Aspect CONSULTING

MEMORANDUM

Project No.: 150074-07

October 25, 2017

To: Andrew Smith, PE, LHG
UST/Technical Services Unit Supervisor, Toxic Cleanup Program
Washington State Department of Ecology, Southwest Regional Office

cc: Craig Gregory and Bob Tauscher, City of Shelton

From:

Carla E. Brock, LG
Associate Geologist
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John J. Strunk, LG
Principal Geologist
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Re: **Shelton C Street Landfill -** Initial Remedial Investigation Data Submittal

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Aspect Consulting, LLC (Aspect) is submitting the attached documents to the Washington State Department of Ecology (Ecology) on behalf of the City of Shelton for the Shelton C Street Landfill. Work has been conducted at the Shelton C Street Landfill in accordance with Agreed Order No. DE 12929 and the Final Remedial Investigation Work Plan, prepared by Aspect and dated April 21, 2017 (Work Plan). The work conducted to date for the remedial investigation (RI) consists of the following:

1. Completion of a site topographic and boundary survey. The drawing of the survey is provided as Attachment A.
2. Performance of a geophysical survey investigation to evaluate the presence, thickness, and lateral extent of landfill waste. The geophysical survey report is provided as Attachment B.
3. Collection and laboratory analysis of surface soil samples using incremental-sampling methodology (ISM) to investigate and characterize the presence, nature, and extent of constituents of potential concern (COPCs) in surface and shallow subsurface soil in the sludge disposal area. The laboratory analytical report is provided as Attachment C. The laboratory analytical data is preliminary and has not yet been validated; once we receive the full Level 4 data package from the laboratory and validate the dioxins/furans data, we will compile results onto a summary table, including both the reported individual congener concentrations as well as the calculated total toxic equivalent concentrations, for submittal to Ecology.

Please feel free to contact me at cbrock@aspectconsulting.com or (206) 838-6598 if you have any questions.

V:\150074 Shelton C Street Landfill Remediation\Deliverables\Data Transmittal\RI data transmittal Oct2017.docx

ATTACHMENT A

Site Topographic and Boundary Survey

TOPOGRAPHIC SURVEY

NE 1/4 SECTION 24
TOWNSHIP 20 NORTH, RANGE 4 WEST W.M.
MASON COUNTY, WASHINGTON

NORTH

0 25 50 100

SCALE: 1"=50'
CONTOUR INTERVAL: 2 FOOT

NOTES AND COMMENTS:

1.) PURPOSE OF SURVEY: THE PURPOSE OF THIS SURVEY WAS TO DEVELOP A 2-FOOT CONTOUR INTERVAL TOPOGRAPHIC MAP OF THE SUBJECT PROPERTY FOR USE AS A PLANNING AND DESIGN BASE BY OTHERS. A BOUNDARY SURVEY OF THE SUBJECT PROPERTY WAS PERFORMED CONCURRENTLY WITH THIS MAPPING.

2.) HORIZONTAL DATUM: THE OVERALL HORIZONTAL DATUM FOR THIS PROJECT IS NAD 83/2011, WASHINGTON COORDINATE SYSTEM, SOUTH ZONE, BASED ON GPS MEASUREMENTS USING THE WASHINGTON STATE REFERENCE NETWORK.

3.) VERTICAL DATUM: THE VERTICAL DATUM FOR THIS SURVEY IS NAVD 88, BASED ON GPS MEASUREMENTS USING THE WASHINGTON STATE REFERENCE NETWORK.

4.) FIELD SURVEY METHODOLOGY: FIELD MEASUREMENTS FOR THIS SURVEY WERE PERFORMED USING A 5-SECOND OR BETTER ELECTRONIC TOTAL STATION.

5.) INSTRUMENT CALIBRATION: ALL MEASURING INSTRUMENTS EMPLOYED IN THIS SURVEY HAVE BEEN MAINTAINED IN ACCORDANCE WITH MANUFACTURER'S SPECIFICATIONS.

6.) THIS MAP GRAPHICALLY REPRESENTS CONDITIONS AND FEATURES EXISTING AT THE TIME OF THIS SURVEY ONLY, WHICH WAS PERFORMED DURING SEPTEMBER OF 2017.

7.) THIS SURVEY WAS PREPARED FOR THE EXCLUSIVE USE OF THE CLIENT NAMED HEREON. ITS' USE DOES NOT EXTEND TO ANY UNNAMED PERSON OR PERSONS WITHOUT THE EXPRESS RECERTIFICATION BY THIS SURVEYOR NAMING SUCH PARTY.

8.) FOR YOUR INFORMATION: 0.0833 FEET = 1 INCH ON THE GROUND

9.) MASON COUNTY TAX PARCEL NUMBER: 42024-21-60430

10.) PARCEL AREA: 713,994 ± SQ. FT. (16.39 ACRES)

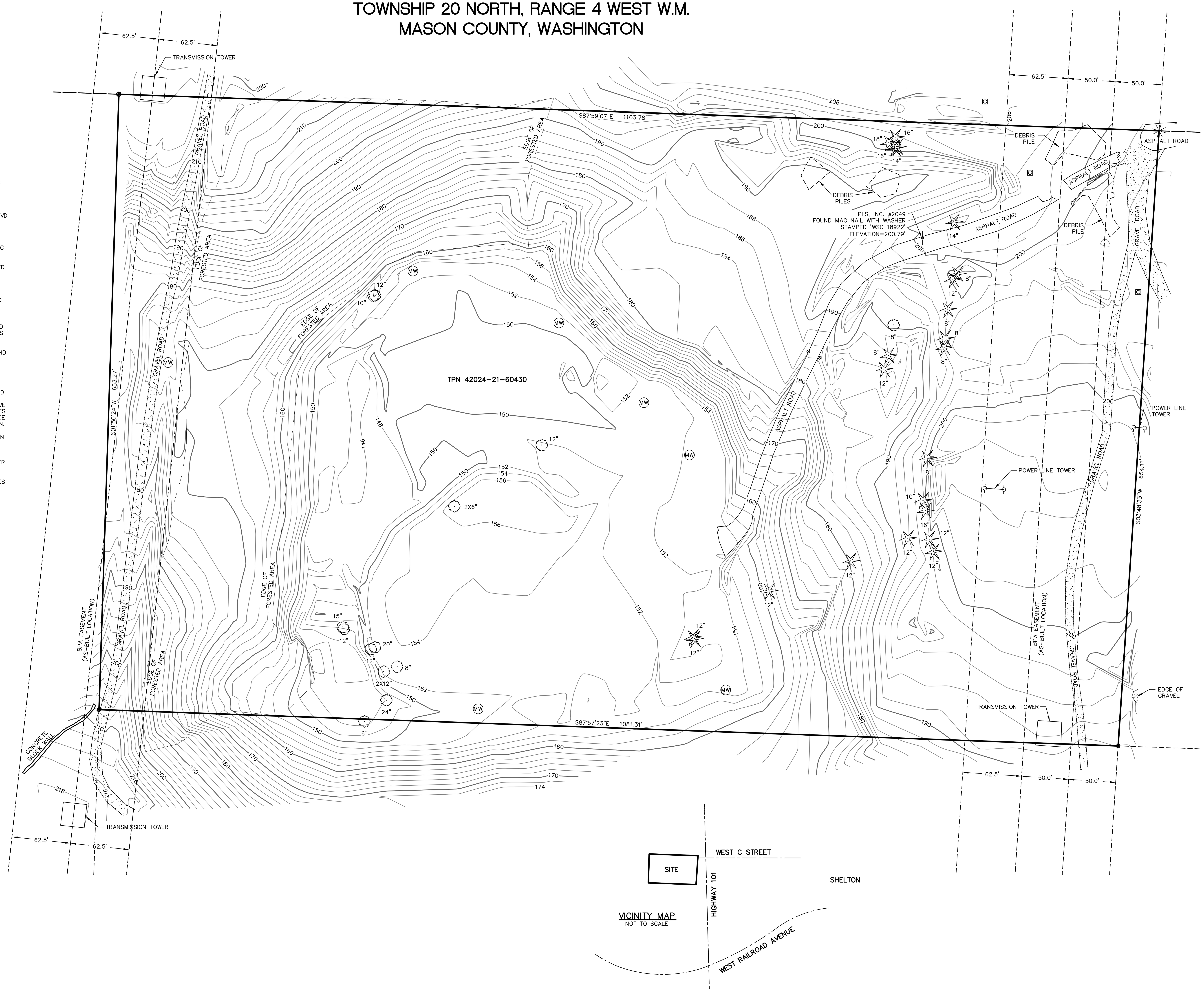
11.) THE UNDERGROUND UTILITIES SHOWN HEREON HAVE BEEN LOCATED FROM THE FIELD SURVEYED LOCATION OF VISIBLE SURFACE UTILITY STRUCTURES SUCH AS MANHOLE LIDS, GRATES, GAS AND WATER VALVE LIDS, ETC. WE MAKE NO GUARANTEE THAT THE UNDERGROUND UTILITIES SHOWN COMPRISE ALL SUCH UTILITIES IN THE AREA, EITHER IN SERVICE OR ABANDONED, NOR THAT THEY ARE IN THE EXACT LOCATION SHOWN.

12.) THE PROPERTY AND PUBLIC RIGHT-OF-WAY LINES SHOWN HEREON ARE BASED ON A BOUNDARY SURVEY BY PLS, INC. PERFORMED CONCURRENTLY WITH THE MAPPING OF THE SITE. SAID BOUNDARY SURVEY WAS PERFORMED WITHOUT BENEFIT OF A CURRENT TITLE REPORT AND, ACCORDINGLY, MAY NOT INCLUDE EASEMENTS AND OTHER MATTERS OF RECORD, IF ANY.

13.) WE HAVE USED GRAPHIC SYMBOLS TO REPRESENT SOME FEATURES ON THIS MAP, SUCH AS UTILITIES, TREES AND FENCES. THE DEFAULT SIZE OF THOSE SYMBOLS MAY NOT REFLECT THE TRUE SIZE OF THE FEATURE THAT WAS MAPPED.

LEGEND:

	FOUND MAG NAIL WITH WASHER
	FOUND IRON PIPE W/CAP STAMPED 'SLEETH'
	SET PK NAIL W/WASHER STAMPED 'KAP 49286'
	SET REBAR AND CAP STAMPED 'KAP 49286'
	TREE (CONIFEROUS) WITH TRUNK DIAMETER NOTED
	TREE (DECIDUOUS) WITH TRUNK DIAMETER NOTED
	BOLLARD
	GUY POLE
	UNDERGROUND GAS MARKER
	CONCRETE SURFACE
	GRAVEL SURFACE
MW	PROPOSED MONITORING WELL
TPN	TAX PARCEL NUMBER



PLS, Inc.
Professional Land Surveyors
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ASPECT CONSULTING, LLC
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KURT A. PARCHER — PROFESSIONAL LAND SURVEYOR — 49286

REVISIONS

NO.	DATE	DESCRIPTION	BY

SHEET TITLE: TOPOGRAPHIC SURVEY
SHELTON C STREET LANDFILL REMEDIATION SITE

CLIENT: ASPECT CONSULTING

DRAWN BY: BPM	CHECKED BY: KAP
SCALE: 1"= 50'	DATE: OCT. 13, 2017
JOB NO: 17171	
DRAWING NAME: 17171 TOPO.DWG	
SHEET 1 OF 1	

ATTACHMENT B

Geophysical Survey Report

RPT-2017-024, Rev. 0

Geophysical Survey of the C Street Landfill, Shelton, WA

N. Crook, Ph.D.

M. Levitt

K. Rucker

M. McNeill

2302 N. Forbes Blvd, Tucson, AZ 85745 USA

Date Published
August 2017

Prepared for:

Aspect Consulting LLC

TABLE OF CONTENTS

LIST OF FIGURES

1.0 INTRODUCTION

1.1 PROJECT DESCRIPTION

In May 2017, hydroGEOPHYSICS, Inc. (HGI) performed a multi-method geophysical survey at a closed landfill in Shelton, WA. This survey effort was completed to determine the lateral extents and thickness of buried waste and the depth of cover material over the waste at the location of the former C Street Landfill. A combined electromagnetic (EM) and magnetic (Mag) survey over the entire accessible landfill area, as well as five lines of two-dimensional (2D) Electrical Resistivity Tomography (ERT) were completed.

1.2 SCOPE

The scope of this project includes using EM, Mag, and ERT to characterize the subsurface at the survey site. The ground conductivity portion of the EM measurement provides a good indication of the lateral limits of covered or closed landfill, presented in a georeferenced 2D plan view of the electrical properties of the subsurface. The magnetic measurements are highly sensitive to ferrous metals in the landfill, providing a high-resolution plan view map of the distribution of ferrous metallic wastes within the landfills. The electrical resistivity imaging method results in 2D cross sections of the electrical properties of the subsurface materials, allowing the depth, thickness, and lateral limits of the conductive wastes to be estimated, together with an estimate of the thickness of the cover material.

1.3 OBJECTIVE

The objective of this multi-method geophysical survey was to non-invasively determine the extent and thickness of buried waste and the depth of cover material over the waste by mapping the electrical properties of the subsurface. This is based on the theory that, generally, the products of the decomposition of municipal solid waste are conductive, and as these mix with precipitation and/or groundwater flow, the resulting bulk electrical properties of the wastes are likely to be highly conductive compared to typical background native geological materials. The landfill is also expected to contain metallic debris which when imaged using magnetic gradiometry should display contrast to undisturbed materials outside the landfill boundaries.

2.0 BACKGROUND

2.1 SITE LOCATION

The C Street Landfill is located in the city of Shelton, WA, USA. Figure 1 shows the general location of the geophysical survey site.

The C Street Landfill is located at west end of C Street on the west side of the overpass over Highway 101. The landfill operated during the years 1928-1984, with an unknown total of estimated waste and is located in a depression in the ground formed by an old gravel quarry.

Figure 1. General Survey Location.

Aerial imagery © Google Earth 2016

3.0 METHODOLOGY

3.1 SURVEY AREA AND LOGISTICS

EM & Mag data were acquired between 5/17/17 and 5/18/17 at high-resolution sampling with rapid acquisition using a walking system. Data were recorded continuously along survey lines to produce the coverage shown in Figure 2. The total area covered was approximately 8.3 acres. The survey area had steep topography around the edges of the depression and heavy vegetation throughout.

Because of this heavy vegetation, we were unable to cover the entire proposed survey area with the EM and Mag. The planned parallel line spacing of 15 feet was also modified due to the dense vegetation. Instead, the instrument operators selected surveying routes where available access allowed. Sufficient survey coverage over the assumed landfill area was achieved despite the vegetation in most areas, however, towards the northeast, we were unable to get full coverage beyond the landfill boundary. Figure 3 is an example photograph showing the dense vegetation that dominated the side besides the central cleared area.

Resistivity data, were acquired between 5/19/17 and 5/20/17, and consisted of five lines of data with two being approximately 817 feet long each, and three others being approximately 542 feet long, totaling approximately 3,260 feet of total line coverage. The locations of the survey lines are shown in Figure 2 (pink lines). Table 1 lists specific parameters for the resistivity survey lines.

Prior to commencement of the geophysical survey, a general assumption existed on the location of the boundary of the landfill. This information is posted on Figure 2 as the red line, with extents as provided by Aspect Consulting LLC.

Table 1. Resistivity Line Parameters.

