is displayed.

Test Lead Alert

To remind you to check that the test leads are in the correct terminals, LEAd is momentarily displayed when you move the rotary switch to or from the **mA** or **A** position.

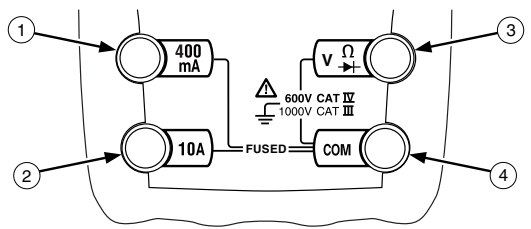
⚠⚠ Warning

Attempting to make a measurement with a test lead in an incorrect terminal might blow a fuse, damage the Meter, and cause serious personal injury.

Battery Saver ("Sleep Mode")

The Meter enters the "Sleep mode" and blanks the display if there is no function change or button press for 20 minutes. To disable the Sleep mode, hold down the **YELLOW** button while turning the Meter on. The Sleep mode is always disabled in the MIN MAX AVG mode and the AutoHOLD mode.

Terminals



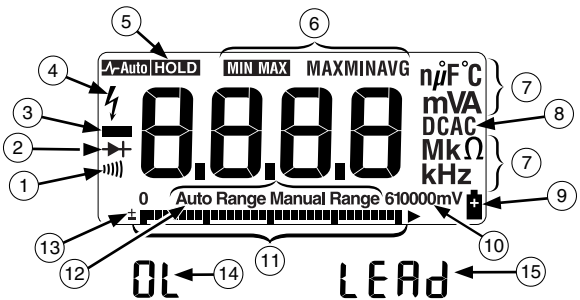
AIK01F.EPS

Item	Description
1	Input terminal for AC and DC milliamp measurements to 400 mA and frequency measurements.
2	Input terminal for AC and DC current measurements to 10 A and frequency measurements.
3	Input terminal for voltage, continuity, resistance, diode, capacitance, frequency, and temperature (Model 179 only) measurements.
4	Common (return) terminal for all measurements.

Rotary Switch Positions

Switch Position	Measurement Function
$\tilde{V}$ Hz	AC voltage from 30.0 mV to 1000 V. Frequency from 2 Hz to 99.99 kHz.
$\overline{\overline{V}}$ Hz	DC voltage 1 mV to 1000 V. Frequency from 2 Hz to 99.99 kHz.
$m\overline{\overline{V}}$ 🌡	DC mV 0.1 mV to 600 mV. Temperature – 40 °C to + 400 °C – 40 °F to + 752 °F
Ω ⊣⊢	Ohms from 0.1 Ω to 50 MΩ. Farads from 1 nF to 9999 µF.
•)) →|	Beeper turns on at <25 Ω and turns off at >250 Ω. Diode test. Displays OL above 2.4 V.
$\overline{\overline{mA}}\sim$ Hz	AC mA from 3.00 mA to 400 mA DC mA from 0.01 mA to 400 mA Frequency of AC mA 2 Hz to 30 kHz.
$\overline{\overline{A}}$ ~A Hz	AC A from 0.300 A to 10 A DC A from 0.001 A to 10 A >10.00 display flashes. >20 A, **OL** is displayed. Frequency of AC A 2 Hz to 30 kHz.
Note: AC voltage and current AC-coupled, true RMS, up to 1 kHz.	

Display



No.	Symbol	Meaning
1	)))))	Continuity test.
2	▶|	Diode test.
3	▬	Negative readings.
4	ϟ	Unsafe voltage. Voltage ≥ 30 V, or voltage overload (**OL**)
5	HOLD Auto HOLD	Display HOLD is enabled. Display freezes present reading. In MIN MAX AVG mode, MIN MAX AVG recording is interrupted. AutoHOLD is enabled. Display holds present reading until it detects new stable input. Then the Meter beeps and displays new reading.
6	MIN MAX **MAX, MIN, AVG**	MIN MAX AVG enabled. Maximum, minimum, average or present reading.

No.	Symbol	Meaning
7	**nμ F, °F, °C** **mVA, MkΩ, kHz**	Measurement units.
8	**DC, AC**	Direct current, alternating current.
9		Low battery. Replace battery.
10	**610000mV**	All possible ranges.
11	Bar graph	Analog display.
12	**Auto Range** **Manual Range**	The Meter selects the range with the best resolution. The user selects the range.
13	±	Bar graph polarity.
14	OL	The input out of range.
15	LEAd	⚠Test lead alert. Displayed when the rotary switch is moved to or from the **mA** or **A** position.

Error Messages	
bAtt	Replace the battery immediately.
diSC	In the capacitance function, too much electrical charge is present on the capacitor being tested.
EEPr Err	Invalid EEPROM data. Have Meter serviced.
CAL Err	Invalid calibration data. Calibrate Meter.
OPEn	Open thermocouple is detected.

MIN MAX AVG Recording Mode

The MIN MAX AVG recording mode captures the minimum and maximum input values, and calculates a running average of all readings. When a new high or low is detected, the Meter beeps.

Note

For DC functions, accuracy is the specified accuracy of the measurement function ± 12 counts for changes longer than 350 ms in duration.

For AC functions, accuracy is the specified accuracy of the measurement function ± 40 counts for changes longer than 900 ms in duration.

To use MIN MAX AVG recording:

⇒ Make sure that the Meter is in the desired measurement function and range. (Autoranging is disabled in the MIN MAX AVG mode.)

⇒ Press **MIN MAX** to activate MIN MAX AVG mode.

MIN MAX and **MAX** light, and the highest reading detected since entering MIN MAX AVG is displayed.

⇒ Press **MIN MAX** to step through the low (**MIN**), average (**AVG**), and present readings.

⇒ To pause MIN MAX AVG recording without erasing stored values, press **HOLD**. HOLD is displayed.

To resume MIN MAX AVG recording, press **HOLD** again. HOLD turns off.

⇒ To exit and erase stored readings, press MIN MAX for 1 second or turn the rotary switch.

Display HOLD and AutoHOLD Modes

⚠⚠ Warning

To avoid electric shock, do not use the Display HOLD or AutoHOLD mode to determine if a circuit is live. Unstable or noisy readings will not be captured.

In the Display HOLD mode, the Meter holds the reading on the display.

In the AutoHOLD mode, the Meter holds the reading on the display until it detects a new stable reading. Then the Meter beeps and displays the new reading.

⇒ Press **HOLD** to activate Display HOLD. HOLD lights.

⇒ Press **HOLD** again to activate AutoHOLD. Auto HOLD lights.

⇒ Press **HOLD** again to resume normal operation.

To resume normal operation at any time, press **HOLD** for 1 second or turn the rotary switch.

YELLOW Button

Press the **YELLOW** button to select alternate measurement functions on a rotary switch setting, e.g., to select DC mA, DC A, Hz, temperature (Model 179 only), capacitance, diode test.

Display Backlight (Model 177 and 179 Only)

Press ☼ to toggle the backlight on and off. The backlight automatically turns off after 2 minutes.

Manual Ranging and Autoranging

The Meter has both Manual range and Autorange modes.

⇒ In the Autorange mode, the Meter selects the range with the best resolution.

⇒ In the Manual Range mode, you override Autorange and select the range yourself.

When you turn the Meter on, it defaults to Autorange and **Auto Range** is displayed.

1. To enter the Manual Range mode, press **RANGE**.
   Manual Range is displayed.
2. In the Manual Range mode, press **RANGE** to increment the range. After the highest range, the Meter wraps to the lowest range.

   Note

   You cannot manually change the range in the MIN MAX AVG, or Display HOLD modes.

   If you press **RANGE** *while in MIN MAX AVG, or Display HOLD, the Meter beeps twice, indicating an invalid operation, and the range does not change.*
3. To exit Manual Range, press **RANGE** for 1 second or turn the rotary switch.
   The Meter returns to Autorange and **Auto Range** is displayed.

Power-Up Options

To select a Power-Up Option, hold down the button indicated while turning the Meter from OFF to any switch position.

Power-Up Options are cancelled when the Meter is turned OFF.

Button	Power-Up Options
AutoHOLD HOLD	$\tilde{V}$ switch position turns on all LCD segments. $\overline{\tilde{V}}$ switch position displays the software version number. m$\overline{\tilde{V}}$ switch position displays the model number.
MIN MAX	Disables beeper. (**bEEP**)
RANGE	Enables "Smoothing" mode. (**S---**) Dampens display fluctuations of rapidly changing inputs by digital filtering.
(YELLOW)	Disables automatic power-down ("Sleep mode"). (**PoFF**) Sleep mode is also disabled while the Meter is in a MIN MAX AVG Recording mode, or the AutoHOLD mode.
☼	Disables automatic 2-minute backlight timeout. (**LoFF**) (**Model 177 and 179 Only**)

Making Basic Measurements

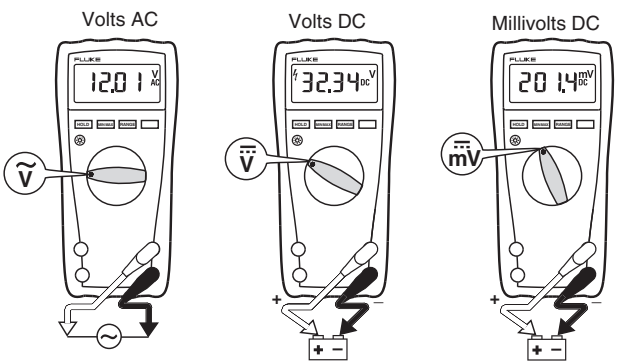
The figures on the following pages show how to make basic measurements.

When connecting the test leads to the circuit or device, connect the common (**COM**) test lead before connecting the live lead; when removing the test leads, remove the live lead before removing the common test lead.

⚠⚠ Warning

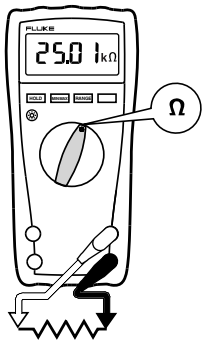
To avoid electric shock, injury, or damage to the Meter, disconnect circuit power and discharge all high-voltage capacitors before testing resistance, continuity, diodes, or capacitance.

Measuring AC and DC Voltage



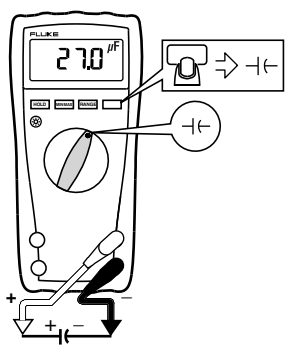
AIK03F.EPS

Measuring Resistance



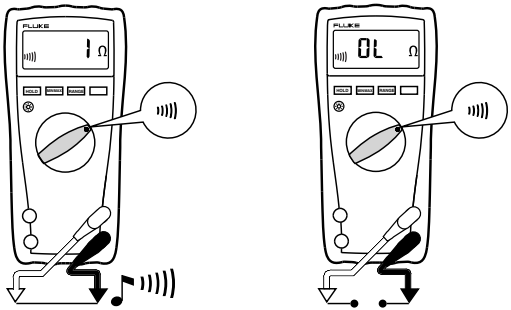
AIK04F.EPS

Measuring Capacitance



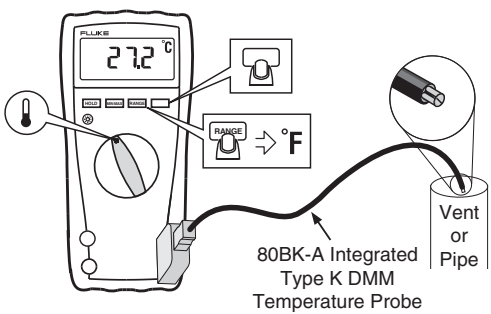
AIK05F.EPS

Testing for Continuity



AIK06F.EPS

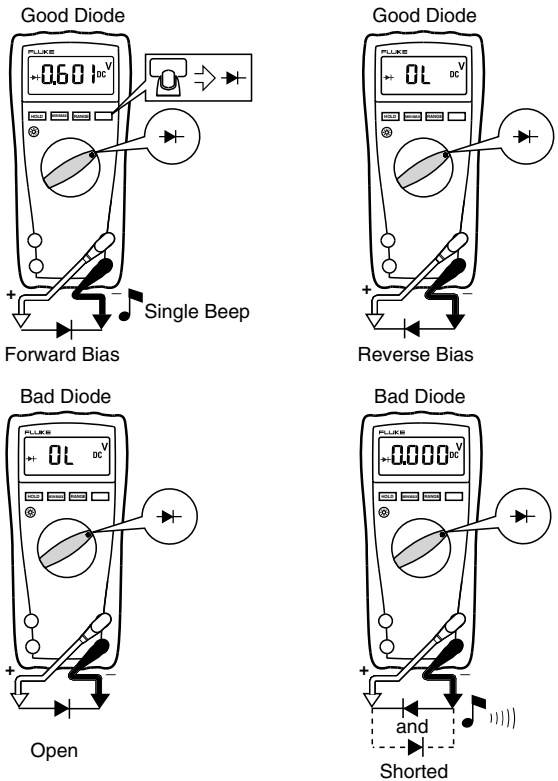
Measuring Temperature (Model 179 Only)



AIK10F.EPS

⚠⚠ Warning: Do not connect 80BK-A to live circuits.

Testing Diodes



AIK07F.EPS

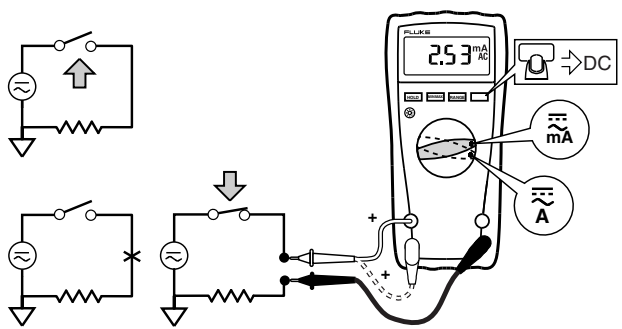
Measuring AC or DC Current

⚠⚠ Warning

To avoid personal injury or damage to the Meter:

- **Never attempt to make an in-circuit current measurement when the open-circuit potential to earth is >1000 V.**
- **Check the Meter's fuses before testing. (See "Testing the Fuses".)**
- **Use the proper terminals, switch position, and range for your measurement.**
- **Never place the probes in parallel with a circuit or component when the leads are plugged into the current terminals.**

Turn power OFF, break circuit, insert Meter in series, turn power on.



AIK08F.EPS

Understanding AC Zero Input Behavior of True RMS Meters

Unlike averaging meters, which can accurately measure only pure sinewaves, True RMS meters accurately measure distorted waveforms. Calculating True RMS converters require a certain level of input voltage to make a measurement. This is why AC voltage and current ranges are specified from 5% of range to 100% of range. Non-zero digits that are displayed on a True RMS meter when the test leads are open or are shorted are normal. They do not affect the specified AC accuracy above 5% of range.

Unspecified input levels on the lowest ranges are:

- AC voltage: below 5% of 600 mV AC, or 30 mV AC
- AC current: below 5% of 60 mA AC, or 3 mA AC

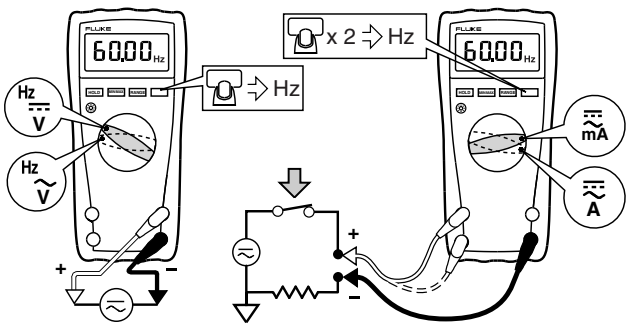
Measuring Frequency

⚠⚠ Warning

To avoid electrical shock, disregard the bar graph for frequencies > 1 kHz. If the frequency of the measured signal is > 1 kHz, the bar graph is unspecified.

The Meter measures the frequency of a signal. The trigger level is 0 V, 0 A AC for all ranges.

AC/DC Voltage Frequency AC Current Frequency



AIK09F.EPS

⇒ To exit frequency, press **YELLOW** button or turn the rotary switch.

⇒ In frequency, the bar graph shows the AC/DC voltage or AC current accurately up to 1 kHz.

⇒ Select progressively lower ranges using manual ranging for a stable reading.

Using the Bar Graph

The bar graph is like the needle on an analog Meter. It has an overload indicator (▶) to the right and a polarity indicator (±) to the left.

Because the bar graph updates about 40 times per second, which is 10 times faster than the digital display, the bar graph is useful for making peak and null adjustments and for observing rapidly changing inputs.

The bar graph is disabled when measuring capacitance or temperature. In frequency, the bar graph accurately indicates the voltage or current up to 1 kHz.

The number of lit segments indicates the measured value and is relative to the full-scale value of the selected range.

In the 60 V range, for example (see below), the major divisions on the scale represent 0, 15, 30, 45, and 60 V. An input of –30 V lights the negative sign and the segments up to the middle of the scale.



AIK11F.EPS

Cleaning

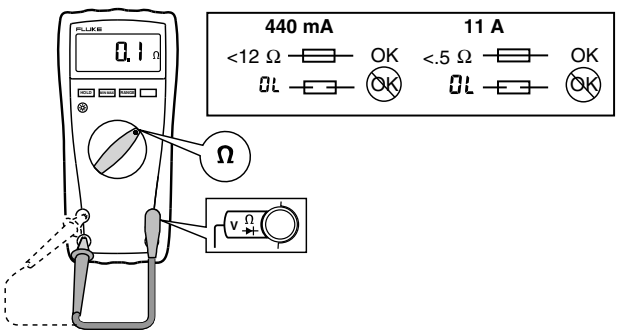
Wipe the case with a damp cloth and mild detergent. Do not use abrasives or solvents. Dirt or moisture in the terminals can affect readings.

Testing the Fuses

⚠⚠ Warning

To avoid electrical shock or injury, remove the test leads and any input signals before replacing the fuse.

Test fuses as shown below.



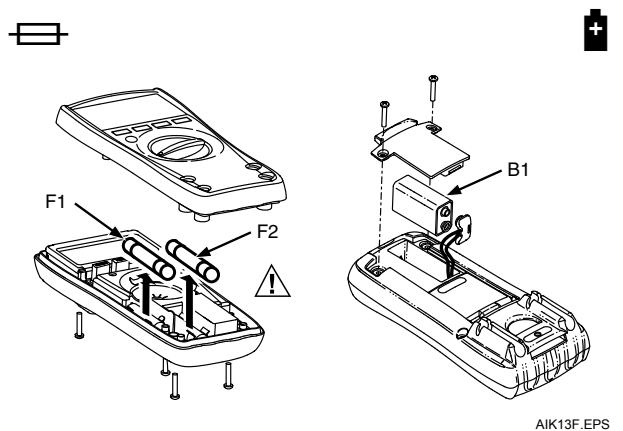
AIK12F.EPS

Replacing the Battery and Fuses

⚠⚠ Warning

To avoid shock, injury, or damage to the Meter:

- **Use ONLY fuses with the amperage, interrupt, voltage, and speed ratings specified.**
- **Replace the battery as soon as the low battery indicator ( ) appears.**



AIK13F.EPS

F1 Fuse, 440 mA, 1000 V, FAST	Fluke PN 943121
F2 Fuse, 11 A, 1000 V, FAST	Fluke PN 803293
B1 Battery, 9 V Alkaline NEDA 1604 / 1604A	Fluke PN 614487

Specifications

Accuracy is specified for 1 yr after calibration, at operating temperatures of 18 °C to 28 °C, with relative humidity at 0 % to 90 %. Accuracy specifications take the form of: ± ([% of Reading] + [Counts])

Maximum voltage between any terminal and earth ground: 1000 V DC or AC RMS

Surge Protection:	8 kV peak per IEC 61010
⚠ Fuse for mA inputs:	440 mA, 1000 V FAST Fuse
⚠ Fuse for A input:	11 A, 1000 V FAST Fuse
Display:	Digital: 6000 counts, updates 4/sec Bar Graph: 33 segments; Updates 40/sec Frequency: 10,000 counts Capacitance: 1,000 counts
Altitude:	Operating: 2000 m; Storage: 12,000 m
Temperature:	Operating: –10 °C to +50 °C; Storage: –40 °C to +60 °C
Temperature coefficient:	0.1 X (specified accuracy / °C (< 18 °C or > 28 °C)
Electromagnetic Compatibility (EN 61326-1:1997):	In an RF field of 3 V/M, accuracy = specified accuracy except in temperature: specified accuracy ± 5 °C (9 °F)
Relative Humidity:	Maximum Noncondensing 90 % to 35 °C 75 % to 40 °C 45 % to 50 °C
Battery Life:	Alkaline: 400 hrs typical
Size (H x W x L):	4.3 cm x 9 cm x 18.5 cm
Weight:	420 g
Safety Compliances:	ANSI/ISA S82.02.01, CSA C22.2-1010.1, IEC 61010 to 1000 V Measurement Category III, 600 V Measurement Category IV
Certifications:	CSA, TÜV (EN61010), UL, CE, N10140, VDE