Line #	Date of Acquisition	Electrode Spacing (feet)	Length (feet)	Line Orientation	Start Position (Easting, Northing) UTM - meters	End Position (Easting, Northing) UTM - meters
1	5/20/17	10	817	SW-NE	489820.8, 5228954	490025, 5229082
2	5/20/17	10	817	NW-SE	489846.4, 5229133	489986.7, 5228942
3	5/21/17	10	542	E-W	489973.1, 5228993	489816.1, 5228992
4	5/21/17	10	542	E-W	489957, 5229029	489789.9, 5229024
5	5/21/17	10	542	E-W	489949.1, 5229065	489788.7, 5229084

Figure 2. Detailed Survey Coverage Map.

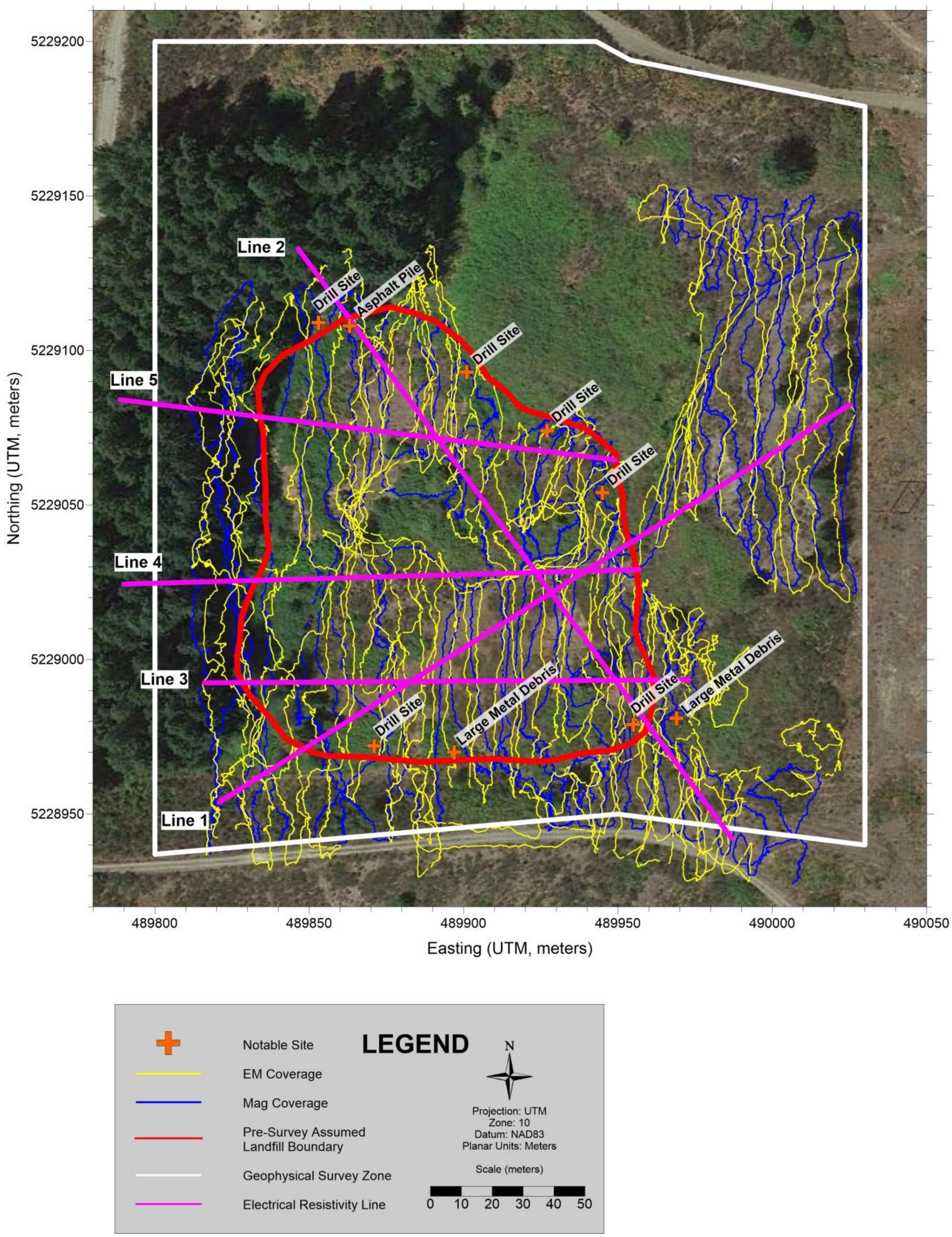


Figure 3. Example of Dense Vegetation Cover across the Proposed Survey Area.

3.2 EQUIPMENT

3.2.1.1 Magnetic Gradiometry

A Geometrics, Inc. G-859 cesium vapor magnetometer with integrated WAAS/EGNOS enabled Tallysman™ GPS was used to provide magnetic data for the project. The magnetometer and GPS system were mounted on a non-magnetic backpack, with a waist mounted console used to control data collection parameters and record the total magnetic field data. The instrument is commercially available and was designed to provide detection of subsurface ferrous metals by mapping distortions to the measured localized magnetic field. The magnetometer console contains a serial input and necessary firmware that is used to interface with and store GPS data.

Interchangeable low voltage 12V dc gel cell batteries are used to power the magnetometer console. A daily inspection is completed by the qualified operator to ensure all components are in satisfactory working condition. Quality assurance tests, including a visual inspection and an instrument check survey line were performed at the beginning and end of each day and each time the instrument power was cycled.

To perform the diurnal correction, a Geometrics, Inc. G-857 proton precession magnetometer was used as a base station to provide a continuous record of changes in the Earth's magnetic field to correct the collected total magnetic field survey data.

A daily inspection is completed by the qualified operator to ensure all components are in satisfactory working condition. Quality assurance tests including a visual inspection, a function test, a static response test, a vibration test, and a dynamic response test were performed daily.

3.2.1.2 Electromagnetic Induction

The GEM-2® electromagnetic instrument (Geophex Ltd, Raleigh, NC) was used to provide electromagnetic (EM) data. The electromagnetic system is used to detect variations in subsurface soil moisture, soil conductivity, and the presence of subsurface infrastructure (utilities, pipes, tanks, etc.). The GEM-2 consists of a sensor housing (the "ski"), and the electronics console. The console includes the data acquisition, rechargeable battery, and data storage hardware. Accessories include a battery charger, carrying straps, a download cable, a brief field guide, and manual. The console contains one DB9 serial connector for downloading data to a PC using the manufacturer-supplied WinGEM software, and another DB9 serial connector that accepts and records a GPS data stream. The GPS time and location are appended to each electromagnetic data point. The instrument is commercially available and is widely used within the geophysical arena.

A daily inspection is completed by the qualified operator to ensure all components are in satisfactory working condition. Quality assurance tests including a visual inspection, a function test, a static response test, a vibration test, and a dynamic response test were performed daily.

3.2.2 Resistivity

Data were collected using a Supersting™ R8 multichannel electrical resistivity system (Advanced Geosciences, Inc. (AGI), Austin, TX) and associated cables, electrodes, and battery power supply. The Supersting™ R8 meter is commonly used in surface geophysical projects and has proven itself to be reliable for long-term, continuous acquisition. The stainless steel electrodes were laid out along lines with a constant electrode spacing of approximately 10 feet (3 meters). Multi-electrode systems allow for automatic switching through preprogrammed combinations of seven electrode measurements.

® GEM-2 is a registered trademark of Geophex, Ltd.

3.2.2.1 Handheld GPS

Positional data for the resistivity lines were acquired via a handheld Garmin GPS unit. Topographical data were incorporated into the 2D resistivity inversion modeling routines.

3.3 DATA CONTROL AND PROCESSING

3.3.1 Quality Control

All data were given a preliminary assessment for quality control (QC) in the field to assure quality of data before progressing the survey. Following onsite QC, all data were transferred to the HGI server for storage and detailed data processing and analysis. Each line or sequence of acquisition was recorded with a separate file name. Data quality was inspected and data files were saved to designated folders on the server. Raw data files were retained in an unaltered format as data editing and processing was initiated. Daily notes on survey configuration, location, equipment used, environmental conditions, proximal infrastructure or other obstacles, and any other useful information were recorded during data acquisition and were saved to the HGI Tucson server. The server was backed up nightly and backup tapes were stored at an offsite location on a weekly and monthly basis.

3.3.1.1 Total Field Magnetics

Time, date, and magnetic data were stored within a data logger and downloaded to a laptop PC for processing. Magnetic data were processed using MAGMAPPER software. The raw data are downloaded to a computer and then the GPS data are integrated with the magnetic data to provide sub-meter accuracy. There are several options that are employed to remove any spikes in the data set from anomalous data points. In addition, data are corrected for diurnal changes by normalizing to a local base magnetometer. Data are reviewed on a daily basis with emphasis on making sure the data quality is good. As the survey progressed, each new day was added into the existing data base to ensure coherency among the whole dataset. There are typical offsets from one day to the next and to ensure that the whole dataset was on the same datum we collected calibration lines at several times during the day; in the morning, and at about every 3 hours when there was a battery change. Each dataset collected was corrected to the first day's calibration line using a calculated correction factor.

3.3.1.2 Electromagnetic Induction

Multiple frequencies were acquired for the electromagnetic data and each were processed and analyzed. Both in-phase and quadrature data were acquired at 3 frequencies ranging from 5 kHz to 20 kHz. These electromagnetic data were processed using the WinGEM Software as provided by the manufacturer and an electrical conductivity value was calculated. The EM conductivity and EM in-phase data were selected for final processing and presentation. The EM conductivity data is more sensitive to soil conductivity (electrical properties) changes, while the EM in-phase data is more sensitive to metal in the subsurface. For the purposes of this survey, all frequencies were reviewed and there was virtually no difference in the interpretation of the datasets, so only the 10 kHz data are presented. A similar process to the mag dataset is used to integrate the GPS and correct each dataset against the calibration line.

3.3.1.3 EM & Mag Plotting

The EM and Mag data were gridded and color contoured in Surfer (Golden Software, Inc.). The combined EM and Mag datasets, after being compensated for the calibration set, were combined into one master file. The Kriging gridding algorithm was used within the Surfer software. This algorithm is good for large datasets and honors the actual raw data very well without adding in artificial character to the datasets.

3.3.2 Resistivity Data Processing

The geophysical data for the resistivity survey, including measured voltage, current, measurement (repeat) error, and electrode position, were recorded digitally with the AGI SuperSting R8 resistivity meter. Quality control both in-field and in-office was performed throughout the survey to ensure acceptable data quality. Data were assessed and data removal was performed based on quality standards and degree of noise/other erroneous data. Edited data were inverted and the results plotted for final presentation and analysis.

The raw data were evaluated for measurement noise. Those data that appeared to be extremely noisy and fell outside the normal range of accepted conditions were manually removed within an initial Excel spreadsheet analysis. Examples of conditions that would cause data to be removed include, negative or very low voltages, high-calculated apparent resistivity, extremely low current, and high repeat measurement error. Secondary data removal occurred for some of the lines via the RMS error filter built in to the RES2DINVx64 software. RMS error filter runs were performed removing no greater than 5% of the data, and were initiated to bring the final RMS value down to 5% or below based on model convergence standards (see section 3.3.2.1 for more details).

3.3.2.1 2D Resistivity Inversion

RES2DINVx64 software (Geotomo, Inc.) was used for inverting individual lines in two dimensions. RES2DINV is a commercial resistivity inversion software package available to the public from www.geoelectrical.com. An input file was created from the initial edited resistivity data and inversion parameters were chosen to maximize the likelihood of convergence. It is important to note that up to this point, no resistivity data values had been manipulated or changed, such as smoothing routines or box filters. Noisy data had only been removed from the general population.

The inversion process followed a set of stages that utilized consistent inversion parameters to maintain consistency between each model. Inversion parameter choices included the starting model, the inversion routine (robust or smooth), the constraint defining the value of smoothing and various routine halting criteria that automatically determined when an inversion was complete. Convergence of the inversion was judged whether the model achieved an RMS of less than 5% within three to five iterations.

Additional data editing was performed for some of the lines using the RMS error filter with RES2DINVx64. This option provides a secondary means of removing bad data points from the data set; the RES2D program displays the distribution of the percentage difference between the logarithms of the observed and calculated apparent resistivity values in the form of a bar chart. It is expected the “bad” data points will have relatively large “errors”, for example above 100 percent. Points with large errors can be removed and a new input file is created omitting these points based on the cut-off error limit selected. The data are then re-run through the inversion routine, and named with the naming convention (_i, _ii) to denote the filter trial number.

3.3.2.2 2D Resistivity Plotting

The inverted data were output from RES2DINV into a .XYZ data file and were gridded and color contoured in Surfer (Golden Software, Inc.). Where relevant, intersecting features were plotted on the resistivity section to assist in data analysis. Qualified in-house inversion experts subjected each profile to a final review.

4.0 RESULTS

4.1 EM & MAG

The analysis of the EM & Mag results is based on the anticipated contrast in electrical properties between the conductive (low resistivity) landfill materials and the more resistive natural background materials. Generally, the products of the decomposition of waste are conductive, and as these mix with precipitation and surface water inflitration, the resulting bulk electrical properties of the wastes are likely to be highly conductive compared to typical natural background materials. Metal waste within the landfill will also be electrically conductive and generally magnetic. The electromagnetic and magnetic survey methods result in high-resolution 2D plan view maps of the electrical properties of the subsurface materials, allowing the lateral limits of the landfill to be estimated.

The magnetic measurements are highly sensitive to ferrous metals in the landfill. This can provide a high-resolution map of the distribution of metallic wastes within the landfills. The EM conductivity measurements would be expected to be more susceptible to moisture content and other conductive materials (clays, leachate, etc.), with the moisture in contact with waste materials of the landfill expected to be of increased conductivity.

Figure 4 shows the results of the EM conductivity (sensitive to bulk conductivity changes) and Mag (sensitive to ferrous metal only) survey for the whole survey site. Magnetic data are plotted as total magnetic field, measured in nanotesla (nT). Red and purple hues indicate highest anomalous areas, while yellow are more representative of background values or areas where fill material is thicker and landfill waste is beyond detection limits. The data show heterogeneity throughout the survey site, generally within the assumed landfill boundaries.