Function	Range [1]	Resolution	Accuracy ±([% of Reading] + [Counts])		
			Model 175	**Model 177**	**Model 179**
AC Volts [2, 3]	600.0 mV 6.000 V 60.00 V 600.0 V 1000 V	0.1 mV 0.001 V 0.01 V 0.1 V 1 V	1.0 % + 3 (45 Hz to 500 Hz) 2.0 % + 3 (500 Hz to 1 kHz)	1.0 % + 3 (45 Hz to 500 Hz) 2.0 % + 3 (500 Hz to 1 kHz)	1.0 % + 3 (45 Hz to 500 Hz) 2.0 % + 3 (500 Hz to 1 kHz)
DC mV	600.0 mV	0.1 mV	0.15 % + 2	0.09 % + 2	0.09 % + 2
DC Volts	6.000 V 60.00 V 600.0 V	0.001 V 0.01 V 0.1 V	0.15 % + 2	0.09 % + 2	0.09 % + 2
	1000 V	1 V	0.15 % + 2	0.15 % + 2	0.15 % + 2
Continuity	600 Ω	1 Ω	Meter beeps at < 25 Ω, beeper turns off at > 250 Ω; detects opens or shorts of 250 µs or longer.		
Ohms	600.0 Ω 6.000 kΩ 60.00 kΩ 600.0 kΩ 6.000 MΩ 50.00 MΩ	0.1 Ω 0.001 kΩ 0.01 kΩ 0.1 kΩ 0.001 MΩ 0.01 MΩ	0.9 % + 2 0.9 % + 1 0.9 % + 1 0.9 % + 1 0.9 % + 1 1.5 % + 3	0.9 % + 2 0.9 % + 1 0.9 % + 1 0.9 % + 1 0.9 % + 1 1.5 % + 3	0.9 % + 2 0.9 % + 1 0.9 % + 1 0.9 % + 1 0.9 % + 1 1.5 % + 3
Diode test	2.400 V	0.001 V	1 % + 2		
Capacitance	1000 nF 10.00 µF 100.0 µF 9999 µF [4]	1 nF 0.01 µF 0.1 µF 1 µF	1.2 % + 2 1.2 % + 2 1.2 % + 2 10 % typical	1.2 % + 2 1.2 % + 2 1.2 % + 2 10 % typical	1.2 % + 2 1.2 % + 2 1.2 % + 2 10 % typical
AC Amps [5] (True RMS) (45 Hz to 1 kHz)	60.00 mA 400.0 mA[6] 6.000 A 10.00 A[7]	0.01 mA 0.1 mA 0.001 A 0.01 A	1.5 % + 3	1.5 % + 3	1.5 % + 3

1. All AC voltage and AC current ranges are specified from 5 % of range to 100 % of range.
2. Crest factor of ≤ 3 at full scale up to 500 V, decreasing linearly to crest factor ≤ 1.5 at 1000 V.
3. For non-sinusoidal waveforms, add -(2% reading + 2% full scale) typical, for crest factors up to 3.
4. In the 9999 µF range for measurements to 1000 µF, the measurement accuracy is 1.2 % + 2 for all models.
5. Amps input burden voltage (typical): 400 mA input 2 mV/mA, 10 A input 37 mV/A.
6. 400.0 mA accuracy specified up to 600 mA overload.
7. > 10A unspecified.

Function	Range [1]	Resolution	Accuracy ±([% of Reading] + [Counts])		
			Model 175	**Model 177**	**Model 179**
DC Amps[4]	60.00 mA 400.0 mA[6] 6.000 A 10.00 A[7]	0.01 mA 0.1 mA 0.001 A 0.01 A	1.0 % + 3	1.0 % + 3	1.0 % + 3
Hz (AC- or DC-coupled, V or A [2, 3] input)	99.99 Hz 999.9 Hz 9.999 kHz 99.99 kHz	0.01 Hz 0.1 Hz 0.001 kHz 0.01 kHz	0.1 % + 1	0.1 % + 1	0.1 % + 1
Temperature	-40 °C to +400 °C -40 °F to +752 °F	0.1 °C 0.1 °F	NA	NA	1 % + 10[5] 1 % + 18[5]
MIN MAX AVG	For DC functions, accuracy is the specified accuracy of the measurement function ±12 counts for changes longer than 350 ms in duration. For AC functions, accuracy is the specified accuracy of the measurement function ±40 counts for changes longer than 900 ms in duration.				

1. All AC voltage and AC current ranges are specified from 5 % of range to 100 % of range.
2. Frequency is specified from 2 Hz to 99.99 kHz in Volts and from 2 Hz to 30 kHz in Amps.
3. Below 2 Hz, the display shows zero Hz.
4. Amps input burden voltage (typical): 400 mA input 2 mV/A, 10 A input 37 mV/A.
5. Does not include error of the thermocouple probe.
6. 400.0 mA accuracy specified up to 600 mA overload.
7. > 10A unspecified.

Function	Overload Protection [1]	Input Impedance (Nominal)	Common Mode Rejection Ratio (1 kΩ Unbalanced)		Normal Mode Rejection
Volts AC	1000 V RMS	> 10 MΩ < 100 pF	> 60 dB @ DC, 50 Hz or 60 Hz		
Volts DC	1000 V RMS	> 10 MΩ < 100 pF	>120 dB @ DC, 50 Hz or 60 Hz		> 60 dB @ 50 Hz or 60 Hz
mV/🌡	1000 V RMS[2]	> 10 MΩ < 100 pF	>120 dB @ DC, 50 Hz or 60 Hz		> 60 dB @ 50 Hz or 60 Hz
		Open Circuit Test Voltage	**Full Scale Voltage To:** 600 kΩ	50 MΩ	**Short Circuit Current**
Ohms/Capacitance	1000 V RMS[2]	< 8.0 V DC	< 660 mV DC	< 4.6 V DC	< 1.1 mA
Continuity/Diode test	1000 V RMS[2]	< 8.0 V DC	2.4 V DC		< 1.1 mA
1. 10^7 V-Hz maximum.					
2. For circuits < 0.3 A short circuit. 660 V for high energy circuits.					

Function	Overload Protection	Overload
mA	Fused, 44/100 A, 1000 V FAST Fuse	600 mA overload for 2 minutes maximum, 10 minutes rest minimum
A	Fused, 11 A, 1000 V FAST Fuse	20 A overload for 30 seconds maximum, 10 minutes rest minimum

ATTACHMENT C

Creating a Properly Made Ice Bath

The easiest way to test the accuracy of any thermometer is in a properly made ice bath. If you do this carefully, your ice bath will be 32.0°F within ±0.1°F. If you are not careful, the ice bath can be off by several whole degrees. (Just a cup with ice water in it can be 12 or more degrees too high.)

Step One: Fill with ice

Making a proper ice bath is all about keeping a proper ice-to-water ratio. Fill a vessel all the way to the top with ice. Crushed ice is preferred because there are fewer gaps between the ice, however cubed ice will also work fine.

Step Two: Add Water

Slowly add water to fill the spaces between the ice. Fill about 1/2" below the top of the ice. Let the mixture sit for a minute or two to allow the temperature of the water to settle. If you see the ice starting to float off the bottom of the vessel, pour off some water and add more ice. Water below the ice will not be at 32°F.

Step Three: Insert the Probe

Once the mixture has rested for a minute or two, insert your probe (or thermometer stem) into the mixture and stir in the vertical center of the ice slurry. Stirring the probe keeps the sensor from resting against an ice cube, which will affect your reading. Keep the probe tip away from the side walls and don't allow it to rest against the bottom of the vessel. Doing so will give you inaccurate temperature readings. If the thermometer has an extremely fast and sensitive needle tip, like the Thermapen, you MUST gently stir the probe or you will find colder and warmer spots in the ice bath. Stirring equilibrates the temperature throughout the vessel.

Step Four: Confirm Calibration

Your thermometer should read 32°F (0°C) in the ice bath. Adjust your dial thermometer as directed by the manufacturer; however, before you attempt to adjust a digital, instant-read thermometer, check that the readings are within the manufacturers' accuracy specifications. (Look for a ±°F on the documentation included with the instrument.) If it's within the specified tolerance, don't adjust.

Reference: Thermo Works website
http://thermoworks.com/learning/thermapen101_creating_an_icebath.html)

APPENDIX G

STANDARD OPERATING PROCEDURE FOR MANAGEMENT OF A LOCAL SUBSURFACE OXIDATION EVENT

Local Subsurface Oxidation (SSO – Potential Landfill Fires)
Bridgeton Landfill – North Quarry

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

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

Typical Symptoms

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

Initial Notification and Investigation

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

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

2) Health and Safety Considerations

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

3) Conduct physical inspection

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

c) Inspect the landfill surface within 500 feet of nearest extraction well to the potential SSO location.
d) Visibly inspect for large localized settlement, cracks, holes, collapse, missing components, and areas that could be sources of air intrusion into the waste mass including:

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

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

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

6) Infrared Thermometer Survey

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

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

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

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

Formal Notifications

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

Data Analysis

Determine the state of the SSO

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

Removing the Oxygen from the Fire

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

1) Shutdown well(s) that is believed to have been the cause of the SSO.
2) Shutdown all wells in surrounding area (within the approximately 300 feet of suspect well(s)).
3) Cap or repair any item identified during the physical inspection that may be contributing to oxygen intrusion.
4) Carefully add additional cover to areas that show cap integrity issues if necessary. Work slowly and pay special attention to the ground surface as material placement commences.

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

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

Things to Avoid

- *Flushing the well with water* – Flushing the well with water can potentially clog the well.
- *Excavating soil in the SSO area* – Do not excavate in the SSO area. Excavation will allow additional oxygen to enter the already smoldering waste mass and can potentially auto-ignite.
- Venting – Do not remove the wellhead to vent the well. Wellfields are typically under negative pressure. Residual vacuum exists in the waste mass for a period of time when wells are closed. If the wellhead is removed to vent, it is highly possible that the residual vacuum in the area will pull ambient air into the waste mass adding oxygen to the SSO.
- *Dry ice application* – While dry-ice may have a temporary cooling effect on the physical well casing, it will have little to no effect extinguishing the SSO. In order to apply the dry ice to the well, the wellhead has to be removed, allowing oxygen a pathway to the waste mass (see above).
- *Introduction of water into open cap fissures* – Applying water to open fissures in the cap where an SSO exists can create a plume of highly odorous stream. It is also dangerous to bring a heavy, rubber tired water truck to the area to apply water. The steam created can be dangerous to workers in the immediate area. If an open cap fissure exists in an SSO area, is shall be safely filled with soil. Removing the pathway for oxygen intrusion is the most effective way to put out the SSO.

Continued Monitoring

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

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

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

Repairs

Repairs should be made to the SSO area, as necessary

- Visual Inspection
- O&M Provider shall visually inspect the following:
    - Wellheads and lateral piping,
    - Cover soil and geosynthetics, and
    - Other items within SSO area.

- Provide findings to, and generate repair options for OM&M Manager.
- OM&M Manager shall facilitate repairs, as required.