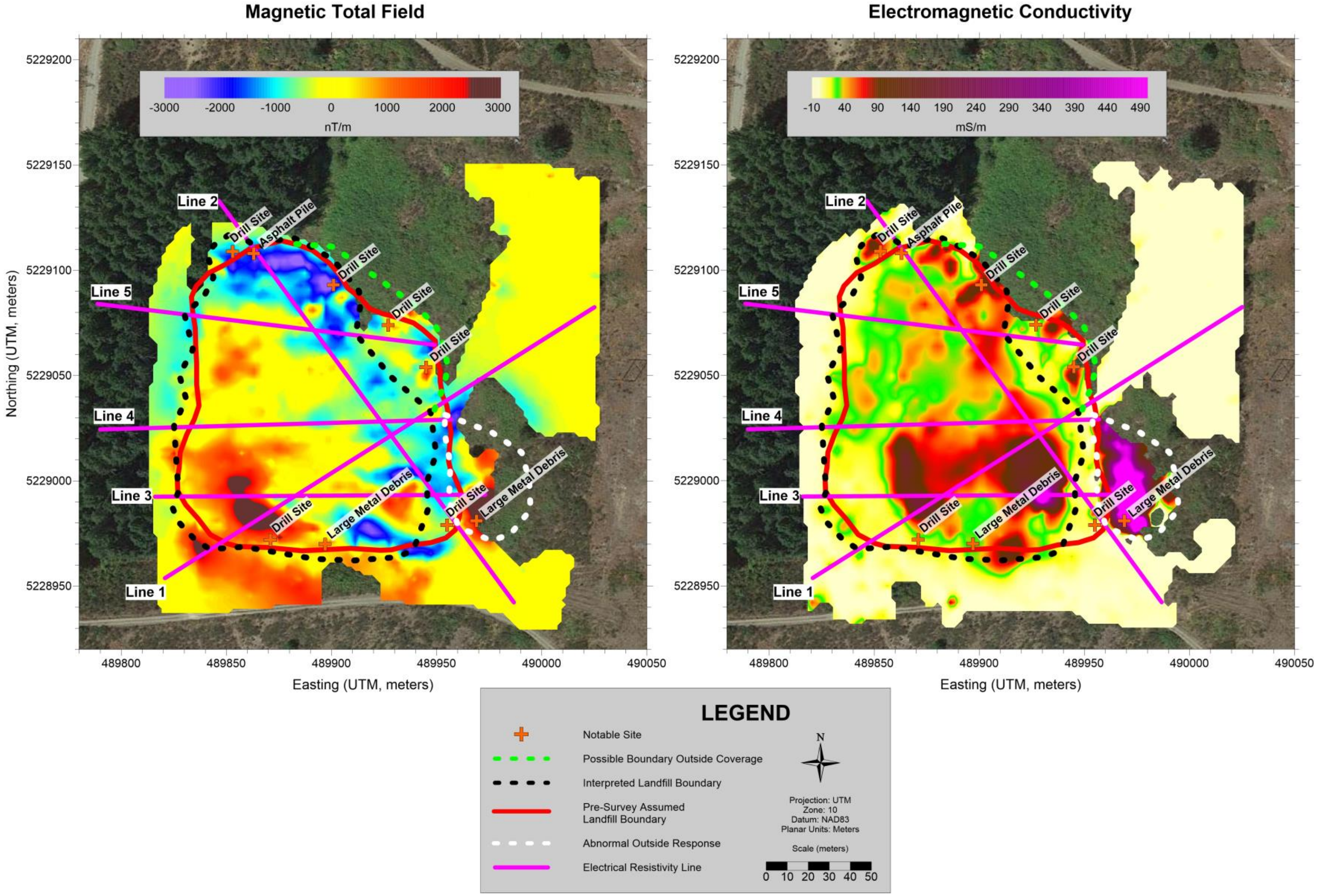
The results of the EM survey are plotted as 10 kHz conductivity data in millisiemens per meter (mS/m). In the EM conductivity results, purple and green hues indicate anomalous areas, yellow hues represent background values. The data show heterogeneity throughout the survey site, generally within the assumed landfill boundaries.

Generally speaking, the magnetic response patterns are in congruence with the EM results. Data for the complete survey site, as well as the results of the resistivity transects, are discussed in detail in the following sections.

The inverse model results for the electrical resistivity survey lines are presented as two-dimensional (2D) profiles. Common color contouring scales are used for all of the lines to provide the ability to compare anomalies from line to line. Electrically conductive (low resistivity) subsurface regions are represented by cool hues (purple to blue) and electrically resistive regions are represented by warm hues (olive to red).

The objective of the survey is to geophysically characterize heterogeneities in the subsurface that can indicate contrasts in electrical conductivity or metallic content. As such, within the resistivity profiles, the zones of lower resistivity (higher conductivity) would be assumed to be within the landfill, while contrasting higher resistivity would be expected to persist in the outer undisturbed materials.

Figure 4. Contoured Electromagnetics and Magnetics Map.



The results of the EM and Mag surveys have been interpreted to provide a potential waste boundary to delineate the spatial extent of the landfill, shown with a black dashed perimeter line in Figure 4. In general, the interpreted western and southern landfill boundary shows a good agreement to the pre-survey assumed landfill boundary (shown as the red polygon). There are a number of areas along these two boundaries where the interpreted landfill boundary (black dashed line) extends beyond the assumed boundary by approximately 20-30 feet. The EM results display a very distinct change along these two boundaries, with very homogeneous low conductivity values reflecting the native geological materials outside of the interpreted landfill area. In contrast, while the western boundary of the Mag displays a similar sharp boundary to more homogeneous background values, the area outside the southern boundary appears to display somewhat more heterogeneity in places. This appears as a broad positive Mag response (red tones) and could be a response to the underlying geology. The northern boundary displays a good agreement between the interpreted and assumed boundaries, apart from a significant EM and Mag response on the northwest corner. The response extends the interpreted boundary of the landfill by approximately 40 feet in this area. The northeastern side of the landfill was an area of limited coverage due to the hill slope and associated dense vegetation, which made access extremely difficult outside of our coverage area. Consequently, there is a significant portion of this area where the EM and Mag results do not display a distinct change to the homogeneous background values, as observed on the western boundary for example. Therefore, we have indicated two potential interpreted boundaries along this side of the landfill; the dashed black line of the interpreted landfill boundary and a green dashed line indicating the potential boundary outside the geophysical coverage based on the limited indications that background values were reached along this boundary area. For example, there in the region to the northwest of the access road into the landfill (where the eastern end of Line 5 is located) the EM and Mag results would appear to indicate a transition to background values, which is also corroborated in the electrical resistivity results of Line 5. However, on the eastern limit of the EM and Mag coverage we observe several responses that would indicate waste materials are still present in the subsurface. These responses are on the coverage limit of the electrical resistivity Line 5 and so it is difficult to be certain if this is a return to landfill waste material in the subsurface or an isolated response to surface features (rubble or debris piles or metallic objects on the ground surface).

The interpreted landfill boundary on the eastern side of the landfill, to the south of the access road into the landfill, would suggest the boundary shifts to the west by 20-40 feet based on the EM results. The Mag results still display some heterogeneity in this region, possibly again a response to the underlying native geology, since the electrical resistivity results from Line 3 corroborate the EM results. There is a very significant response in the EM and Mag results to the east of this area, indicated by the white dashed line in Figure 4. Based on field observations this would appear to be a near-surface response to a debris pile and surface metallic objects on the ground. This would correlate to the abnormally large responses observed in both the EM and Mag values. The EM coverage to the north and east of the large response manages to capture the return to background values on the eastern edge of this feature, highlighting the lateral limits of this response.

As stated, the EM results are in general congruence with the Mag results, with high amplitude anomalies in the EM conductivity correlating with high amplitude anomalies in the Mag results. The majority of the high amplitude responses tend to be associated with the southern half of the landfill, potentially indicating thicker waste material depths or a greater degree of decomposition. Higher concentrations of decomposition products and leachates are expected in areas with increased ferrous metal content. Another smaller region associated with high amplitude responses in the EM and Mag results is located on the northeast edge of the landfill. Again this could indicate thicker waste material depths or a higher degree of decomposition potential, with increased ferrous metal content.

4.2 RESISTIVITY RESULTS

4.2.1 Line 1

Figure 5 shows the resistivity profile for Line 1 (upper profile), which ran approximately southwest to northeast across the southern portion of the landfill. Line 1 spanned the pre-survey assumed extent of the landfill and extended into the native geology on either side of the landfill.

The landfill wastes typically present as a conductive target (purple and blue colors), therefore between approximately 95 to 490 feet along the line, the depth of the waste is estimated to be on average approximately 30 feet (the interpreted base of the waste material is highlighted by the black dashed line in

Figure 5), and the thickness of the cover is around 8 to 10 feet based on the more resistive near-surface layer (olive and brown colors). This extent of waste material correlates well to the pre-survey assumed landfill boundaries, indicated by the yellow triangles in Figure 5.

Between approximately 160 to 275 feet along the line the depth of the conductive waste feature appears to increase to approximately 45 feet, with a waste material thickness of approximately 35 feet. Below this thickening of the waste material layer there appears to be a reduction in the resistivity of the underlying native geological materials (indicated by the resistive red colors). This thickening of the highly conductive material could be attributable to thicker waste and-or infiltration of waste decomposition products into the underlying native geological formation.

The cover material appears to increase in thickness between approximately 95 and 150 feet along the line, which correlates to a decrease in the EM Conductivity value in the EM results of Figure 4. This would be expected since as the thickness of the more resistive cover material increases, the EM instrument, which has a limited investigation depth, would be sensitive to a decreasing amount of the conductive waste materials. Therefore, while the EM results may indicate an absence of waste material in this region, based on the conductivity value, the electrical resistivity confirms that the waste layer is present but has a thicker cover material layer.

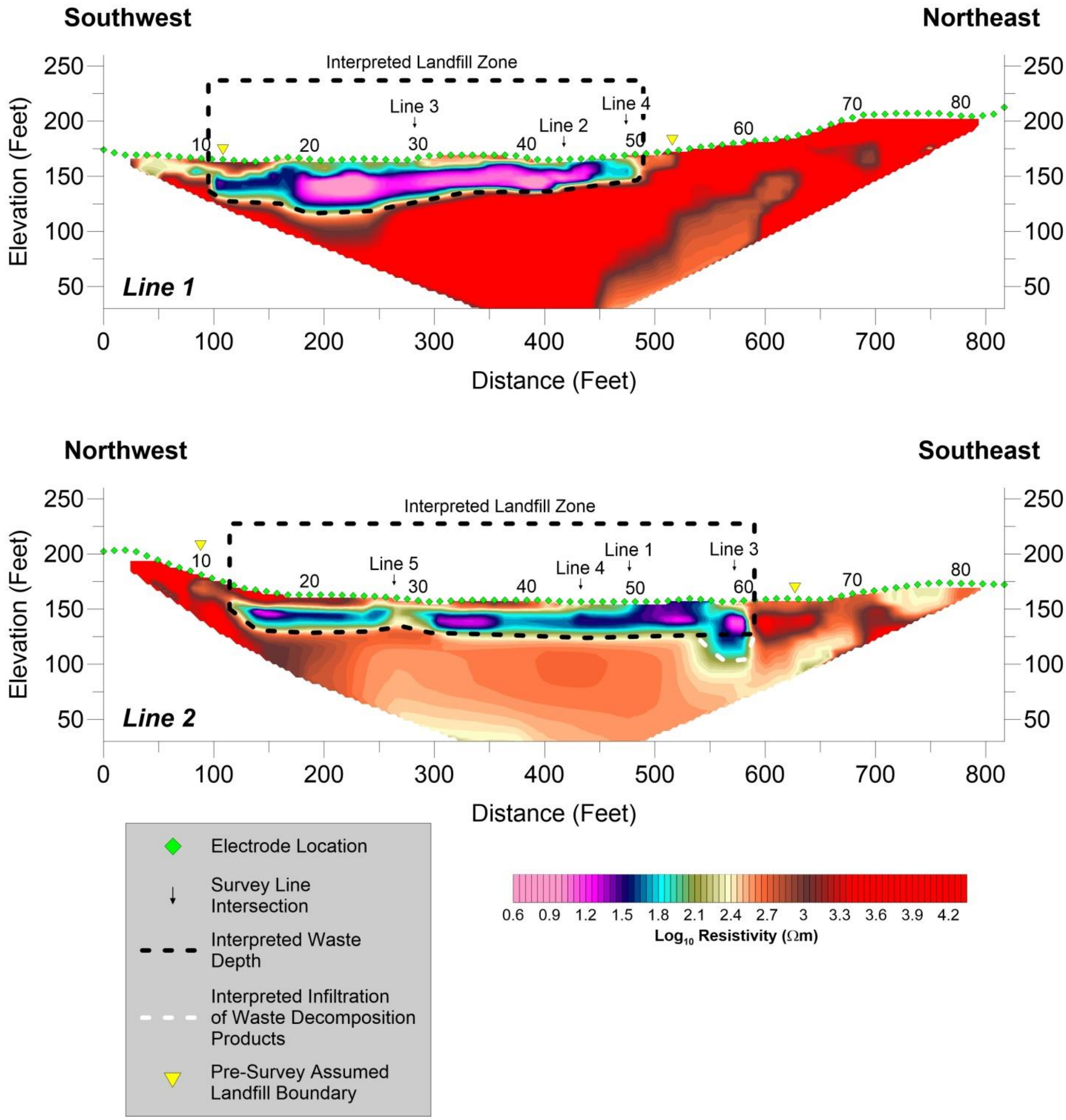
4.2.2 Line 2

Figure 5 shows the resistivity profile for Line 2 (lower profile), which ran approximately northwest to southeast across the northeast portion of the landfill. Line 2 spanned the pre-survey assumed extent of the landfill and extended into the native geology on either side of the landfill.

Again the landfill wastes are represented by the highly conductive target between approximately 115 and 590 feet along the line (the interpreted base of the waste material is highlighted by the back dashed line in Figure 6). In general, there appears to be a thin approximately 7 feet thick cover material layer, overlying a highly conductive layer, representing the waste materials, approximately 22 feet in thickness, both of which appear consistent across the line. This extent of waste material correlates well to the pre-survey assumed landfill boundary on the northwest end of the line, indicated by the yellow triangles in Figure 5. There is a degree of discrepancy on the southeast end of the line, where the pre-survey assumed boundary extends approximately 35 feet beyond the interpreted boundary.

Between approximately 265 and 285 feet along the line the model results appear to indicate the waste material layer becomes more resistive. This may be the result of more resistive waste materials being placed in the landfill in this region, or a cell division within the landfill separated by more resistive natural materials. The cover material thickness appears to significantly decrease between approximately 475 and 550 feet along the line, with the model results indicate highly conductive material at the ground surface. This may reflect the cover material being very thin in this region, or the cover material contains a higher degree of finer materials (increased clay content for example). Between approximately 540 to 590 feet along the line the depth of the conductive waste feature appears to increase to approximately 50 feet, with a waste material thickness of approximately 45 feet. This thickening of the highly conductive material could be attributable to thicker waste and-or infiltration of waste decomposition products into the underlying native geological formation.

Figure 5. Lines 1 and 2 Electrical Resistivity Model Results.



4.2.3 Line 3

Figure 6 shows the electrical resistivity profile for Line 3 (lower profile), which ran approximately west to east across the southern portion of the landfill. Line 3 spanned the pre-survey assumed extent of the landfill and extended into the native geology on either side of the landfill.

Again the landfill wastes are represented by the highly conductive target between approximately 75 and 440 feet along the line (the interpreted base of the waste material is highlighted by the back dashed line in Figure 6). This extent of waste material displays a degree of discrepancy to the pre-survey assumed landfill boundary; with the pre-survey assumed boundary extending approximately 35 feet beyond the interpreted boundary on each end of the line.

There appears to be some variability in the thickness of the waste material and overlying cover material layers across this line. Between approximately 75 and 120 feet along the line the thickness of the cover material decreases, from approximately 15 to 10 feet. This again correlates well to the low conductivity region observed in this area of the landfill in the EM results, and discussed previously for the Line 1 results section. The waste material layer rapidly increases in thickness, from approximately 7 to 40 feet. Beyond 120 feet along the line, the depth to the base of the waste material remains constant, at approximately 40 feet below ground surface (bgs), although the thickness of the waste layer increases due to a decreasing cover material layer thickness. The waste material reaches a maximum thickness of approximately 35 feet, between approximately 140 and 175 feet along the line, where the cover material reduces to approximately 2 to 3 feet thickness. In general beyond 225 feet along the line, there appears to be a thin approximately 8 feet thick cover material layer, overlying the highly conductive layer, representing the waste materials, approximately 18 feet in thickness. Between approximately 205 to 285 feet along the line the conductive waste feature appears to increase significantly, extending down to the depth limit of the model between approximately 250 and 300 feet along the line. This thickening of the highly conductive material could be attributable to thicker waste and-or infiltration of waste decomposition products into the underlying native geological formation.

The conductive layer appears predominantly highly conductive in nature, indicated by the pink and purple colors. This could be responses to the waste materials having a increased decomposition potential, which has produced significant quantities of decomposition products. The waste material layer in the southern portion of the landfill, covered by the majority of Lines 1 and 3, presents on average as more conductive than other regions of the landfill. This could reflect a difference in the waste materials across the landfill and their potential for decomposition.

4.2.4 Line 4

Figure 6 shows the electrical resistivity profile for Line 4 (middle profile), which ran approximately west to east across the central portion of the landfill. Line 4 spanned the pre-survey assumed extent of the landfill and extended into the native geology on either side of the landfill.

Again the landfill wastes are represented by the highly conductive target between approximately 130 and 490 feet along the line (the interpreted base of the waste material is highlighted by the back dashed line in Figure 6). This extent of waste material correlates well to the pre-survey assumed landfill boundary on the west end of the line, indicated by the yellow triangles in Figure 6. There is a degree of discrepancy on the east end of the line, where the pre-survey assumed boundary extends approximately 45 feet beyond the interpreted boundary.

There appears to be some variability in the thickness of the waste material and overlying cover material layers across this line. Between approximately 130 and 250 feet along the line the thickness of the cover material decreases, from approximately 10 to 6 feet. This again correlates well to the low conductivity region observed in this area of the landfill in the EM results, which has been discussed previously. The waste material layer increases in thickness, from approximately 30 to 35 feet, as the cover material layer thickness appears to decrease. The depth to the base of the waste material appears to displays little variation across the line, although it is difficult to be certain as there is a broad response to a potential conductive “plume” apparent between approximately 175 and 375 feet along the line. This extends to the depth limit of the model results between approximately 250 and 350 feet along the line, with the majority of this plume feature associated with the highly conductive regions of the waste material layer. This is similar to the deep response noted on Line 3 (showing good continuity), but with a slightly shallower, broader feature. This thickening of the highly conductive material could be attributable to thicker waste and-or infiltration of waste decomposition products into the underlying native geological formation.

Beyond approximately 250 feet along the line, the thickness of the waste material layer decrease gradually from approximately 35 to 18 feet. Since the base of the waste materials remains constant across this section of the line, at approximately 28 feet (bgs), the cover material layer increases in thickness, from approximately 6 to 9 feet between 250 and 490 feet along the line. There is a section, between approximately 415 and 445 feet along the line, where the conductive layer appears to approach the ground surface. This may reflect the cover material being very thin in this region, or the cover material contains a higher degree of finer materials (increased clay content for example).

4.2.5 Line 5

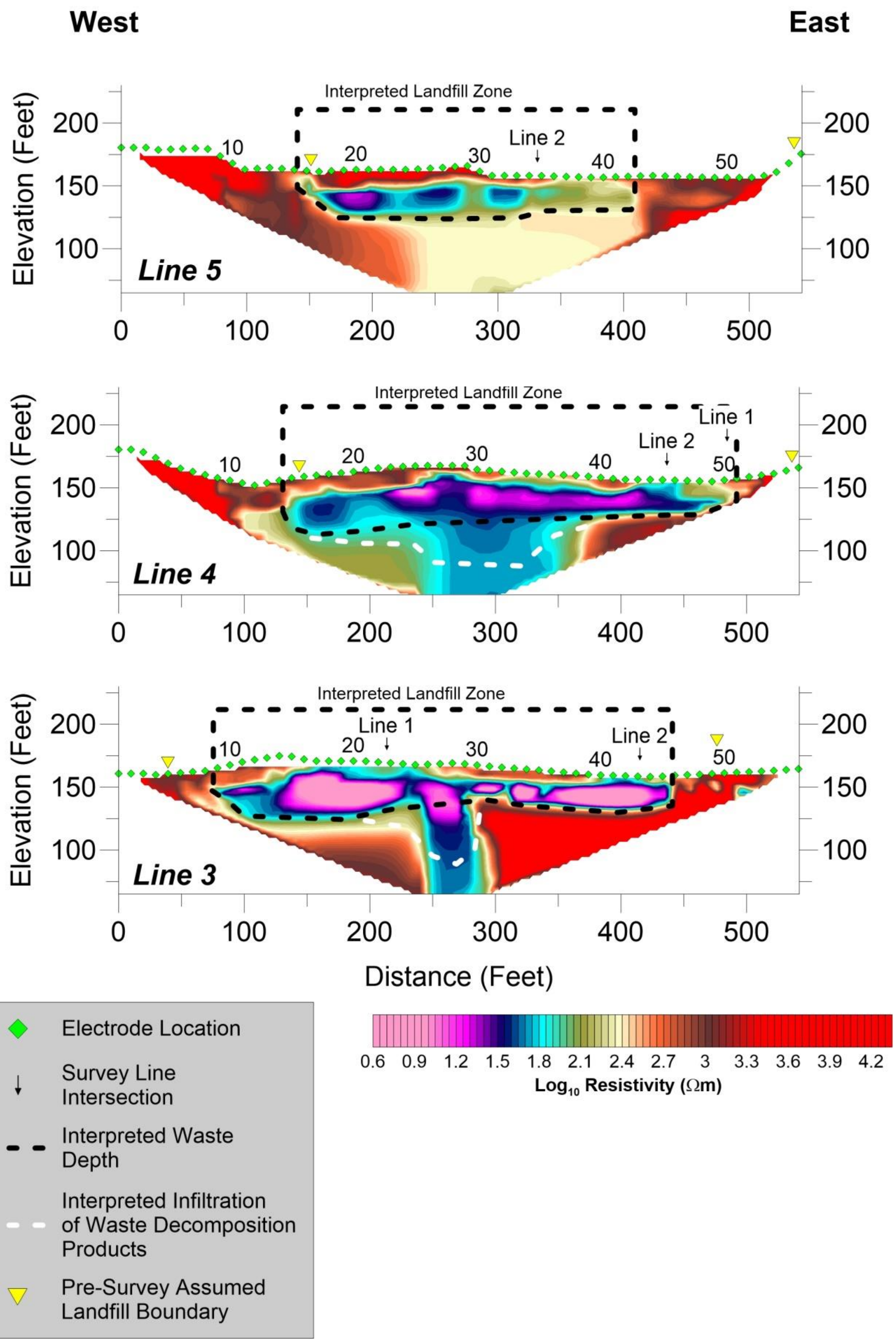
Figure 6 shows the electrical resistivity profile for Line 5 (upper profile), which ran approximately west to east across the northern portion of the landfill. Line 5 spanned the pre-survey assumed extent of the landfill and extended into the native geology on either side of the landfill.

Again the landfill wastes are represented by the highly conductive target between approximately 140 and 410 feet along the line, the depth of the waste is estimated to be on average approximately 26 feet (the interpreted base of the waste material is highlighted by the black dashed line in

Figure 5), and the thickness of the cover is around 7 to 10 feet based on the more resistive near-surface layer (olive and brown colors). This extent of waste material correlates well to the pre-survey assumed landfill boundary on the west end of the line, indicated by the yellow triangles in Figure 6. There is a degree of discrepancy on the east end of the line, where the pre-survey assumed boundary extends approximately 125 feet beyond the interpreted boundary.

The cover material layer appears to thicken on the west end of the interpreted landfill zone, with a maximum thickness of approximately 14 feet between approximately 140 and 180 feet along the line. This increase in thickness again correlates well to the low conductivity region observed in this area of the landfill in the EM results, which has been discussed previously. While there is no significant increase in conductivity below the waste layer similar to those observed on electrical resistivity lines 2, 3, and 4, we do observed a general decrease in the resistivity of the underlying materials (indicated by the yellow colors between approximately 250 and 350 feet along the line). This could indicate infiltration of waste decomposition products to a lesser degree and-or with less conductivity relative to other areas of the landfill. In general, the conductivity associated with the waste material layer in the northern portion of the landfill area tends to be lower, possibly indicating less decomposition of wastes.

Figure 6. Lines 3-5 Electrical Resistivity Results.



5.0 CONCLUSIONS

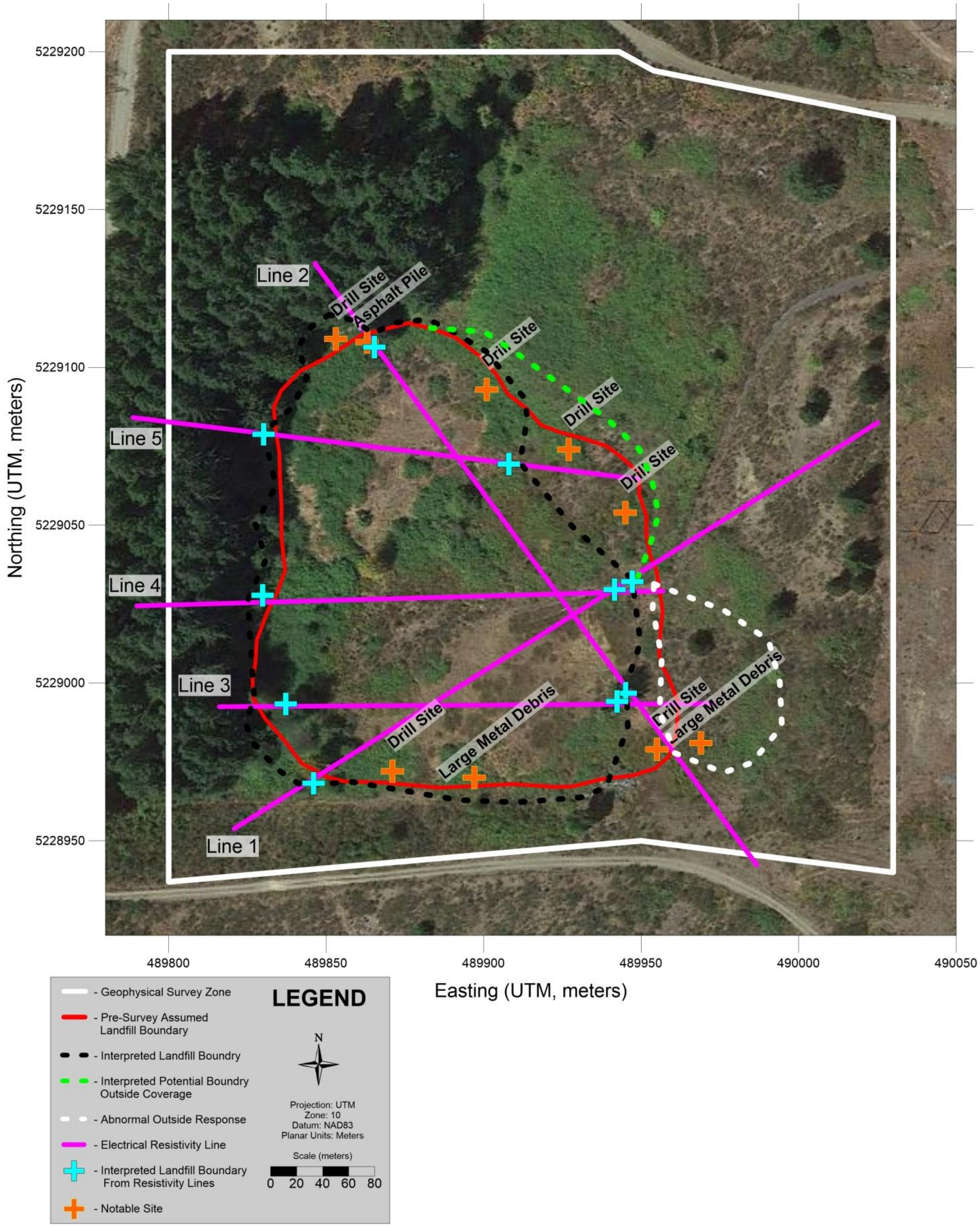
A multi-method geophysical survey was performed at the C Street Landfill near, Shelton, WA, USA, in May of 2017. The survey was performed to determine the lateral extents and thickness of landfill waste and the thickness of the cover material. Combined electromagnetic and magnetic surveys over the entire accessible landfill area, as well as five lines of 2D electrical resistivity were completed. The EM and Mag measurements provided an indication of the lateral limits of covered landfill (Figures 4 and 7). The electrical resistivity imaging method confirmed these boundary results and allowed the depth and thickness of the conductive wastes and the thickness of the cover material to be estimated (Figures 5, 6, and 7).

Based on the theory that the products of the decomposition of municipal solid waste will be conductive compared to background geological materials, and that areas with metallic debris will display increased magnetic gradient contrast to undisturbed materials outside the landfill boundaries, the following observations have been made using the acquired geophysical data:

- The EM and Mag data were acquired at reasonably high spatial resolution throughout the survey site, and showed good agreement for distribution of anomalous data that would indicate the presence of landfill waste material. The anomalous data for both methods mainly occur within the boundary of the landfill boundary that was assumed prior to geophysical surveying. The data outside of this assumed boundary mostly show little anomalous data, indicating background conditions have been mapped effectively. Combined analysis of the EM, Mag, and Resistivity results would tend to suggest the western and southern portions of the assumed landfill boundary would increase by 20 to 30 feet in some portions as indicated by the black dashed line in Figure 4. However, the south eastern corner would appear to recede by up to 60 feet in places from the pre survey assumed boundary, and likewise portions of the northeast would recede by as much as 90 feet in places.
- The resistivity data provided additional imaging to support the lateral extents determined using the EM and Mag data, and the resistivity interpretation was favored in the north and northeastern areas where EM and MAG coverage was limited.

The resistivity profile results estimated the thickness of the waste to be approximately 20-35 feet at the locations of the resistivity survey lines, with cover thickness estimated on average to be 6-10 feet. Highly conductive regions were observed towards the central portions of resistivity lines 1, 3, and 4 and to some degree line 5, where the magnitude and character of the anomaly are indicative of infiltration of waste decomposition products into the native geological formations extending to the bottom of the techniques imaging depth.

Figure 7. Summary of the Interpreted Boundaries for the C-Street Landfill Geophysical Survey.