Timeline for Local SSO Resolution

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

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

Classification of the Event

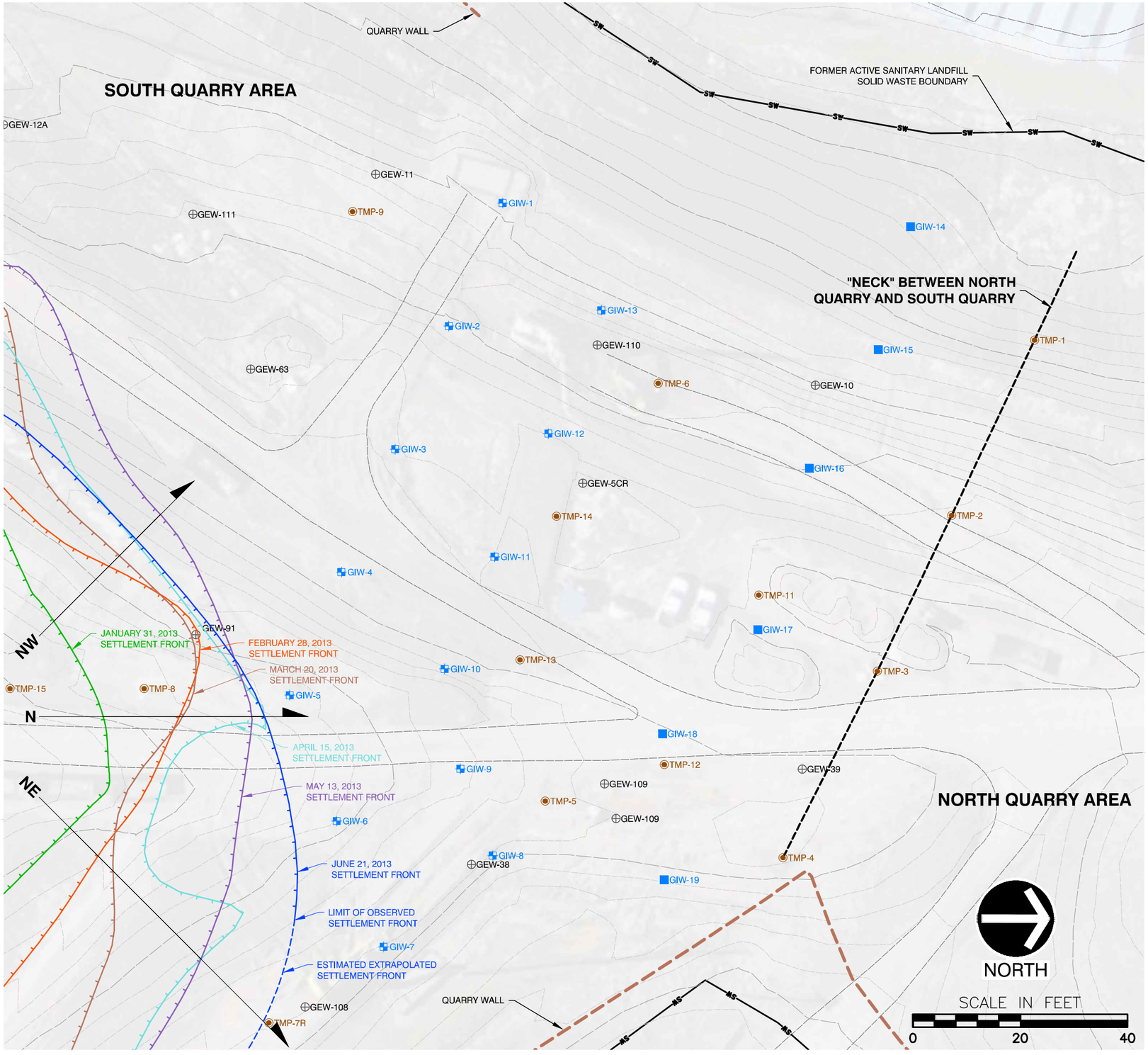
The Environmental Manager and the MDNR will actively collaborate to verify and classify the SSO event. Such determination will be made within four weeks of the Initial Notification.

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

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

APPENDIX H

ANALYSIS OF RATE OF SSE MOVEMENT



VECTOR DATA

DATE RANGE (ALL 2013)	1/31-2/28	2/28-3/20	3/20-4/15	4/15-5/13	5/13-6/21	TOTAL	AVERAGE MOVEMENT (FEET/DAY)
NO. OF DAYS	28	20	26	28	38	140	
NE VECTOR (FT)	15	8	46	0	33	102	0.73
N VECTOR (FT)	28	1	30	-5	5	59	0.42
NW VECTOR (FT)	29	6	8	14	-13	44	0.31
OVERALL AVERAGE							0.49

NOTE

1. SETTLEMENT FRONT DEFINED AS LINE OF EQUAL RATE OF SETTLEMENT 1.35 FEET PER 30 DAY PERIOD.

LEGEND

- GEW-81 — EXISTING LFG EXTRACTION WELL (GEW)
- GEW-2 — EXISTING LFG EXTRACTION WELL (WITH PUMP)
- TMP-6 — EXISTING TEMPERATURE MONITORING PROBE (TMP)
- GIW-10 — GAS INTERCEPTOR WELL (GIW)
- TMP-16 — CONTINGENT TEMPERATURE MONITORING PROBE (TMP)
- GIW-14 — EXISTING SOLID WASTE BOUNDARY
- SW — EXISTING SOLID WASTE BOUNDARY
- EXISTING QUARRY HIGHWALL
- VECTOR DATA LINE

REFERENCE

1. TOPOGRAPHIC INFORMATION BASED UPON BRIDGETON LANDFILL– DTM.DWG PROVIDED BY COOPER AERIAL SURVEYS CO., DATED FEB. 2013. SURVEY FIELD SUPPLEMENTED BY WEAVER BOOS CONSULTANTS.
2. AERIAL IMAGERY PROVIDED BY EAST WEST GATEWAY COORDINATING COUNCIL OF MISSOURI AND ILLINOIS, COLLECTED IN LATE FEBRUARY AND EARLY MARCH OF 2012.

SETTLEMENT MOVEMENT MAP

DRAWN BY:	MSP	CHECKED BY:	MRB	APPROVED BY:	DRAFT	FIGURE NO.:	
DATE:	JUL. 2013	DWG SCALE:	1"=20'	PROJECT NO:	131-178.0001		--

P:\2013\131-484\-CADD\DWG\SOLIDWASTE\131178-FIGURE_SETTLEMENT-FRONTLINE LAST SAVED BY(MPEAKE) - 7/23/2013 10:12:7 AM, LAST PRINTED BY(PEAKE, MONTE) - 7/23/2013 10:26:54 AM

APPENDIX I

PRELIMINARY COOLING POINT DESIGN

Heat Removal Using Vertical Exchange Elements – Circulated Water Cooling Points

Highlights

1. Approach – Heat is removed from the waste mass, arresting advancement of the pyrolytic heat front of the SSE. Cooler water is circulated through pipes (this could work even with water entering the pipe at about 85° F and water exiting at about 80° F) resulting in the removal of heat energy, much like a car radiator works.
2. Installation - This may be achieved using existing GIWs which are enhanced with the addition of closed loop water circulation pipes and/or through the installation of new, dedicated driven cooling points. An untriggered limited-scale operation could provide data for design of a full-scale triggered installation.
3. Timelines – A limited-scale operation could be in place within six weeks of notice to proceed. A full-scale operation, including driving of up to 30 dedicated cooling point casings, could be functioning within three months of triggering/notice to proceed.

Method of Heat Removal

Circulation of water within vertical elements (i.e. existing or new gas wells, or single purpose closed pipe exchange wells) is proposed as a method of heat removal. Water is circulated inside vertical elements either using closed loops within gas wells or within a closed pipe for single purpose exchange wells as shown in Figure 1. The circulated water is cooler than the landfill waste when it enters the exchange element and comes slightly warmed on the exit side of the exchange element as shown on Figure 2. The difference in temperature represents removal of heat energy.

The amount of heat energy removed depends on a number of factors, including:

1. The difference between the entrance cooling water and the exit cooling water,
2. The absolute temperature of the entrance and cooling water,
3. Flow rate of water through the tubing,
4. Spacing and depth of the vertical cooling points,
5. The temperature of waste mass being cooled and the amount flux (heat flow) rate toward the cooling area, and
6. Thermal properties of the waste which is being cooled.

Items 1-4 can be controlled by design, equipment, and operation.

Flow rates and inlet/outlet temperatures are used to determine the amount of heat removed. Higher flow rates require lower differences between the entrance and exit cooling water temperature. Heat removal can be increased easily by the total rate of heat removal in the area exceeds the rate of heat

addition from the waste mass to the south the temperature of the waste mass will fall. This is analogous in many (but not all) ways to dewatering an unconfined aquifer.

Lowering the temperature requires the removal of both the influx of heat to the area and the depletion of heat energy stored in the waste mass within the area to be cooled from its present temperature. Vertical heat exchange units can be considered analogous to wells or well points (depending on size) where the removal rate at given location is governed by the difference in temperature inside the exchange point, the transfer rate from the point to the waste and the thermal conductivity and heat storage properties of the waste mass. Continuing with the same analogy; the temperature is analogous to total head, the heat conduction properties of the exchange point and waste analogous to permeability and the heat capacity of the waste similar to the storage coefficient or drainable porosity.

The use of cooling points in porous media has a long history in civil engineering both in the practice of ground freezing and of late, geothermal energy. While it may not have been used for the exact purpose proposed at the site, it does not represent a new technology. There is no doubt that heat can be removed in sufficient quantity to lower the temperature of the waste.

The main design issues that are not resolved at present are the mechanics of transfer at the exchange points, the thermal properties of the waste and the rate of energy supply being conducted from the south or generated within the area of the neck itself. These same issues are present for a gas injection system which was also considered, but the use of liquid circulation in closed systems does not include the massive uncertainties associated with getting the gas to flow in the zones of interest and the effect of frozen zones around the injection points would have on injection capacity.

The design parameters for use in the eventual cooling program can be developed by conducting some trial tests in existing wells. This approach is described in later sections of this report.

Feasibility

Calculations indicate (see Attachment A) the rate of heat flux to the north is approximately 14 watts/meter^2 (W/m^2). Therefore removal of more than this amount would result in cooling of the waste mass in the vicinity of the narrow point in the quarry. It should be noted that the 80° F circulation temperature is achievable as a daily average using standard commercial air to water coolers and evaporative sprays to reach wet bulb temperatures. During the fall, winter, and spring much lower temperatures could be achieved using the same equipment, this would increase the potential heat removal by up to 50% with a reduction to 40° F from 80° F in the well system presented.

Enhanced GIWs

Calculations, provided in Attachment B, indicate that existing gas wells with a 6 inch radius and 36 inch gravel pack that is saturated (enhanced GIWs), could remove 22 W/m^2 (at least 1.5 times the calculated incoming heat flux) spaced at 20 foot centers if the temperature of water within the well were cooled to approximately 80° F. For reference, the 22 W/m^2 flux rate represents about 38 KWatts across the quarry narrow point if the width of area is 250 feet wide and approximately 80 feet deep.

This calculation suggests that eventually cooling of the waste mass between points would occur and that the steady state temperature would be on the order of 160° F. The calculation relies upon some assumptions concerning the conveyance properties of the waste and gravel zone around the well. In the event these properties turn out to be less favorable for the heat transfer mechanism or the flux rate would be higher locally, additional heat withdrawal points could be added or the temperature of the circulating fluid lowered to achieve greater heat withdrawal.

Driven Cooling Points

In addition, calculations are presented in Attachment B for smaller diameter driven closed end piping of 4 inch and 6 inch diameter exchange pipes. These calculations show that spacing of 12 foot on center would also be sufficient with an 80 degree circulation fluid temperature. The exit temperature once steady state occurs would be on the order of 85 degrees.

Implementation Approach

Limited Operation in Enhanced Existing GIWs

The initial step in the design will be to perform a limited scale operation on two wells using a once through water circulation system. Monitoring or the inlet and outlet temperature, liquid temperature in the gas well (either GEW or GIW) and liquid coolant flow rate will be performed. In addition the nearest TMPs will be read daily. Initially, a single loop of circulation tube will be used. This should prove in sufficient to lower the temperature; a second loop will be introduced (see Figure 1 for a schematic showing the configuration of the loops within the well). For this limited scale operation, the liquid pumps would be removed from the wells allowing condensation to fill the well (likely stabilizing near the top of the well screen), and providing the necessary liquid column for heat exchange with the closed-loop cooling pipes. This will allow the removal of the pump and piping associated with it, removing the need to custom design the cooling coils.