6.0 REFERENCES

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APPENDIX A

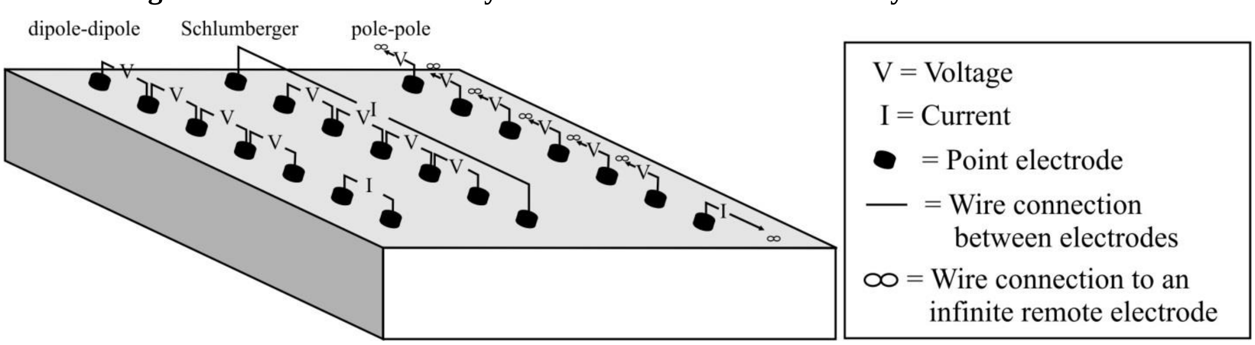
Description of Electrical Resistivity

7.0 DESCRIPTION OF ELECTRICAL RESISTIVITY

Electrical resistivity is a volumetric property that describes the resistance of electrical current flow within a medium (Rucker et al., 2011; Telford et al., 1990). Direct electrical current is propagated in rocks and minerals by electronic or electrolytic means. Electronic conduction occurs in minerals where free electrons are available, such as the electrical current flow through metal. Electrolytic conduction, on the other hand, relies on the dissociation of ionic species within a pore space. With electrolytic conduction, the movement of electrons varies with the mobility, concentration, and the degree of dissociation of the ions.

Mechanistically, the resistivity method uses electric current (I) that is transmitted into the earth through one pair of electrodes (transmitting dipole) that are in contact with the soil. The resultant voltage potential (V) is then measured across another pair of electrodes (receiving dipole). Numerous electrodes can be deployed along a transect (which may be anywhere from feet to miles in length), or within a grid. Figure 8. Possible Arrays for Use in Electrical Resistivity Characterization. shows examples of electrode layouts for surveying. The figure shows transects with a variety of array types (dipole-dipole, Schlumberger, pole-pole). A complete set of measurements occurs when each electrode (or adjacent electrode pair) passes current, while all other adjacent electrode pairs are utilized for voltage measurements. Modern equipment automatically switches the transmitting and receiving electrode pairs through a single multi-core cable connection. Rucker et al. (2009) describe in more detail the methodology for efficiently conducting an electrical resistivity survey.

Figure 8. Possible Arrays for Use in Electrical Resistivity Characterization.



The modern application of the resistivity method uses numerical modeling and inversion theory to estimate the electrical resistivity distribution of the subsurface given the known quantities of electrical current, measured voltage, and electrode positions. A common resistivity inverse method incorporated in commercially available codes is the regularized least squares optimization method (Sasaki, 1989; Loke, et al., 2003). The objective function within the optimization aims to minimize the difference between measured and modeled potentials (subject to certain constraints, such as the type and degree of spatial smoothing or regularization) and the optimization is conducted iteratively due to the nonlinear nature of the model that describes the potential distribution. The relationship between the subsurface resistivity (ρ) and the measured voltage is given by the following equation (from Dey and Morrison, 1979):

$$-\nabla \cdot \left[\frac{1}{\rho(x,y,z)} \nabla V(x,y,z) \right] = \left(\frac{I}{U} \right) \delta(x - x_s)\delta(y - y_s)\delta(z - z_s) \quad (1)$$

where I is the current applied over an elemental volume U specified at a point (x_s, y_s, z_s) by the Dirac delta function.

Equation (1) is solved many times over the volume of the earth by iteratively updating the resistivity model values using either the L_2-norm smoothness-constrained least squares method, which aims to minimize the square of the misfit between the measured and modeled data (de Groot-Hedlin & Constable, 1990; Ellis & Oldenburg, 1994):

$$\left(J_i^T J_i + \lambda_i W^T W \right) \Delta r_i = J_i^T g_i - \lambda_i W^T W r_{i-1} \quad (2)$$

or the L_1-norm that minimizes the sum of the absolute value of the misfit:

$$\left(J_i^T R_d J_i + \lambda_i W^T R_m W \right) \Delta r_i = J_i^T R_d g_i - \lambda_i W^T R_m W r_{i-1} \quad (3)$$

where g is the data misfit vector containing the difference between the measured and modeled data, J is the Jacobian matrix of partial derivatives, W is a roughness filter, R_d and R_m are the weighting matrices to equate model misfit and model roughness, Δr_i is the change in model parameters for the i^{th} iteration, r_i is the model parameters for the previous iteration, and λ_i = the damping factor.

APPENDIX B

Description of Electromagnetic Induction and Magnetic Methods

8.0 DESCRIPTION OF EM & MAG

8.1 MAGNETOMETRY

Magnetometry is the study of the Earth's magnetic field and is the oldest branch of geophysics. The Earth's field is composed of three main parts:

1. Main field is internal (i.e., from a source within the Earth that varies slowly in time and space)

2. Secondary field is external to the Earth and varies rapidly in time

3. Small internal fields constant in time and space are caused by local magnetic anomalies in the near-surface crust.

Of interest to the geophysicist are the localized anomalies. These anomalies are either caused by magnetic minerals, mainly magnetite or pyrrhotite, or buried steel and are the result of contrasts in the magnetic susceptibility (*k*) with respect to the background sediments. The average values for *k* are typically less than 1 for sedimentary formations and upwards to 20,000 for magnetite minerals.

The magnetic field is measured with a magnetometer. Magnetometers permit rapid, non-contact surveys to locate buried metallic objects and features. A one person portable field unit can be used virtually anywhere a person can walk; although, they may be sensitive to local interferences, such as fences and overhead wires. Airborne magnetometers are towed by aircraft and are used to measure regional anomalies. Field-portable magnetometers maybe single- or dual-sensor. Single-sensor magnetometers measure total field. Dual-sensor magnetometers are called gradiometers and measure gradient of the magnetic field.

Magnetic surveys are typically conducted with two separate magnetometers. The first magnetometer is used as a base station to record the Earth's primary field and the diurnally changing secondary field. The second magnetometer is used as a rover to measure the spatial variation of the Earth's field and may include various components (e.g., inclination, declination, and total intensity). By removing the temporal variation and perhaps the static value of the base station from that of the rover, one is left with a residual magnetic field that is the result of local spatial variations only. The rover magnetometer is moved along a predetermined linear grid laid out at the site. Readings are virtually continuous and results can be monitored in the field as the survey proceeds.

The shortcoming with most magnetometers is that they only record the total magnetic field (**F**) and not the separate components of the vector field. This shortcoming can make the interpretation of magnetic anomalies difficult, especially since the strength of the field between the magnetometer and target is reduced as a function of the inverse of distance between the magnetometer and target, cubed. Additional complications can include the inclination and declination of the Earth's field, the presence of any remnant magnetization associated with the target, and the shape of the target.

8.2 ELECTROMAGNETIC INDUCTION

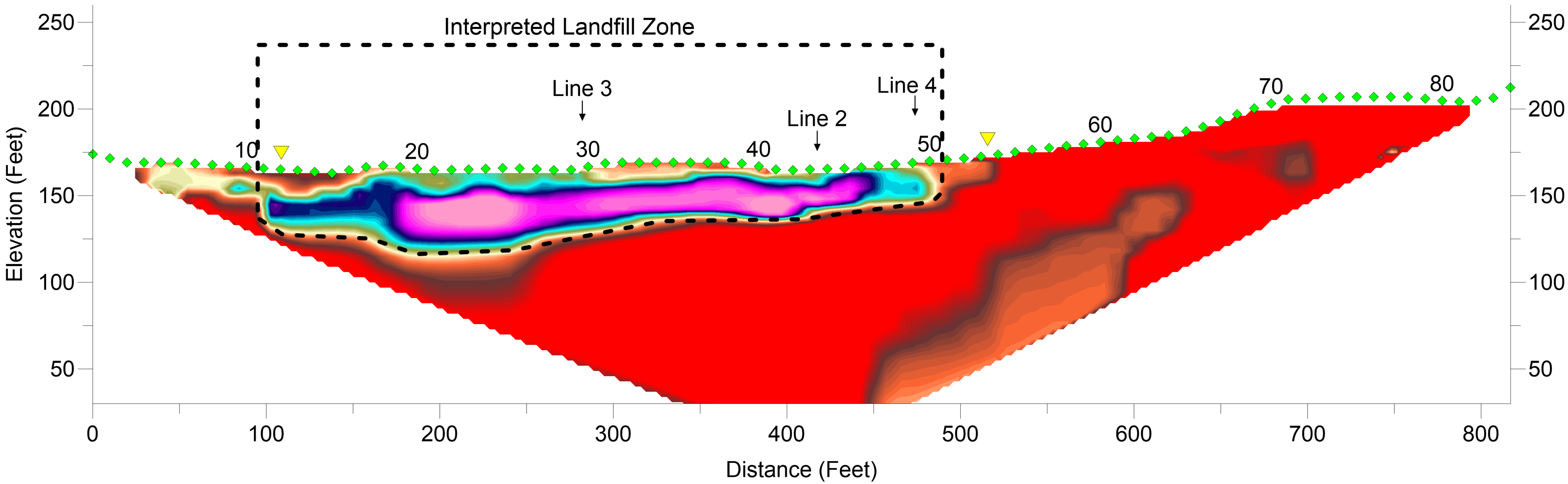
EM data is typically collected using portable ground conductivity instrumentation. Basically, a transmitting coil induces an electromagnetic field and a receiving coil at a fixed separation usually measures the amplitudes of the in-phase and quadrature components of the magnetic field. Various instruments have different coil spacings and operating frequencies. Spacing and frequency effect depth of signal penetration. Both single frequency and multi-frequency instruments have been developed for commercial use.

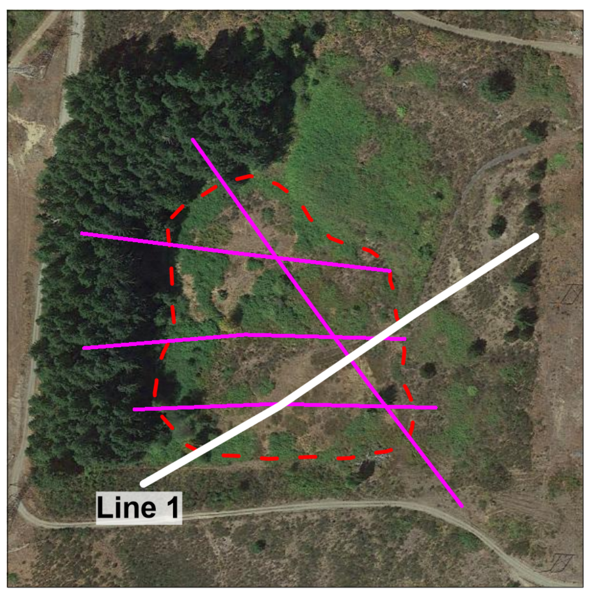
Earth materials have the capacity to transmit electrical currents over a wide range. Earth conductivity is a function of soil type, porosity, permeability, and dissolved salts. Terrain conductivity methods seek to identify various Earth materials by measuring their electrical characteristics and interpreting results in terms of those characteristics. EM techniques are used to measure Earth conductivities of various soil, rock, and water components at individual survey areas employing portable, rapid, non-invasive equipment operating at various frequencies depending on range and depth desired.

The recorded electromagnetic field is separated into two sub-components: in-phase and conductivity (also referred to as quadrature). The in-phase component is the most sensitive to metallic objects and is measured in parts per million (ppm). The conductivity component is sensitive to soil condition variations and is measured in log Siemens per meter (log S/m) using the GEM-2 instrument.

The EM method was chosen due to the capability of mapping changes in soil conductivity that are caused by changes in soil moisture, disruption, other conductivity changes caused by physical property contrasts, the ability to detect metallic objects (i.e., ferrous and non-ferrous), and the relatively rapid rate of data acquisition.

C Street Landfill Geophysical Survey
Electrical Resistivity Results - Line 1





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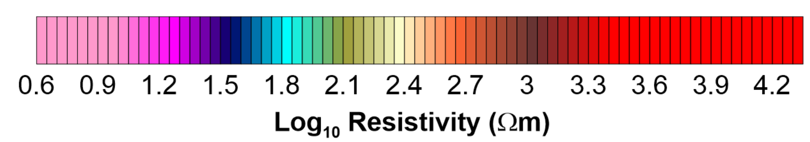
- Survey Line Intersection
- Interpreted Waste Depth
- Interpreted Infiltration of Waste Decomposition Products
- Pre-Survey Assumed Landfill Boundary



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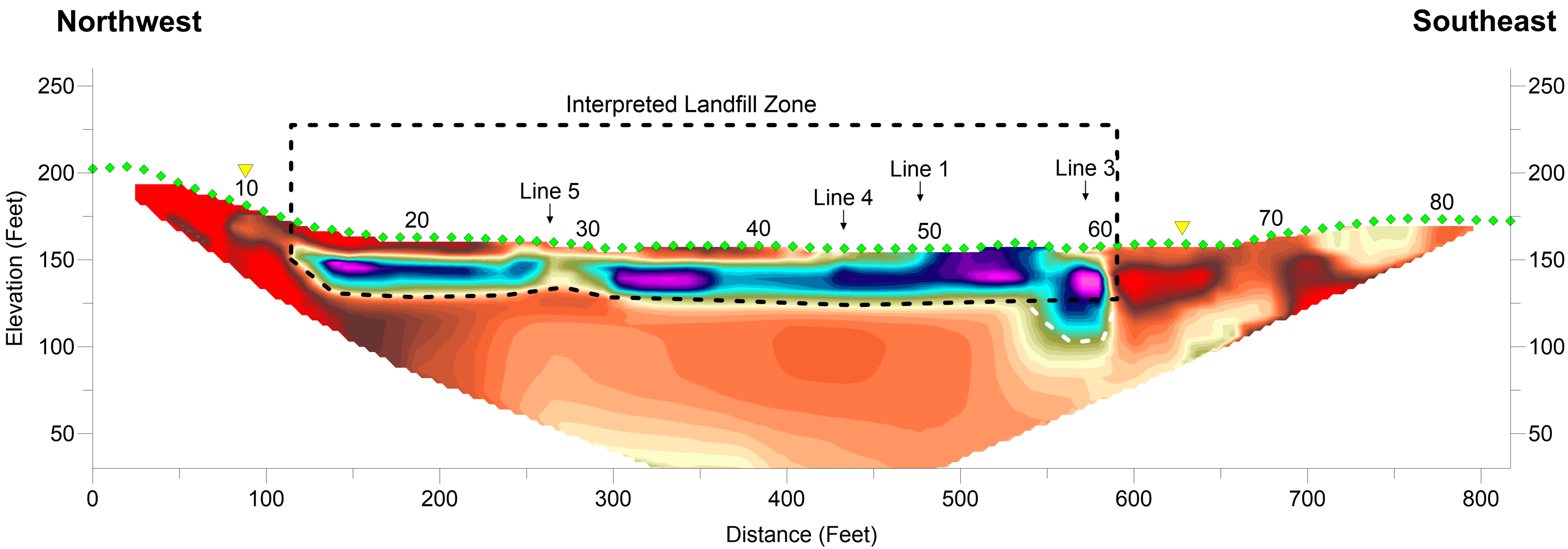
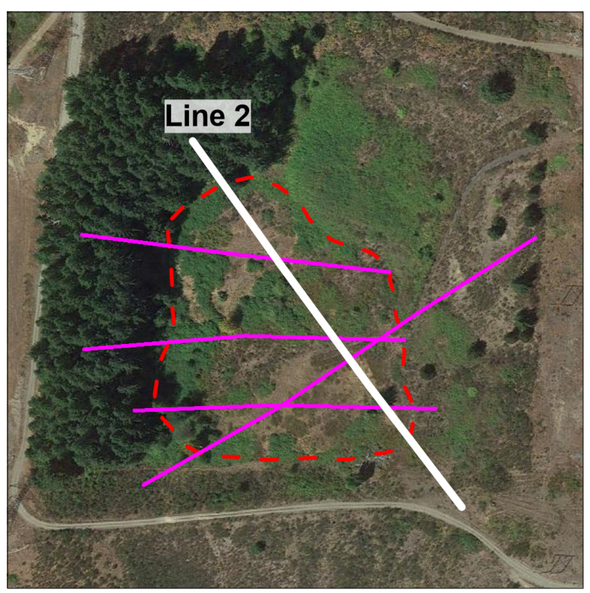
C Street Landfill Geophysical Survey