Within three weeks of startup, adequate time, temperature and heat removal rates could be developed to allow back-calculation of heat transfer and heat capacity constants. The limited operation wells should be separated from each other so as to simplify the analysis.

Optional Non-Triggered Wider-Scale Deployment

Following the limited scale operation it is envisioned that the heat removal process could be expanded to include more existing gas wells (GIWs or GESs) in the neck area of the south quarry. It should be pointed out that heat removed from the approaching hotter areas to immediate south of the neck area is heat that ultimately would not have to be taken from the neck itself. Also, the extraction process will be more efficient where the temperature differential is higher between the desired waste temperature and the current waste temperature. For this reason GIWs that are currently in or proximate to the heat front could be used for extraction purposes. This could reduce the total heat flux to the north and make the achievement of the desired conditions at the neck easier.

Given the current rate of movements of the heat front toward the neck, there is time to perform such a deployment. It is likely that wells would be designed to allow water levels to rise up to as high as 50 to 70 feet from the ground surface in the well so as to maximize heat exchange capacity while still allowing gas collection. It should be pointed out that gas collection is dominated by the upper screened portion of a gas well in any case so this will have little impact if any on gas collection.

For the initial phase, an air to water cooler will be utilized to maintain the circulation fluid temperature. Supply and return headers would be employed. The same data of inflow and outflow temperature, liquid levels and flow rate would be collected for the initial stage. Readings of TMPs and gas wells would continue and the size of the initial system will provide a larger set of data to demonstrate the efficacy of the approach. It should be noted that even if the spacing of the existing wells were not sufficient to achieve the desired temperatures, the overall extraction of heat would be significant and the already slowly moving event would slow even more.

Triggered Implementation of Cooling System

If triggers are reached which require installation of a cooling system, the data gathered from the limited operation and from a potential non-triggered wider scale deployment will be used to finalize the design. Additional extraction points would likely be pile-driven, stout closed-end pipe shapes with the internal downtube pipes as shown on Figure 1.

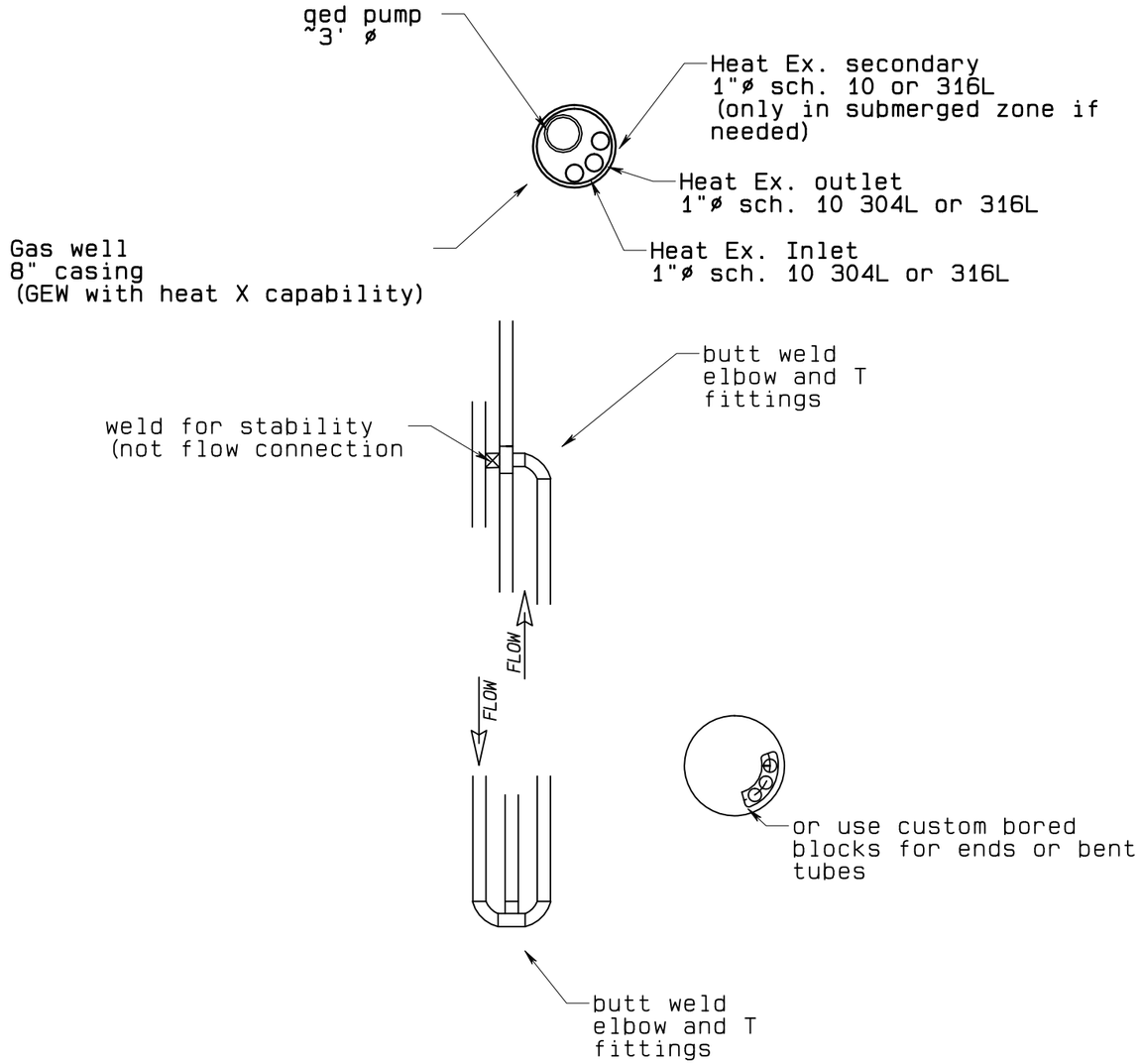
The system as it may finally be deployed may not result in the development of a neat line of heat extraction devices. The extraction system, especially if pile driven, can be far more effective if it is targeted to hotter zones and if the heat removal process performed in the initial installation demonstrates that the heat is mostly being conducted from the south rather than being locally generated, extraction nearer the warm zones to the south than the neck will be more effective. Unlike other methods of mitigation, any identified progress of the reaction in a specific area could be treated locally with some number of extraction points.

In any case, it is envisioned that cooling points would be placed south of the neck area in an attempt to prevent the SSE from entering the North Quarry.

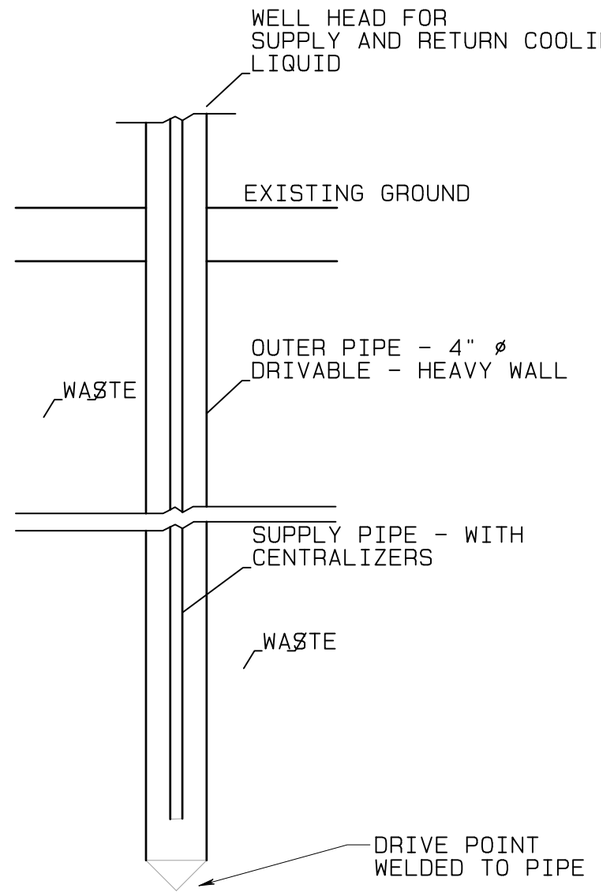
Installation Time Frames

The installation of heat exchanging units within the existing gas wells could begin following fabrication of the exchange elements which may require several weeks. The cooler units (see Attachment C) are reportedly available within a 6 week period after order and may be available faster required. It is our understanding that a 3 week mobilization time for driving equipment would be more than adequate and a production rate for piling up to 150 feet in length would be on the order of 2 to 4 per day, requiring 2 weeks maximum once the driver were on site and materials available. Pumping and other piping can be deployed within 2 weeks after the driving is completed and the system would likely be operational once the cooling system arrived. The entire process would take less than three months from notice to proceed to commencement of operations. Addition of monitoring and other features could be done following initial operations. This is far faster than the current rate of advance of the heat front.

FIGURES



TYPICAL GAS WELL
HEAT EXCHANGER UNIT



TYPICAL DRIVE POINT
HEAT EXCHANGER UNIT

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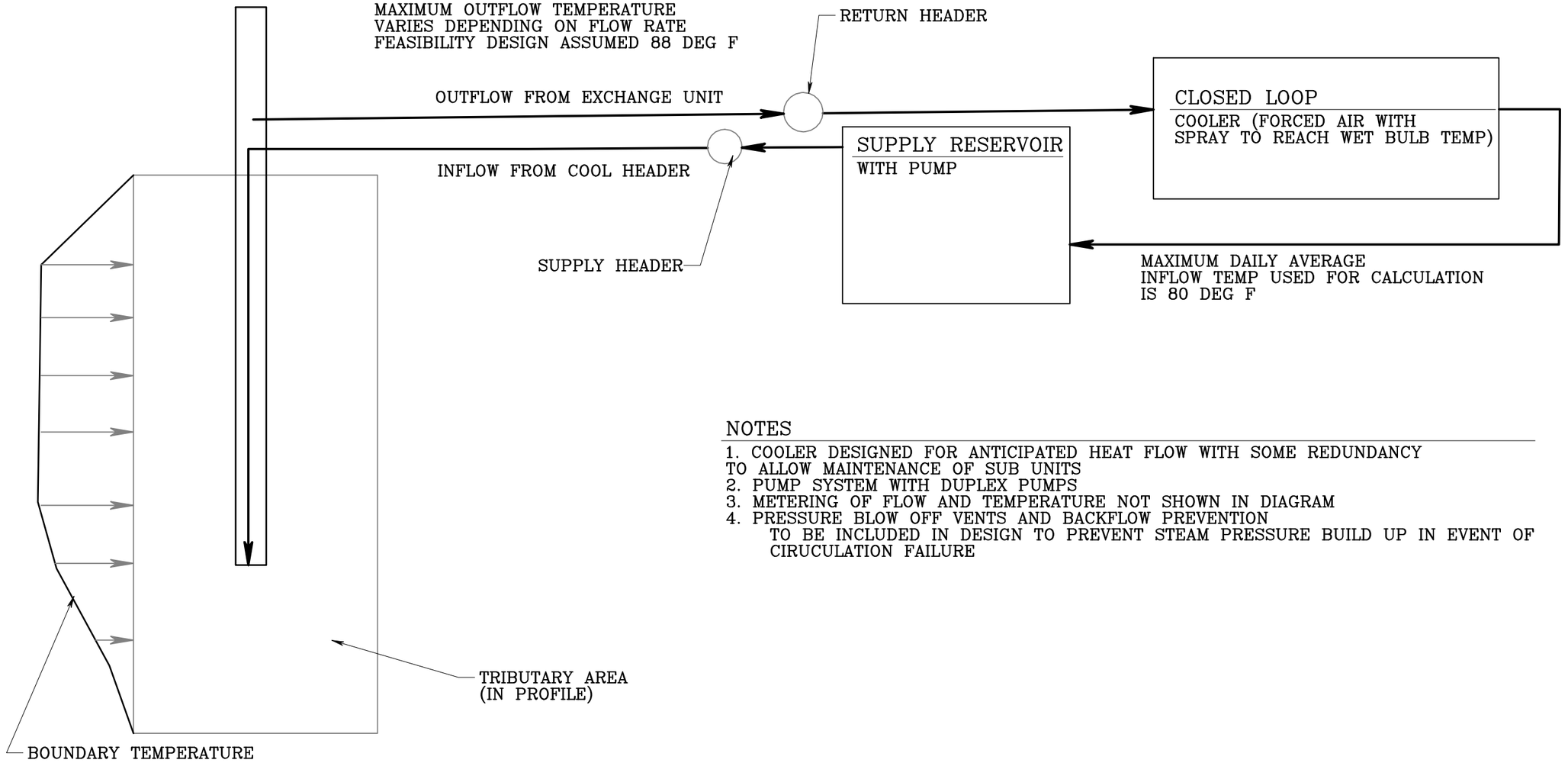
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DRAWN BY: PJC/LCH
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VERTICAL HEAT
EXCHANGE UNITS