Date: May.2017

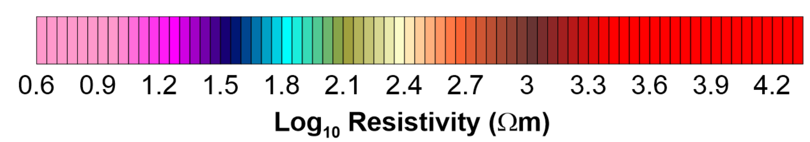
Fig.: RESISTIVITY LINE 1

C Street Landfill Geophysical Survey
Electrical Resistivity Results - Line 2





- Electrode Location
- Survey Line Intersection
- Interpreted Waste Depth
- Interpreted Infiltration of Waste Decomposition Products
- Pre-Survey Assumed Landfill Boundary



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C Street Landfill Geophysical Survey

Date: May.2017	Fig.: RESISTIVITY LINE 2

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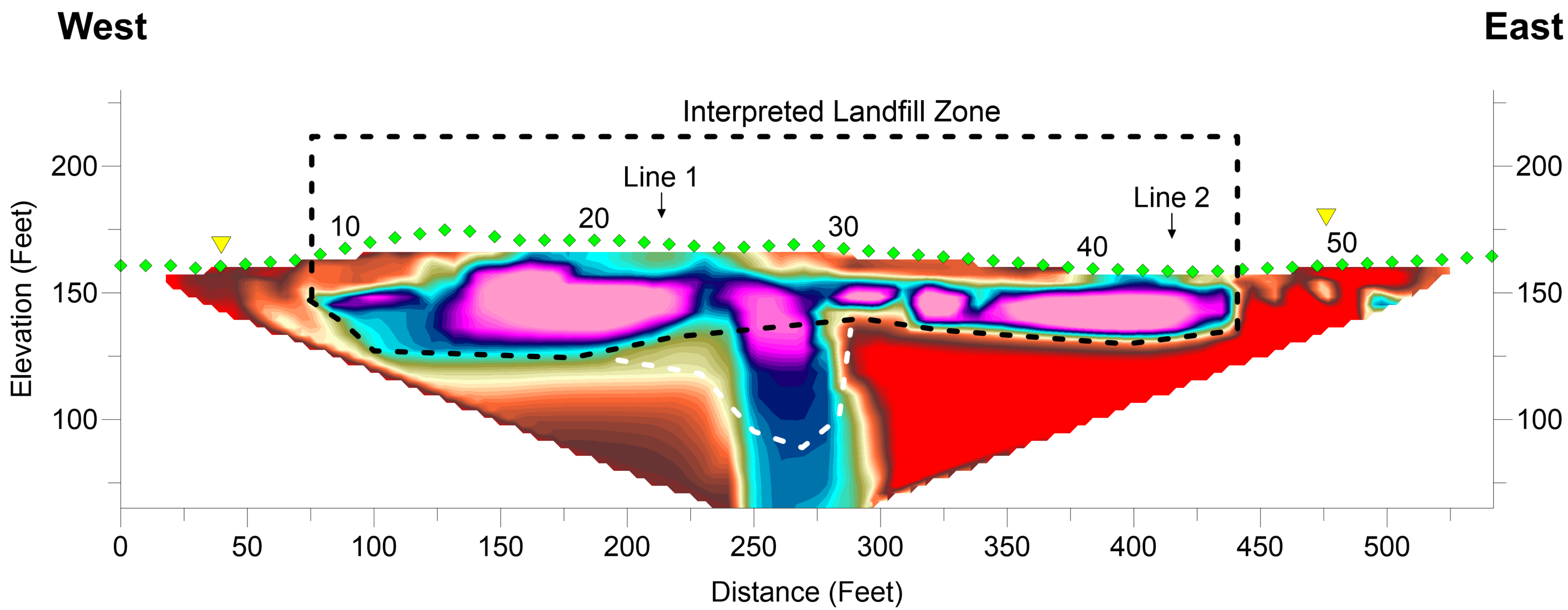
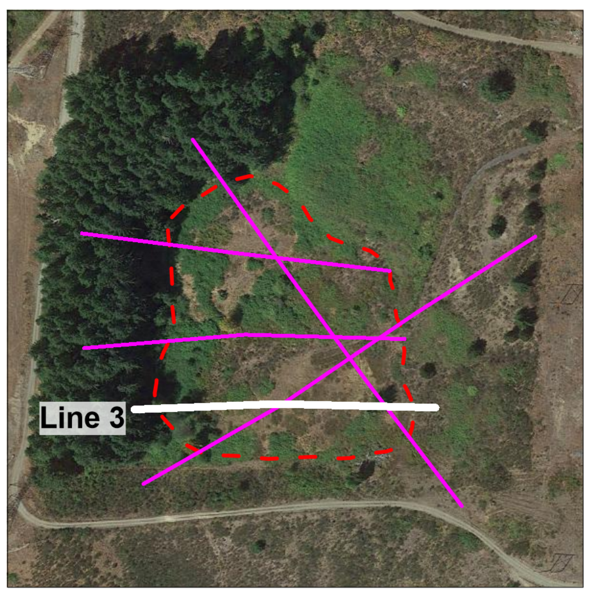
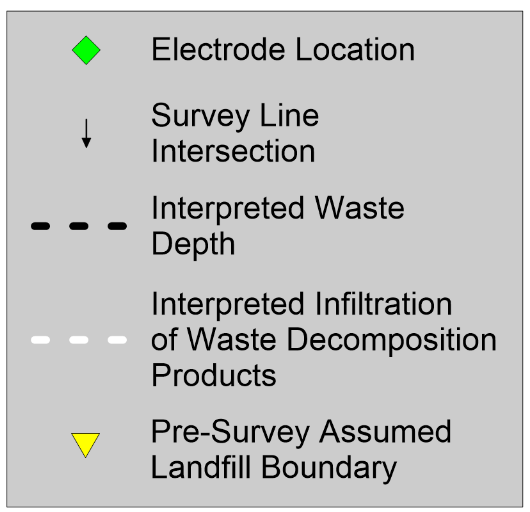
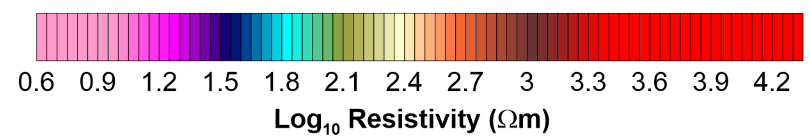
C Street Landfill Geophysical Survey
Electrical Resistivity Results - Line 3









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Date: May.2017	**Fig.: RESISTIVITY LINE 3**

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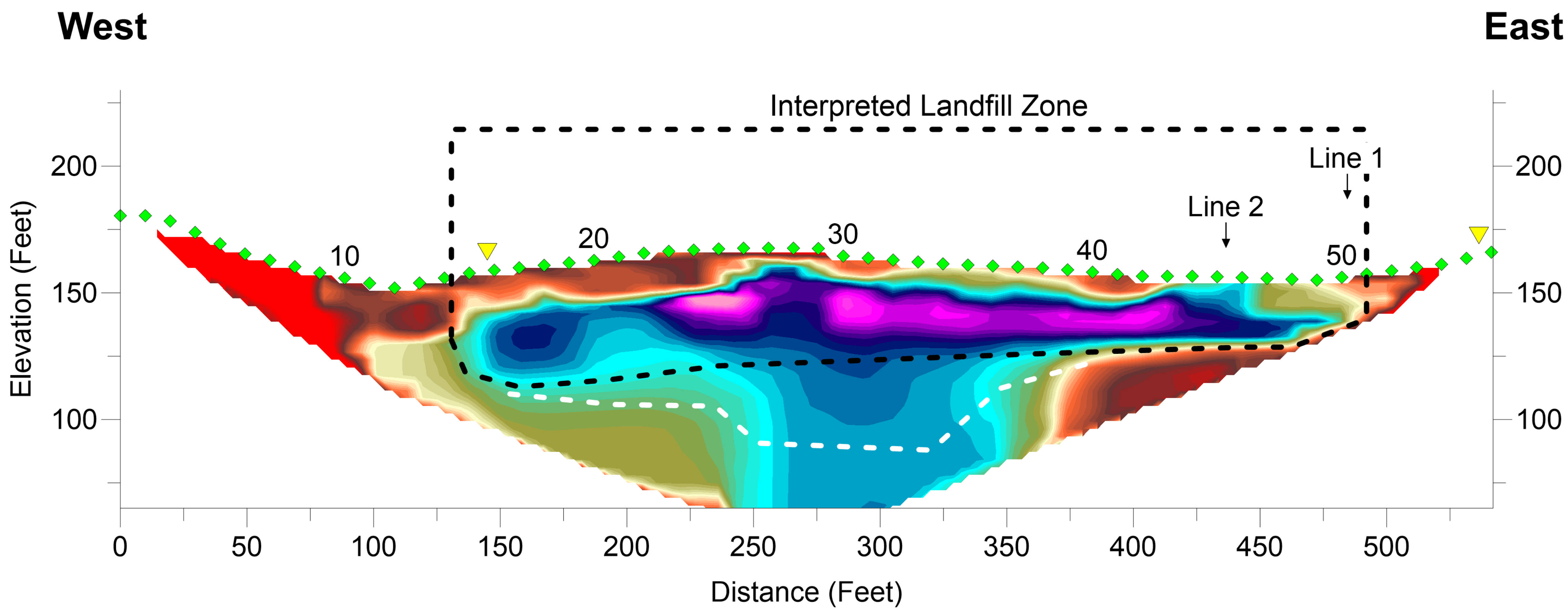
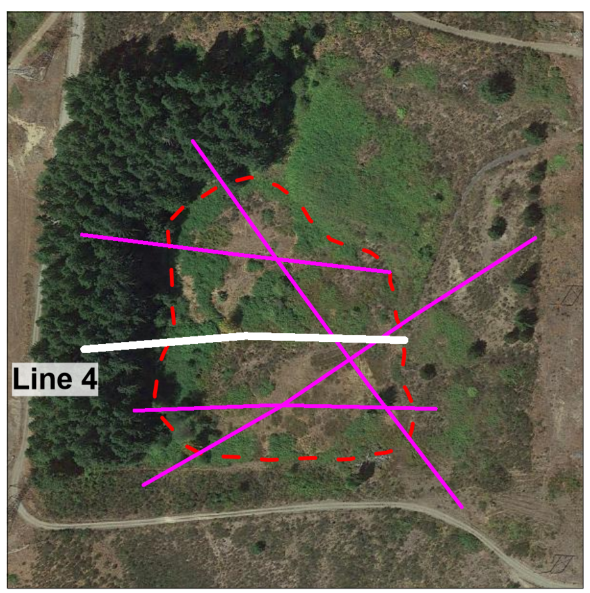
C Street Landfill Geophysical Survey
Electrical Resistivity Results - Line 4





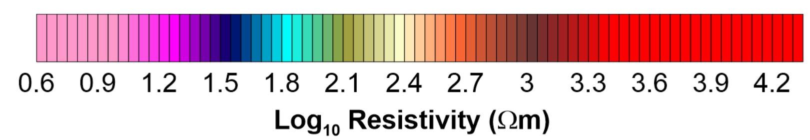
Electrode Location

Survey Line Intersection

Interpreted Waste Depth

Interpreted Infiltration of Waste Decomposition Products

Pre-Survey Assumed Landfill Boundary



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C Street Landfill Geophysical Survey

Date: May.2017	**Fig.: RESISTIVITY LINE 4**

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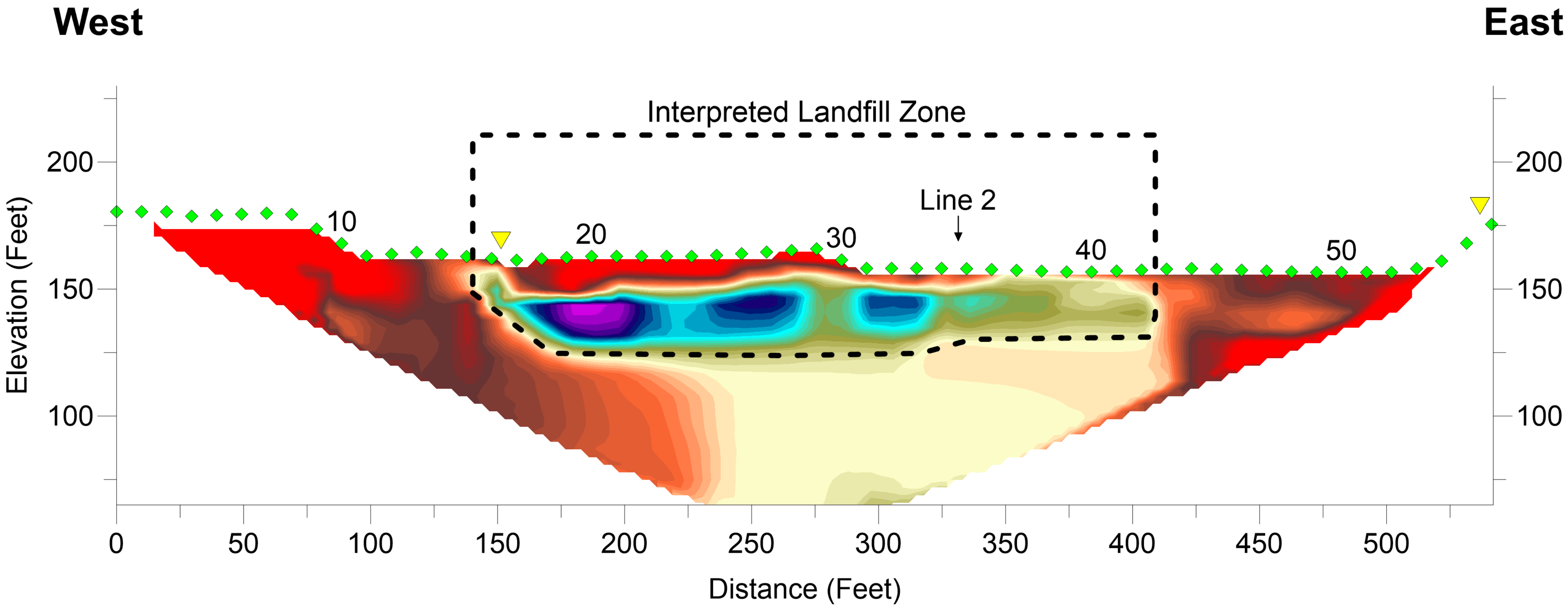
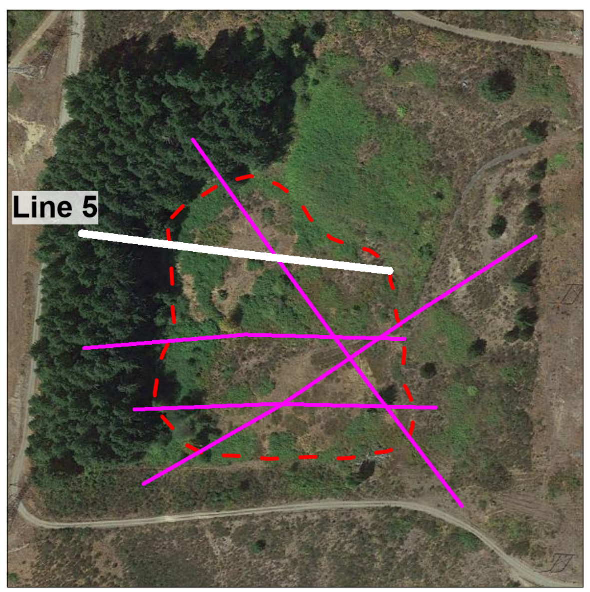
C Street Landfill Geophysical Survey
Electrical Resistivity Results - Line 5