BRIDGETON LANDFILL

DRAWING
FIG-1



NOTES

1. COOLER DESIGNED FOR ANTICIPATED HEAT FLOW WITH SOME REDUNDANCY TO ALLOW MAINTENANCE OF SUB UNITS
2. PUMP SYSTEM WITH DUPLEX PUMPS
3. METERING OF FLOW AND TEMPERATURE NOT SHOWN IN DIAGRAM
4. PRESSURE BLOW OFF VENTS AND BACKFLOW PREVENTION TO BE INCLUDED IN DESIGN TO PREVENT STEAM PRESSURE BUILD UP IN EVENT OF CIRUCULATION FAILURE

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COOLING SYSTEM SCHEMATIC

BRIDGETON LANDFILL

DRAWING
FIG-2

ATTACHMENT A

P.J.Carey & Associates, P.C.

CLIENT Bridgeton Landfill CALCULATION BY Peter J. Carey

PROJECT Bridgeton Contingency

JOB No 179.003

DATE 8-11-13

OBJECT : Estimation of heat flow to the north of the heat front that is flowing from the front area toward the quarry narrow area (line of tmp 1-4)

Reference: Yoshida, H., Rowe, R.K.,"Consideration of Landfill Liner Temperature" Proceedings Ninth International Waste Management and Landfill Symposium, Sardinia October 2003. Used for source of approximate heat conductivity and heat capacity of solid waste materials

General Approach

Use the temperature gradient as measured in the tmps and the rate of warming per month to achieve an estimate of the energy being conveyed toward the quarry narrow area. Base the rate of temperate rise on the monthy advance of the heat front, which based on both settlement front movment and the time between Jan 15 and June 15 (approximately 150 days for the front to advance from TMP 8 to TMP-7R (a northern distance of 42 feet) or $\frac{42\text{ft}}{150\cdot\text{day}} = 0.28\,\frac{\text{ft}}{\text{day}}$. Use a value of 0.3 feet per day. This would amount to the same 9 feet per month u. For gradient on the cool side of the heat front use the values determined in March based on the warmest 60 foot of each tmp, this was $\text{Gradient} := \frac{0.84\,°\text{F}}{\text{ft}}$. Behavior measured at the site has not indicated any higher flux rates at present, for example the gradient between TMP-14 and TMP-11 is less than 0.4 per foot using maximum temperatures at present.

Warming of Front Zone

At the heat front the change in temperature does not typically change more than $\Delta_{\text{temp}} := 10\cdot\text{K}$ (approximately 18 deg F) per month and the typical zone being heated this amount is less than 80 feet thick. The heat energy involved in this warming is equal to the mass of the waste times the total heat capacity times the change in temperature. Using the upper value for heat capacity for the waste from the above reference

$$\text{WarmingEnergy} := \left(60\text{ft}\cdot 9\,\frac{\text{ft}}{30\text{day}}\cdot 2000\cdot\frac{\text{joule}}{\text{kg}\cdot\text{K}}\cdot 63\,\frac{\text{lb}}{\text{ft}^3}\cdot 10\text{K}\right) = 119.068\,\frac{1}{\text{ft}}\,\text{W}$$ per ft width of front

$$\text{Warmingheatflux} := \frac{\text{WarmingEnergy}}{100\text{ft}} = 12.816\,\frac{\text{W}}{\text{m}^2}$$ if a 100 foot deep removal system is used

where 2000 joule per kg per deg K is the heat capacity of the waste

Gradient Flux Rate

The heat flux associated with maintaining the gradient on the cool side of the reaction is computed using the thermal conductivity of the waste.

$k_e := 0.96 \cdot \frac{joule}{m \cdot sec \cdot K}$ for saturated waste use an unit area $A := 1m^2$

converting the gradient to deg k $Gradient := 0.467 \frac{K}{ft}$

$GradientHeat := Gradient \cdot k_e$ $GradientHeat = 1.471 \frac{W}{m^2}$

the computed total flux is then

$$GradientHeat + Warmingheatflux = 14.287 \frac{W}{m^2}$$

a design for 50% greater than this value would represent the something that would result in cooling by also removing some stored heat in the waste. It should be noted that other heat losses are being ignored in this simplified approach.

$14.8 \cdot 1.5 \frac{W}{m^2} = 22.2 \frac{W}{m^2}$

this could be used as a limiting value that the system may eventually need to be able to handle, including whatever added points are used for extraction south of whatever "barrier line" is utilized. The total energy removal is computed by using the depth of the heat zone times the width of treatment. Note that this value is based on the faster moving portion of the front.

ATTACHMENT B

P.J.Carey & Associates, P.C.

CLIENT Bridgeton Landfill CALCULATION BY Peter J. Carey

PROJECT Bridgeton Contingency

JOB No 179.003 Calculation of Vertical Extraction point capacities

DATE 8-11-13

OBJECT: Calculate Extraction Capability of vertical extraction points with varying diameters and geometry needed to extract heat at up to the value computed as the approximate waste flux plus 50 %

Reference: Jumikis,Alfred, Thermal Soil Mechanics, Rutgers Press 1966

Thermal properties of waste taken from Yashida and Rowe, Yoshida, H., Rowe, R.K.,"Consideration of Landfill Liner Temperature" Proceedings Ninth International Waste Management and Landfill Symposium, Sardinia October 2003

the general equation for extaction from a single vertical wells is, for steady state conditions,

$$q = 2\pi \cdot k_e \cdot \frac{(T_1 - T_2)}{\ln\left(\frac{r_2}{r_1}\right)}$$

where q is the heat removed per unit length of well
T_1 is the temperature inside the well
T_2 is the temperature at a distance r_2 and
r_1 is the radius of the contact surface of exchange
(for gravel packed saturated zones it can be taken as the radius of the gravel pack, and for driven points it is the outer diameter of the driven point element
k_e is the thermal conductivity of the waste

As can be seen looking at the equation the heat extaction is linearly dependant on the thermal conductivity value, and the equation is nearly identical in form to the flow of a single well in a confined aquifer. If the thermal conductivity is higher the heat flow energy would higher toward the quarry neck but the extraction potential of the point would be equally higher. Therefore, the exact value of the heat conduction is not as important as the ratio between heat capacity and heat conduction.

Assume $k_e := 0.96 \frac{joule}{(m \cdot sec \cdot K)}$ yashida and rowe for saturated waste

if the heat extraction were to occur over a 100 ft depth then the design heat extraction rate is

$q(r_2) := 22.2 \frac{W}{m^2} \cdot 2 \cdot r_2$ where r_2 would be radius between extraction points (1/2 the spacing)

the use of a 100 foot extraction depth can be accomodated in all gas wells of 150 ft depth or greater while still leaving the upper 50 foot of the well for gas collection.

if a air/water cooling device were to be used the maximum temperature on a daily average that could be used for a worst case design is 80deg F (the daily wet bulb average for St Louis) it can assumed to be T1+8 deg for transfer in the coolant tubes for Gas Well closed loop systems, the T2 desired eventually for steady state is 165 deg F at the inceased design flux rate (22.2 w/m^2) and it can be assigned as T2. The 8 degree addition to T1 allows for the differential temperature required to transfer the heat flow from the well liquid through the tubes and into the closed loop system. See the calculation in this worksheet at 4 gpm flow rate.
Using the solving routine in Mathcad the required spacing can be computed to achieve the design heat flow extraction

For 36 diameter gas wells assuming the gravel pack is saturated and more conductive than the waste

$q_{design}(r_2) := -22.2 \frac{W}{m^2} \cdot 2 \cdot r_2$ $T_1 := 88\,°F$ $T_2 := 165\,°F$

$r_1 := 36 \frac{in}{2}$ $r_2 := 12.5ft$

$q(r_2) := 2\pi \cdot k_e \cdot \frac{(T_1 - T_2)}{\ln\left(\frac{r_2}{r_1}\right)}$

Given

$q_{design}(r_2) = q(r_2)$

$Minerr(r_2) = 10.033\,ft$

or the spacing is 20 ft on center in an array to obtain the heat extraction, with an extraction depth of 100 feet of exchanging

heat transfer between the closed loop and the liquid in the gas well

$q_{design}(r_2) := -22.2 \frac{W}{m^2} \cdot 2 \cdot r_2$ $k_{epipe} := 0.41 \frac{W}{m \cdot K}$

$T_1 := 84\,°F$ $T_2 := 88\,°F$

$r_1 := 1.14 \frac{in}{2}$ $r_2 := \frac{1.35in}{2}$

$$q(T_2) := 2\pi \cdot k_{epipe} \cdot \frac{(T_1 - T_2)}{\ln\left(\frac{r_2}{r_1}\right)}$$

where the average temperature of the water rises

Given

$$q_{design}(r_2) = q(T_2)$$

$$Minerr(T_2) = 84.09 \cdot °F$$ this would be the average temperature difference

flow rate needed for conveyance of power

$$flow := 4gpm$$

solving for power

$$Power_{design} := 22.2 \cdot \frac{W}{m^2} 2 \cdot 10.03ft \cdot 100ft$$

$$Power(flow) := \left(1000 \frac{cal}{kgf \cdot K} \cdot 1 \frac{kgf}{l}\right) \cdot flow \cdot 4 \cdot K$$

Given

$$Power_{design} = Power(flow)$$

$$Minerr(flow) = 3.916\ gpm$$ so a gpm flow rate suffices at temp difference of 4 deg K

For driven points of 4 inch in diameter

$$q_{design}(r_2) := -22.2 \frac{W}{m^2} \cdot 2 \cdot r_2$$

$$T_1 := 80\,°F \quad T_2 := 165\,°F$$

$$r_1 := 4 \frac{in}{2} \quad r_2 := 6ft$$

$$q(r_2) := 2\pi \cdot k_e \cdot \frac{(T_1 - T_2)}{\ln\left(\frac{r_2}{r_1}\right)}$$

Given

$$q_{design}(r_2) = q(r_2)$$

$$Minerr(r_2) = 5.901\ ft$$ or the spacing is 12 ft on center in an array to obtain the heat extraction, with an extraction depth of 100 feet of exchanging

For driven points of 6 inch in diameter

$q_{design}(r_2) := -22.2 \frac{W}{m^2} \cdot 2 \cdot r_2$ $T_1 := 80\,°F$ $T_2 := 165\,°F$

$r_1 := 6 \frac{in}{2}$ $r_2 := 6ft$

$$q(r_2) := 2\pi \cdot k_e \cdot \frac{(T_1 - T_2)}{\ln\left(\frac{r_2}{r_1}\right)}$$

Given

$$q_{design}(r_2) = q(r_2)$$

$Minerr(r_2) = 6.469\ ft$ or the spacing is 13 ft on center in an array to obtain the heat extraction, with an extraction depth of 100 feet of exchanging

As an example of sensivity to the to the temperature of the circulating fluid temperature, if the water were to be chilled to 40 deg F (which is possible all for approximately 5 months of the year) the heat extraction would increase for a given array lineraly with the temperature difference so

$\frac{40 - 165}{80 - 165} = 1.471$ if the boundary condition remained the same in terms of temperature at the center.

The above ratio shows higher heat extraction rates, beyond the design calculations, would be available during the non summer months. The calculations presented are based on summer month conditions

Use of Isolated Withdrawal Points in Currently Hotter Zones

The extraction from a single point not in an array would be somewhat greater given the boundary temperatures would be higher, much the same as a single dewatering well will produce more flow than a well that is within the influence zone of other wells. If the current temperature in the neck area were assumed to be 200 deg F in some areas an single point with a assumed maximum radius of 30 feet if it were a gas well and 100 ft of exchange length were assumed then the long term extactable energy would be

$q_{design}(r_2) := -22.2 \frac{W}{m^2} \cdot 2 \cdot r_2$ $T_1 := 88\,°F$ $T_2 := 200\,°F$

$r_1 := 36 \frac{in}{2}$ $r_2 := 15ft$

$$q(T_2) := 2\pi \cdot k_e \cdot \frac{(T_1 - T_2)}{\ln\left(\frac{r_2}{r_1}\right)} \cdot 100\,ft \qquad q(T_2) = -4.968 \times 10^3\,W$$

the total flux in the neck area is approximately

$$Q_{totalneck} := 350\,ft \cdot 60\,ft \cdot \frac{22.2}{1.5} \cdot \frac{W}{m^2} = 2.887 \times 10^4\,W$$

Therefore each converted well represents a possible significant withdrawal of power compared to the total flux. If all of the 12 existing wells were to be operated as heat exchangers the heat extraction would be close to the computed flux rates toward the neck and clearly they should have an overall impact on reducing temperature rise and or heat levels . The point of this calculation is mearly to demonstrate that heat extraction from isolated wells can have a significant impact, even though they may not achieve the desired maximum temperature values between extraction points.

ATTACHMENT C

Industrial

Cooling Systems









- Reduce or Eliminate Water Use
- Winter Heat Recovery
- Free Cooling Economizers

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COOLING SOLUTIONS

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Motivair closed-loop fluid cooling systems dramatically cut utility and maintenance costs when applied to water-cooled industrial equipment including molding machines, air compressors, furnaces, and hydraulic systems. They are also ideal for “Free-Cooling” economizers on chillers, when used to pre-cool the return chilled water during winter operation.

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Designed for simple installation, these pre-engineered systems continuously cool and circulate a solution of water and ethylene glycol without any evaporation loss, freeze-ups, water treatment or routine maintenance. Internal scaling and corrosion are virtually eliminated because air is automatically removed and the same fluid is re-circulated continuously. In contrast to cooling towers or city water systems, water or sewer charges are eliminated.

Motivair MFC systems are shipped in two sections, an air-cooled heat exchanger and a pumping station. Both are completely factory assembled and tested before shipment. The heat exchanger features a galvanized housing for indoor or outdoor use. Copper tubes and aluminum fins provide superior heat transfer. Fans are compartmentalized for efficient fan cycling. Solid-state fan sequencer is standard on multiple fan units. All heat exchangers are tested to 400 PSIG and multiple fan units are shipped with a pre-wired control panel.

The pumping station may be installed anywhere between the heat source and the heat exchanger. Included are single or duplex close-coupled pumps, TEFC motors, NEMA 4 panel, temperature and pressure gauges, pressure differential switch (duplex systems) isolation and check valves, expansion tank, purger, vent and fill valve. The control panel includes starters, indicating lights, auto changeover (duplex systems) lead/lag selector switch and pump failure visual and audible alarms. All pump stations are sized per application ensuring adequate flow and pressure for each individual system.

AVAILABLE OPTIONS INCLUDE:

- Shell and tube trim cooler
- Copper fins
- Coil coating for corrosive environments
- Stainless steel construction

MFC SPECIFICATIONS

FLUID COOLER MODEL	FLOW RATE (GPM)	HEAT REJECTION CAPACITY* (BTU/HR)	NO. OF FANS	TOTAL AIRFLOW (SCFM)	OVERALL DMENSIONS(IN.) L	W	H	INT VOL. (GAL.)	EMPTY WEIGHT (LBS.)
MFC0200	22	200,000	2	21,000	90	43	50	6	580
MFC0250	28	250,000	2	20,600	90	43	50	9	630
MFC0300	34	300,000	2	19,800	90	43	50	9	650
MFC0350	39	350,000	2	18,500	76	43	50	12	730
MFC0400	45	400,000	3	30,900	130	43	50	17	900
MFC0450	51	450,000	3	29,700	130	43	50	17	930
MFC0500	56	500,000	3	28,600	130	43	50	22	1010
MFC0550	62	550,000	4	41,200	231/121**	88	50	18	1580
MFC0600	68	600,000	4	39,600	231/121**	88	50	18	1620
MFC0700	79	700,000	4	37,000	231/121**	88	50	24	1760
MFC0800	90	800,000	6	61,000	341/176**	88	50	27	1810
MFC0900	101	900,000	6	60,600	341/176**	88	50	27	2390
MFC0950	107	950,000	6	59,400	341/176**	88	50	27	2440
MFC1000	113	1,000,000	6	57,200	341/176**	88	50	36	2550
MFC1100	124	1,100,000	6	55,500	341/176**	88	50	36	2610
MFC1200	135	1,200,000	8	79,200	231	88	50	36	3140
MFC1300	146	1,300,000	8	76,300	231	88	50	48	3200
MFC1400	158	1,400,000	8	74,000	231	88	50	48	3510
MFC1500	169	1,500,000	10	99,000	286	88	50	45	3990
MFC1600	180	1,600,000	10	98,200	286	88	50	60	4000
MFC1700	191	1,700,000	10	95,300	286	88	50	60	4150
MFC1800	203	1,800,000	10	92,500	286	88	50	60	4380
MFC1900	214	1,900,000	12	117,900	341	88	50	72	4710
MFC2000	225	2,000,000	12	114,400	341	88	50	72	4890
MFC2100	236	2,100,000	12	111,000	341	88	50	72	5230

**Performance based on 40% glycol entering the cooler @ 125° F, leaving the cooler @ 105° F, & 95° F ambient.*
***These coolers are available in eiher a 1-fan or 2-fan-wide configuration.*
Contact Motivair for Economizer (Free-Cooling) applications!

MEC CLOSED LOOP EVAPORATIVE COOLING TOWERS

DESIGN FEATURES

The Motivair MEC closed loop evaporative towers combine the advantages or our MFC closed loop dry fluid coolers with the lower water temperatures available from an open draft evaporative cooling tower. Rugged construction, and optional hot dipped galvanizing after fabrication make these towers suitable for the most demanding industrial applications.



The spray pump continuously drenches the tubular heat exchanger surface with a spray of re-circulated water, while the fan forces ambient air across the coil. The evaporation of the spray water removes heat from the closed loop fluid at temperatures below the ambient “dry bulb” temperature. The evaporative cooling effect is based on the prevailing “wet bulb” temperature, which is a measurement of moisture in the air. (A lower wet bulb temperature increases evaporation from the cooler, and directly increases capacity.)

COMPONENTS

The MEC Series Closed Loop Evaporative Towers consist of four main components: (1) the cooling coil; (2) the spray system; (3) the fan system; and (4) the discharge mist eliminators.

- **THE COOLING COIL** separates the closed loop fluid from the spray water thereby eliminating the possibility of contaminated cooling water. This also allows the use of glycol as the closed loop fluid for winter operation.
- **THE SPRAY SYSTEM** includes a sump, spray pump, riser, distribution pipes, and spray nozzles designed to circulate spray water from the basin and continuously drench the cooling coil surface.
- **THE FAN SYSTEM** moves the correct amount of air over the wet cooling coil surface to maximize the heat transfer. This air carries away the heat from the closed loop fluid in the form of increased temperature and evaporated spray water (latent heat of vaporization).
- **THE DISCHARGE MIST** eliminators keep spray water droplets inside the cooler, to reduce water consumption, drift losses and vapor “plumes.”

In most areas of North America the maximum ambient “wet bulb” temperature is below 78°F, and it rarely exceeds 80°F. In general, this makes Evaporative Closed Loop Systems ideally suited for use when the maximum required cooling water temperature is around 85°F.

Water consumption is approximately 2 GPM per million Btu/h for evaporation losses, plus occasional blow downs to clean the sump.