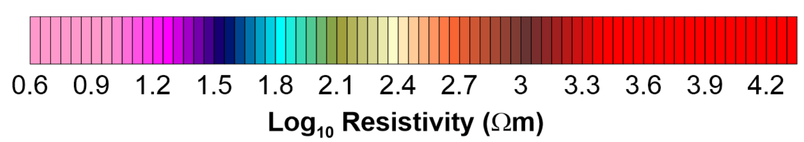
Electrode Location

Survey Line Intersection

Interpreted Waste Depth

Interpreted Infiltration of Waste Decomposition Products

Pre-Survey Assumed Landfill Boundary



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C Street Landfill Geophysical Survey

Date: May.2017

Fig.: RESISTIVITY LINE 5

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2302 North Forbes Blvd. Tucson, Arizona 85745 (520) 647-3315

ATTACHMENT C

Laboratory Analytical Report

FRONTIER ANALYTICAL LABORATORY

NELAP ACCREDITED TNI LABORATORY

August 15, 2017

Mr. Michael Erdahl
Friedman and Bruya, Inc.
3012 16th Ave. W
Seattle, WA 98119

Dear Mr. Erdahl,

The following results are associated with Frontier Analytical Laboratory project **10830**. This corresponds to your project number **707388** and purchase order number **F-27**. Three soil samples were received at Frontier Analytical Laboratory on 8/2/2017. These samples were extracted and analyzed by EPA Method 8290 for tetra through octa chlorinated dibenzo dioxins and furans. The Toxic Equivalency (TEQ) for your samples have been calculated using the 2005 World Health Organization's (WHO's) toxic equivalency factors (TEFs). Freidman and Bruya, Inc. requested a turnaround time of fifteen business days for project **10830**.

Please note that due to high concentrations of hexa dioxin, hepta dioxins, octa dioxin and hexa furans, the extract from sample 10830-003-SA (Friedman and Bruya, Inc. Sample ID: ISM-DU1-072617) was diluted and reanalyzed. The results taken from the analysis of the diluted extracts have been identified with a "*" qualifier on the corresponding sample data sheet.

The following report consists of an Analytical Data section and a Sample Receipt section. The Analytical Data section contains our sample tracking log and the analytical results. The Sample Receipt section contains your chain of custody, our sample login form and a sample photo. The enclosed results and electronic data deliverable (EDD) are specifically for the samples referenced in this report only. These results meet all NELAP requirements and shall not be reproduced except in full. Frontier Analytical Laboratory's State of Oregon NELAP certificate number is **4041**, our State of California ELAP certificate number is **2934** and our State of Washington certificate number is **C844**. This report along with the associated electronic data deliverable (EDD) has been emailed to you as a portable document format (PDF) file. A hardcopy will not be sent to you unless specifically requested.

If you have any questions regarding project **10830**, please feel free to contact me at (916) 934-0900. Thank you for choosing Frontier Analytical Laboratory for your analytical testing needs.

Sincerely,

Thomas C. Crabtree

Thomas C. Crabtree
Director

Frontier Analytical Laboratory

Sample Tracking Log

FAL Project ID: **10830**

Received on: **08/02/2017** Project Due: **08/24/2017** Storage: **R2**

FAL Sample ID	Dup	Client Project ID	Client Sample ID	Requested Method	Matrix	Sampling Date	Sampling Time	Hold Time Due Date
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10830-002-SA	2	707388	ISM-DU2-072617	EPA 8290 D/F	Soil	07/26/2017	12:32 pm	08/25/2017
10830-003-SA	2	707388	ISM-DU1-072617	EPA 8290 D/F	Soil	07/26/2017	03:00 pm	08/25/2017

5172 Hillsdale Circle * El Dorado Hills, CA 95762 * Tel (916) 934-0900 * Fax (916) 934-0999 * www.frontieranalytical.com

EPA Method 8290
PCDD/F

FRONTIER ANALYTICAL LABORATORY

FAL ID: 10830-001-MB	Date Extracted: 08-07-2017	ICal: pcddfal3-5-3-17-7pt	Acquired: 08-10-2017
Client ID: Method Blank	Date Received: NA	GC Column: DB5MS	2005 WHO TEQ: 0.0
Matrix: Soil	Amount: 5.00 g	Units: pg/g	Basis: Dry Weight
Batch No: X4198			

Compound	Conc	DL	Qual	2005 WHO Tox	MDL	Compound	Conc	DL	Qual
2,3,7,8-TCDD	ND	0.137		-	0.0315				
1,2,3,7,8-PeCDD	ND	0.284		-	0.0468				
1,2,3,4,7,8-HxCDD	ND	0.425		-	0.0503				
1,2,3,6,7,8-HxCDD	ND	0.436		-	0.0490	Total TCDD	ND	0.137	
1,2,3,7,8,9-HxCDD	ND	0.403		-	0.0488	Total PeCDD	ND	0.284	
1,2,3,4,6,7,8-HpCDD	ND	0.652		-	0.0541	Total HxCDD	ND	0.436	
OCDD	ND	1.22		-	0.0888	Total HpCDD	ND	0.652	
2,3,7,8-TCDF	ND	0.188		-	0.0243				
1,2,3,7,8-PeCDF	ND	0.290		-	0.0285				
2,3,4,7,8-PeCDF	ND	0.328		-	0.0298				
1,2,3,4,7,8-HxCDF	ND	0.279		-	0.0255				
1,2,3,6,7,8-HxCDF	ND	0.283		-	0.0253				
2,3,4,6,7,8-HxCDF	ND	0.295		-	0.0279				
1,2,3,7,8,9-HxCDF	ND	0.365		-	0.0367	Total TCDF	ND	0.188	
1,2,3,4,6,7,8-HpCDF	ND	0.408		-	0.0321	Total PeCDF	ND	0.328	
1,2,3,4,7,8,9-HpCDF	ND	0.528		-	0.0396	Total HxCDF	ND	0.365	
OCDF	ND	0.626		-	0.0843	Total HpCDF	ND	0.528	

Internal Standards	% Rec	QC Limits	Qual
13C-2,3,7,8-TCDD	90.7	40.0 - 135	
13C-1,2,3,7,8-PeCDD	84.9	40.0 - 135	
13C-1,2,3,4,7,8-HxCDD	93.5	40.0 - 135	
13C-1,2,3,6,7,8-HxCDD	96.3	40.0 - 135	
13C-1,2,3,4,6,7,8-HpCDD	92.2	40.0 - 135	
13C-OCDD	85.5	40.0 - 135	
13C-2,3,7,8-TCDF	92.0	40.0 - 135	
13C-1,2,3,7,8-PeCDF	81.0	40.0 - 135	
13C-2,3,4,7,8-PeCDF	78.1	40.0 - 135	
13C-1,2,3,4,7,8-HxCDF	94.2	40.0 - 135	
13C-1,2,3,6,7,8-HxCDF	96.5	40.0 - 135	
13C-2,3,4,6,7,8-HxCDF	94.1	40.0 - 135	
13C-1,2,3,7,8,9-HxCDF	96.6	40.0 - 135	
13C-1,2,3,4,6,7,8-HpCDF	93.0	40.0 - 135	
13C-1,2,3,4,7,8,9-HpCDF	97.4	40.0 - 135	
13C-OCDF	86.8	40.0 - 135	
Cleanup Surrogate			
37Cl-2,3,7,8-TCDD	94.7	50.0 - 150	

A	Isotopic Labeled Standard outside QC range but signal to noise ratio is >10:1
B	Analyte is present in Method Blank
C	Chemical Interference
D	Presence of Diphenyl Ethers
DNQ	Analyte concentration is below calibration range
E	Analyte concentration is above calibration range
F	Analyte confirmation on secondary column
J	Analyte concentration is below calibration range
M	Maximum possible concentration
ND	Analyte Not Detected at Detection Limit Level
NP	Not Provided
P	Pre-filtered through a Whatman 0.7um GF/F filter
S	Sample acceptance criteria not met
X	Matrix interferences
*	Result taken from dilution or reinjection

Analyst: ____________

Date: 8/14/2017

Reviewed By: ____________

Date: 8/14/2017

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EPA Method 8290
PCDD/F

FRONTIER ANALYTICAL LABORATORY

FAL ID: 10830-001-OPR	Date Extracted: 08-07-2017	ICal: pcddfal3-5-3-17-7pt	Acquired: 08-10-2017
Client ID: OPR	Date Received: NA	GC Column: DB5MS	2005 WHO TEQ: NA
Matrix: Soil	Amount: 5.00 g	Units: ng/ml	
Batch No: X4198			

Compound	Conc	QC Limits	Qual
2,3,7,8-TCDD	10.7	7.00 - 13.0	
1,2,3,7,8-PeCDD	50.5	35.0 - 65.0	
1,2,3,4,7,8-HxCDD	50.8	35.0 - 65.0	
1,2,3,6,7,8-HxCDD	51.3	35.0 - 65.0	
1,2,3,7,8,9-HxCDD	50.0	35.0 - 65.0	
1,2,3,4,6,7,8-HpCDD	52.6	35.0 - 65.0	
OCDD	108	70.0 - 130	
2,3,7,8-TCDF	10.8	7.00 - 13.0	
1,2,3,7,8-PeCDF	52.4	35.0 - 65.0	
2,3,4,7,8-PeCDF	53.4	35.0 - 65.0	
1,2,3,4,7,8-HxCDF	51.7	35.0 - 65.0	
1,2,3,6,7,8-HxCDF	54.2	35.0 - 65.0	
2,3,4,6,7,8-HxCDF	51.8	35.0 - 65.0	
1,2,3,7,8,9-HxCDF	52.6	35.0 - 65.0	
1,2,3,4,6,7,8-HpCDF	52.7	35.0 - 65.0	
1,2,3,4,7,8,9-HpCDF	53.0	35.0 - 65.0	
OCDF	109	70.0 - 130	

Internal Standards	% Rec	QC Limits	Qual
13C-2,3,7,8-TCDD	95.9	40.0 - 135	
13C-1,2,3,7,8-PeCDD	88.3	40.0 - 135	
13C-1,2,3,4,7,8-HxCDD	96.1	40.0 - 135	
13C-1,2,3,6,7,8-HxCDD	99.7	40.0 - 135	
13C-1,2,3,4,6,7,8-HpCDD	92.8	40.0 - 135	
13C-OCDD	87.2	40.0 - 135	
13C-2,3,7,8-TCDF	96.2	40.0 - 135	
13C-1,2,3,7,8-PeCDF	84.1	40.0 - 135	
13C-2,3,4,7,8-PeCDF	81.4	40.0 - 135	
13C-1,2,3,4,7,8-HxCDF	99.7	40.0 - 135	
13C-1,2,3,6,7,8-HxCDF	98.9	40.0 - 135	
13C-2,3,4,6,7,8-HxCDF	98.5	40.0 - 135	
13C-1,2,3,7,8,9-HxCDF	100	40.0 - 135	
13C-1,2,3,4,6,7,8-HpCDF	94.4	40.0 - 135	
13C-1,2,3,4,7,8,9-HpCDF	99.8	40.0 - 135	
13C-OCDF	89.9	40.0 - 135	

Cleanup Surrogate			
37Cl-2,3,7,8-TCDD	103	50.0 - 150	

A	Isotopic Labeled Standard outside QC range but signal to noise ratio is >10:1
B	Analyte is present in Method Blank
C	Chemical Interference
D	Presence of Diphenyl Ethers
DNQ	Analyte concentration is below calibration range
E	Analyte concentration is above calibration range
F	Analyte confirmation on secondary column
J	Analyte concentration is below calibration range
M	Maximum possible concentration
ND	Analyte Not Detected at Detection Limit Level
NP	Not Provided
P	Pre-filtered through a Whatman 0.7um GF/F filter
S	Sample acceptance criteria not met
X	Matrix interferences
*	Result taken from dilution or reinjection

Analyst: [signature]

Date: 8/14/2017

Reviewed By: [signature]

Date: 8/14/2017

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EPA Method 8290
PCDD/F

FRONTIER ANALYTICAL LABORATORY

FAL ID: 10830-001-SA	Date Extracted: 08-07-2017	ICal: pcddfal3-5-3-17-7pt	Acquired: 08-10-2017
Client ID: ISM-DU3-072517	Date Received: 08-02-2017	GC Column: DB5MS	2005 WHO TEQ: 2040
Matrix: Soil	Amount: 5.03 g	Units: pg/g	Basis: Dry Weight
Batch No: X4198	% Solids: 95.00		

Compound	Conc	DL	Qual	2005 WHO Tox	MDL	Compound	Conc	DL	Qual
2,3,7,8-TCDD	144	-		144	0.0315				
1,2,3,7,8-PeCDD	724	-		724	0.0468				
1,2,3,4,7,8-HxCDD	1480	-		148	0.0503				
1,2,3,6,7,8-HxCDD	2920	-		292	0.0490	Total TCDD	104000	-	
1,2,3,7,8,9-HxCDD	2260	-		226	0.0488	Total PeCDD	121000	-	
1,2,3,4,6,7,8-HpCDD	22000	-		220	0.0541	Total HxCDD	142000	-	
OCDD	30200	-		9.06	0.0888	Total HpCDD	36300	-	
2,3,7,8-TCDF	399	-	F	39.9	0.0243				
1,2,3,7,8-PeCDF	345	-		10.4	0.0285				
2,3,4,7,8-PeCDF	371	-		111	0.0298				
1,2,3,4,7,8-HxCDF	257	-	D,M	25.7	0.0255				
1,2,3,6,7,8-HxCDF	330	-	D,M	33.0	0.0253				
2,3,4,6,7,8-HxCDF	389	-		38.9	0.0279				
1,2,3,7,8,9-HxCDF	114	-		11.4	0.0367	Total TCDF	9020	-	D,M
1,2,3,4,6,7,8-HpCDF	721	-		7.21	0.0321	Total PeCDF	5970	-	D,M
1,2,3,4,7,8,9-HpCDF	141	-		1.41	0.0396	Total HxCDF	3310	-	D,M
OCDF	1510	-		0.453	0.0843	Total HpCDF	1970	-	