MEC SPECIFICATIONS

FLUID COOLER MODEL	FLOW RATE (GPM)†	HEAT REJECTION CAPACITY* (BTU/HR)	TOTAL AIRFLOW (SCFM)	FAN MOTOR HP	SPRAY PUMP HP	PAN HEATER KW	OVERALL DMENSIONS(IN.) A	B	C	OPER. WEIGHT (LBS.)
MEC0300	27	300,000	6,400	3	0.5	3	70	67	114	2,790
MEC0400	`36	400,000	9,300	5	0.75	3	70	78	107	3,630
MEC0500	45	500,000	9,200	5	0.75	3	70	78	114	3,895
MEC0700	63	700,000	14,700	7.5	1	4.5	130	73	100	4,520
MEC0900	81	900,000	14,400	7.5	1	4.5	130	73	114	5,455
MEC1100	99	1,100,000	20,500	15	1.5	6	130	84	107	6,580
MEC1300	117	1,300,000	20,500	15	1.5	6	130	84	114	6,990
MEC1600	144	1,600,000	29,400	15	1	4.5	135	103	107	8,670
MEC1800	162	1,800,000	29,400	15	1	4.5	135	103	114	8,910
MEC2000	180	2,000,000	40,500	20	1.5	6	135	126	100	11,020
MEC2200	198	2,200,000	40,200	20	1.5	6	135	126	107	11,270
MEC2400	216	2,400,000	40,100	20	1.5	6	135	126	114	11,600
MEC2800	252	2,800,000	61,200	30	3	9	195	126	100	14,880
MEC3400	306	3,400,000	61,000	30	3	9	195	126	107	15,870
MEC3800	342	3,800,000	60,000	30	3	9	195	126	114	17,410

**Performance based on 40% glycol entering the cooler @ 115° F, leaving the cooler @ 90° F, & 78° F ambient.*
***See Closed Loop Water Cooling Systems brochure for pump station details.*

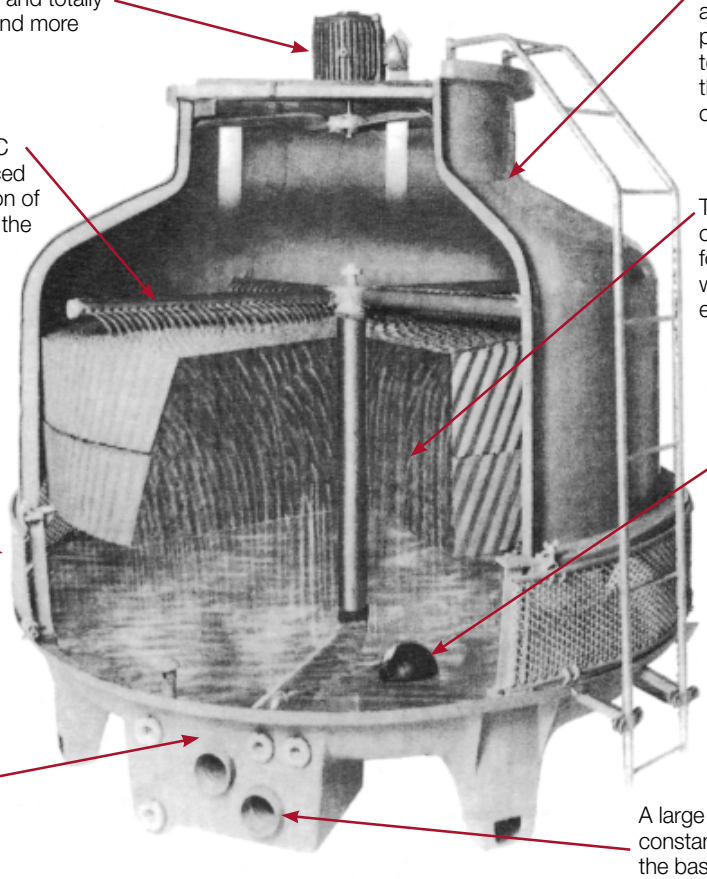
MOT OPEN DRAFT EVAPORATIVE COOLING TOWERS

The fan motor is weather-proofed and totally enclosed allowing for less noise and more efficient long-term performance.

The sprinkler pipes are sturdy PVC material pierced with closely-spaced holes allowing thorough distribution of water in a rotating spray covering the entire surface of the fillter.

The round design permits maximum air intake regardless of wind direction.

Efficiency is enhanced by a low internal pressure drop.



Housing panels and water basin are built of fiberglass reinforced plastic ensuring rust-free long term performance even under the most severe environmental conditions.

The efficiently designed PVC filler creates a surface area that allows for maximum dispersion of water which creates a superior cooling effect.

A large-capacity, durable water basin constructed from rust-proof fiberglass rein-forced platic gurantees low maintenance and long-term operation.

A large diameter outlet pipe draws a constant supply of cooled water from the basin to serve the facility.

RELIABLE, COST EFFECTIVE EVAPORATIVE COOLING

DESIGN FEATURES:

Lightweight and compact, the Motivair open draft cooling towers provide evaporative cooling at the lowest cost, combined with quick and easy installation. On-site assembly is simplified by the modular design of all components. Smaller models are shipped pre-assembled while larger units can be either customer assembled on site, or factory assembled on site for a reasonable fee. Prevailing wind directions will not affect cooling tower performance due to the unique circular design of the basin and casing.

CASING: Easy access simplifies cleaning. Individual fiberglass panels are fastened together with stainless steel bolts for periodic wash down and general clean up. The Motivair MOT cooling tower is designed for durability and long life, even under the most severe environmental weather conditions.

FAN BLADES: Aerodynamically designed propeller type fans are used to conserve power and assure quiet operation. Models MOT-3 through 50 feature a factory balanced ABS plastic blade. Models MOT-60 and above feature an all aluminum alloy, adjustable blade fan.

FAN MOTOR: Models M0T-3 through 200 feature direct drive motors. Models, MOT-225 and larger feature a unique belt drive, designed to reduce noise levels to a minimum.

WATER DISTRIBUTION SYSTEM: Models MOT-3 through 60 feature an ABS plastic sprinkler with stainless steel shaft. Models MOT-70 and above feature an aluminum alloy sprinkler head. Both types of sprinkler head cause very low-pressure loss, and require minimum maintenance.

INLET LOUVERS: Non-rusting PVC plastic mesh provides easy access to the sump, while preventing foreign objects from entering.

LADDER: A ladder is provided for maintenance and inspection accessibility to fan and sprinkler systems on models MOT-40 and above.

FILL MATERIAL: Honeycomb heat embossed PVC is formed to permit high heat transfer efficiency. The Motivair fill is suitable for operation with inlet water temperatures up to 115°F. If higher temperatures are required, please contact factory.

MOT SPECIFICATIONS

Water IN Water OUT Wet Bulb	90°F 80°F 65°F	90°F 80°F 70°F	95°F 85°F 70°F	92°F 82°F 72°F	95°F 85°F 75°F	97°F 87°F 75°F	95°F 85°F 77°F	95°F 85°F 78°F	96°F 86°F 80°F	98°F 88°F 82°F	90°F 83°F 75°F	94°F 85°F 75°F	M O T
	9	6	9	7	8	9	6	6	5	6	8	9	3
	15	10	15	11	12	15	10	10	9	10	13	14	5
	24	18	24	19	20	24	18	16	14	15	22	23	8
	30	21	30	23	26	30	21	20	18	20	28	29	10
	46	33	47	35	40	47	33	30	28	30	41	43	15
	61	44	62	48	52	62	44	40	37	40	56	58	20
	77	56	78	60	66	78	56	50	47	50	70	72	25
	91	68	93	72	80	93	68	61	57	61	84	87	30
	122	90	124	97	107	124	91	83	77	82	112	116	40
	152	114	156	121	134	156	115	105	98	104	140	145	50
	183	137	187	146	160	187	137	125	116	124	169	174	60
G	214	160	218	170	187	218	160	145	135	144	197	203	70
P	244	183	250	195	214	250	183	168	156	167	225	232	80
M	306	228	311	243	268	311	229	208	193	207	281	290	100
	381	287	390	305	335	390	288	262	245	261	352	362	125
	456	346	468	368	403	468	348	318	297	318	422	435	150
	533	401	546	428	470	546	403	369	344	367	493	508	175
	608	461	624	490	539	624	464	426	398	425	563	580	200
	691	509	702	543	600	702	508	460	427	457	633	652	225
	765	570	780	608	670	780	571	520	484	518	704	725	250
	920	681	936	727	801	936	682	620	575	616	845	871	300
	1065	808	1092	859	942	1092	812	744	695	742	986	1016	350
	1220	920	1249	979	1075	1249	924	845	788	842	1127	1161	400
	1502	1182	1560	1250	1363	1560	1200	1113	1053	1119	1408	1453	500
	1825	1386	1873	1473	1616	1873	1394	1278	1194	1275	1690	1742	600
	2108	1648	2185	1745	1904	2185	1670	1546	1459	1551	1971	2035	700
	2433	1848	2498	1965	2155	2498	1860	1703	1592	1700	2255	2323	800
	2994	2379	3121	2514	2735	3121	2421	2253	2139	2270	2815	2908	1000
	3740	2977	3902	3146	3421	3902	3032	2824	2683	2846	3519	3635	1250
	4491	3568	4683	3771	4102	4683	3632	3380	3209	3404	4223	4361	1500

MPF PLATE & FRAME CLOSED LOOP COOLING SYSTEMS

These systems utilize a plate & frame heat exchanger to cool closed loop, re-circulated water, using a raw water supply, (open draft cooling tower, river or pond water) without contaminating the closed loop. This is particularly useful for air compressors or other water-cooled machinery, which have high water side maintenance costs; where avoidance of down time is critical; or when the available cooling water quality is unacceptable.

The high efficiency of the stainless steel plate design enables Motivair systems to cool the closed loop fluid to within 5°F of the raw cooling water. This efficiency also permits an extremely compact design, and occupies minimal floor space. Clip-in Nitrile rubber gaskets allow simple dismantling and re-assembly for cleaning.

Available as a complete package, or a split system, the Motivair system includes a plate and frame exchanger, process pump, NEMA 4 control & alarm panel, piping, isolation valves and temperature & pressure gauges. Piping and electrical connections are the only on-site requirements, before the system is fully operational. Optional strainer packages are available when the cooling water has an unacceptable level of suspended solids. Occasional maintenance is easily performed by back-flushing the exchanger, or by loosening the “follower” plate and removing the stainless steel plates. They are easily cleaned with a pressure hose, then re-assembled with the Nitrile rubber, clip-in gaskets and re-tightened, before resuming operation (see operation and maintenance manual).



REQUIRED DATA FOR SYSTEM DESIGN:

- Application description
- Fluid to be cooled & flow rate
- Fluid temperature entering exchanger
- Required leaving fluid temperature
- Available cooling water flow and temperature
- Allowable pressure drops
- Process fluid pump available pressure (PSI)

OPTIONAL REDUNDANT COMPONENTS

For critical applications, a complete standby exchanger is recommended, with isolation valves, so one may be cleaned while the other is in service. Motivair offers a pressure differential option, which continuously monitors the cooling water pressure differential across the exchanger(s). At a pre-determined, adjustable differential, visible and audible alarms are activated, signaling the operator to clean the exchanger or switch to the standby. Optional strainer assemblies can also be fitted with a similar indicator, to warn the operator to clean the strainer. Also available is an automatic standby pump, with associated piping, valves & controls. In the event of a pump failure, the standby pump starts automatically, while the visible & audible alarms are activated.

PUMP/TANK STATIONS

Every open and closed loop cooling tower requires a pumping package in order to circulate the cooled water or glycol to and from the designated process. Motivair designs and builds a full range of pump stations and pump/tank station packages that can be customized to suit any application (See Pump Station brochure for further details).



Available options include:

- Simplex, duplex or triplex pumps
- Stainless steel water circuit
- Automatic pump change over
- Visible & audible alarms
- Flow meters
- Baffled tanks
- Automatic water make-up
- Pressure & temperature gauges
- Isolation & check valves
- NEMA 4 control box
- VFD pump speed control
- High pressure pump option
- Redundant pump packages

APPLICATION, INTEGRATION & SOLUTIONS FOR ALL YOUR COOLING NEEDS:



MPC
1/2-50 ton packaged air-cooled or water-cooled chillers for Industrial cooling, Medical cooling or custom HVAC applications. Includes integrated microprocessor, pump station, and storage reservoir.



MLC
70-240 ton air-cooled, water-cooled & split system chillers for central plant operation, industrial processes or HVAC applications. Integrated “Free-Cooling” option

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