Internal Standards	% Rec	QC Limits	Qual
13C-2,3,7,8-TCDD	93.2	40.0 - 135	
13C-1,2,3,7,8-PeCDD	89.9	40.0 - 135	
13C-1,2,3,4,7,8-HxCDD	97.3	40.0 - 135	
13C-1,2,3,6,7,8-HxCDD	98.3	40.0 - 135	
13C-1,2,3,4,6,7,8-HpCDD	113	40.0 - 135	
13C-OCDD	114	40.0 - 135	
13C-2,3,7,8-TCDF	103	40.0 - 135	
13C-1,2,3,7,8-PeCDF	101	40.0 - 135	
13C-2,3,4,7,8-PeCDF	86.7	40.0 - 135	
13C-1,2,3,4,7,8-HxCDF	104	40.0 - 135	
13C-1,2,3,6,7,8-HxCDF	103	40.0 - 135	
13C-2,3,4,6,7,8-HxCDF	93.4	40.0 - 135	
13C-1,2,3,7,8,9-HxCDF	97.7	40.0 - 135	
13C-1,2,3,4,6,7,8-HpCDF	94.6	40.0 - 135	
13C-1,2,3,4,7,8,9-HpCDF	104	40.0 - 135	
13C-OCDF	101	40.0 - 135	
Cleanup Surrogate			
37Cl-2,3,7,8-TCDD	94.7	50.0 - 150	

A	Isotopic Labeled Standard outside QC range but signal to noise ratio is >10:1
B	Analyte is present in Method Blank
C	Chemical Interference
D	Presence of Diphenyl Ethers
DNQ	Analyte concentration is below calibration range
E	Analyte concentration is above calibration range
F	Analyte confirmation on secondary column
J	Analyte concentration is below calibration range
M	Maximum possible concentration
ND	Analyte Not Detected at Detection Limit Level
NP	Not Provided
P	Pre-filtered through a Whatman 0.7um GF/F filter
S	Sample acceptance criteria not met
X	Matrix interferences
*	Result taken from dilution or reinjection

Analyst: ____________ Reviewed By: ____________

Date: 8/14/2017 Date: 8/14/2017

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EPA Method 8290
PCDD/F

FRONTIER ANALYTICAL LABORATORY

FAL ID: 10830-002-SA	Date Extracted: 08-07-2017	ICal: pcddfal3-5-3-17-7pt	Acquired: 08-10-2017
Client ID: ISM-DU2-072617	Date Received: 08-02-2017	GC Column: DB5MS	2005 WHO TEQ: 3100
Matrix: Soil	Amount: 5.04 g	Units: pg/g	Basis: Dry Weight
Batch No: X4198	% Solids: 92.45		

Compound	Conc	DL	Qual	2005 WHO Tox	MDL	Compound	Conc	DL	Qual
2,3,7,8-TCDD	234	-		234	0.0315				
1,2,3,7,8-PeCDD	1100	-		1100	0.0468				
1,2,3,4,7,8-HxCDD	2180	-		218	0.0503				
1,2,3,6,7,8-HxCDD	4210	-		421	0.0490	Total TCDD	152000	-	
1,2,3,7,8,9-HxCDD	3370	-		337	0.0488	Total PeCDD	181000	-	
1,2,3,4,6,7,8-HpCDD	31200	-		312	0.0541	Total HxCDD	203000	-	
OCDD	21900	-		6.57	0.0888	Total HpCDD	51200	-	
2,3,7,8-TCDF	702	-	F	70.2	0.0243				
1,2,3,7,8-PeCDF	580	-		17.4	0.0285				
2,3,4,7,8-PeCDF	730	-		219	0.0298				
1,2,3,4,7,8-HxCDF	347	-	D,M	34.7	0.0255				
1,2,3,6,7,8-HxCDF	495	-	D,M	49.5	0.0253				
2,3,4,6,7,8-HxCDF	576	-		57.6	0.0279				
1,2,3,7,8,9-HxCDF	173	-		17.3	0.0367	Total TCDF	15800	-	D,M
1,2,3,4,6,7,8-HpCDF	780	-		7.80	0.0321	Total PeCDF	9710	-	D,M
1,2,3,4,7,8,9-HpCDF	176	-		1.76	0.0396	Total HxCDF	4690	-	D,M
OCDF	404	-		0.121	0.0843	Total HpCDF	1590	-	

Internal Standards	% Rec	QC Limits	Qual
13C-2,3,7,8-TCDD	90.3	40.0 - 135	
13C-1,2,3,7,8-PeCDD	87.0	40.0 - 135	
13C-1,2,3,4,7,8-HxCDD	92.9	40.0 - 135	
13C-1,2,3,6,7,8-HxCDD	95.8	40.0 - 135	
13C-1,2,3,4,6,7,8-HpCDD	109	40.0 - 135	
13C-OCDD	101	40.0 - 135	
13C-2,3,7,8-TCDF	95.5	40.0 - 135	
13C-1,2,3,7,8-PeCDF	97.1	40.0 - 135	
13C-2,3,4,7,8-PeCDF	85.7	40.0 - 135	
13C-1,2,3,4,7,8-HxCDF	102	40.0 - 135	
13C-1,2,3,6,7,8-HxCDF	98.2	40.0 - 135	
13C-2,3,4,6,7,8-HxCDF	89.4	40.0 - 135	
13C-1,2,3,7,8,9-HxCDF	94.8	40.0 - 135	
13C-1,2,3,4,6,7,8-HpCDF	91.0	40.0 - 135	
13C-1,2,3,4,7,8,9-HpCDF	100	40.0 - 135	
13C-OCDF	93.4	40.0 - 135	
Cleanup Surrogate			
37Cl-2,3,7,8-TCDD	91.8	50.0 - 150	

A	Isotopic Labeled Standard outside QC range but signal to noise ratio is >10:1
B	Analyte is present in Method Blank
C	Chemical Interference
D	Presence of Diphenyl Ethers
DNQ	Analyte concentration is below calibration range
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F	Analyte confirmation on secondary column
J	Analyte concentration is below calibration range
M	Maximum possible concentration
ND	Analyte Not Detected at Detection Limit Level
NP	Not Provided
P	Pre-filtered through a Whatman 0.7um GF/F filter
S	Sample acceptance criteria not met
X	Matrix interferences
*	Result taken from dilution or reinjection

Analyst: [signature]
Date: 8/14/2017

Reviewed By: [signature]
Date: 8/14/2017

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EPA Method 8290
PCDD/F

FRONTIER ANALYTICAL LABORATORY

FAL ID: 10830-003-SA
Client ID: ISM-DU1-072617
Matrix: Soil
Batch No: X4198

Date Extracted: 08-07-2017
Date Received: 08-02-2017
Amount: 5.02 g
% Solids: 86.87

ICal: pcddfal3-5-3-17-7pt
GC Column: DB5MS
Units: pg/g

Acquired: 08-10-2017
2005 WHO TEQ: 14700
Basis: Dry Weight

Compound	Conc	DL	Qual	2005 WHO Tox	MDL	Compound	Conc	DL	Qual
2,3,7,8-TCDD	828	-		828	0.0315				
1,2,3,7,8-PeCDD	5170	-		5170	0.0468				
1,2,3,4,7,8-HxCDD	9860	-		986	0.0503				
1,2,3,6,7,8-HxCDD	20800	-		2080	0.0490	Total TCDD	459000	-	
1,2,3,7,8,9-HxCDD	16600	-		1660	0.0488	Total PeCDD	669000	-	
1,2,3,4,6,7,8-HpCDD	145000	-	*	1450	0.0541	Total HxCDD	902000	-	*
OCDD	104000	-	*	31.2	0.0888	Total HpCDD	238000	-	*
2,3,7,8-TCDF	2980	-	F	298	0.0243				
1,2,3,7,8-PeCDF	2440	-		73.2	0.0285				
2,3,4,7,8-PeCDF	4390	-		1320	0.0298				
1,2,3,4,7,8-HxCDF	1670	-	*	167	0.0255				
1,2,3,6,7,8-HxCDF	2130	-	D,M,*	213	0.0253				
2,3,4,6,7,8-HxCDF	3040	-	*	304	0.0279				
1,2,3,7,8,9-HxCDF	934	-	*	93.4	0.0367	Total TCDF	66500	-	D,M
1,2,3,4,6,7,8-HpCDF	4240	-		42.4	0.0321	Total PeCDF	45200	-	D,M
1,2,3,4,7,8,9-HpCDF	1030	-		10.3	0.0396	Total HxCDF	22300	-	D,M,*
OCDF	1460	-		0.438	0.0843	Total HpCDF	8300	-	

Internal Standards	% Rec	QC Limits	Qual
13C-2,3,7,8-TCDD	95.2	40.0 - 135	
13C-1,2,3,7,8-PeCDD	92.4	40.0 - 135	
13C-1,2,3,4,7,8-HxCDD	97.3	40.0 - 135	
13C-1,2,3,6,7,8-HxCDD	90.5	40.0 - 135	
13C-1,2,3,4,6,7,8-HpCDD	114	40.0 - 135	*
13C-OCDD	109	40.0 - 135	*
13C-2,3,7,8-TCDF	99.8	40.0 - 135	
13C-1,2,3,7,8-PeCDF	102	40.0 - 135	
13C-2,3,4,7,8-PeCDF	90.3	40.0 - 135	
13C-1,2,3,4,7,8-HxCDF	110	40.0 - 135	*
13C-1,2,3,6,7,8-HxCDF	116	40.0 - 135	*
13C-2,3,4,6,7,8-HxCDF	91.4	40.0 - 135	*
13C-1,2,3,7,8,9-HxCDF	94.1	40.0 - 135	*
13C-1,2,3,4,6,7,8-HpCDF	94.0	40.0 - 135	
13C-1,2,3,4,7,8,9-HpCDF	98.1	40.0 - 135	
13C-OCDF	98.1	40.0 - 135	

Cleanup Surrogate	% Rec	QC Limits
37Cl-2,3,7,8-TCDD	99.8	50.0 - 150

A	Isotopic Labeled Standard outside QC range but signal to noise ratio is >10:1
B	Analyte is present in Method Blank
C	Chemical Interference
D	Presence of Diphenyl Ethers
DNQ	Analyte concentration is below calibration range
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F	Analyte confirmation on secondary column
J	Analyte concentration is below calibration range
M	Maximum possible concentration
ND	Analyte Not Detected at Detection Limit Level
NP	Not Provided
P	Pre-filtered through a Whatman 0.7um GF/F filter
S	Sample acceptance criteria not met
X	Matrix interferences
*	Result taken from dilution or reinjection

Analyst: [signature]
Date: 8/14/2017

Reviewed By: [signature]
Date: 8/14/2017

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SUBCONTRACT SAMPLE CHAIN OF CUSTODY

10830
OOC

Page # 1 of 1

Send Report To Michael Erdahl
Company Friedman and Bruya, Inc.
Address 3012 16th Ave W
City, State, ZIP Seattle, WA 98119
Phone # (206) 285-8282 Fax # (206) 283-5044

SUBCONTRACTER Frontier

PROJECT NAME/NO. 707388

PO # F-27

REMARKS
Please Email Results

TURNAROUND TIME
☒ Standard (2 Weeks) 21-TAT
☐ RUSH
Rush charges authorized by:

SAMPLE DISPOSAL
☐ Dispose after 30 days
☐ Return samples
☐ Will call with instructions

Sample ID	Lab ID	Date Sampled	Time Sampled	Matrix	# of jars	Dioxins/Furans	EPH	VPH	Nitrate	Sulfate	Alkalinity	TOC-9060M	Chlorinated Pesticides	Chlorinated Herbicides	Dioxins/Furans	Notes
ISM-DU3-072517	⅔	7/25/17	1407	Soil	3										X	10g in each VOA Vial.
ISM-DU2-072617	⅔	7/26/17	1232	↓	3										X	
ISM-DU1-072617	·	↓	1500	↓	3										X	

Michael to Kathy - EPA Method 8290 D/F 15-TAT. KZ.

Friedman & Bruya, Inc.
3012 16th Avenue West
Seattle, WA 98119-2029
Ph. (206) 285-8282
Fax (206) 283-5044

SIGNATURE	PRINT NAME	COMPANY	DATE	TIME
Relinquished by: [signature]	Michael Erdahl	Friedman and Bruya	8/1/17	Noon
Received by: Kathy Zipp	Kathy Zipp	Frontier Analytical	8/2/17	930
Relinquished by:				
Received by:				

Frontier Analytical Laboratory

Sample Login Form

FAL Project ID: **10830**

Client:	Friedman & Bruya, Inc.
Client Project ID:	707388
Date Received:	08/02/2017
Time Received:	09:30 am
Received By:	KZ
Logged In By:	KZ
# of Samples Received:	3
Duplicates:	6
Storage Location:	R2

Method of Delivery:	Fed-Ex
Tracking Number:	809992619396
Shipping Container Received Intact	Yes
Custody seals(s) present?	Yes
Custody seals(s) intact?	Yes
Sample Arrival Temperature (C)	0
Cooling Method	Blue Ice
Chain Of Custody Present?	Yes
Return Shipping Container To Client	Yes
Test aqueous sample for residual Chlorine	No
Sodium Thiosulfate Added	No
Adequate Sample Volume	Yes
Appropriate Sample Container	No
pH Range of Aqueous Sample	N/A

Anomalies or additional comments:

Please note that the samples were received in clear glass jars. NELAP requires samples be received in amber glass bottles or jars. Although this anomaly will not affect your results, we are required by NELAP to make a note of it. We will proceed with analysis unless directed otherwise by you.

5172 Hillsdale Circle * El Dorado Hills, CA 95762 * Tel (916) 934-0900 * Fax (916) 934-0999 * www.frontieranalytical.com


Will call with instructions
ANALYSES REQUESTED
Sample ID
Lab ID
Date Sampled
Time Sampled
Matrix
# of jars
Dioxins/Furans
EPH
VPH
Nitrate
Sulfate
Alkalinity
TOC-9060M
ISM-DU3-072517
7/25/17
1407
Soil
3
ISM-DU2-072617
7/26/17
1232
3
ISM-DU1-072617
1500
3
Friedman & Bruya, Inc.
3012 16th Avenue West
Seattle, WA 98119-2029
Ph. (206) 285-8282
Fax (206) 283-5044
COMPANY
DATE
TIME
Friedman and Bruya
Frontier Analytical
830-001-SA
ID:ISM-DU3-072517
(01 of 03)
10830-002-SA
ID:ISM-DU2-072617
10830-003-S
Client ID:ISM-DU1-072617
Storage: R2
707388
Frontier Analytical Laboratory
2017/08/02

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

James E. Bruya, Ph.D.
Yelena Aravkina, M.S.
Michael Erdahl, B.S.
Arina Podnozova, B.S.
Eric Young, B.S.

3012 16th Avenue West
Seattle, WA 98119-2029
(206) 285-8282
fbi@isomedia.com
www.friedmanandbruya.com

September 8, 2017

Ali Cochrance, Project Manager
Aspect Consulting, LLC
401 2nd Ave S, Suite 201
Seattle, WA 98104

Dear Ms Cochrane:

Included are the additional results from the testing of material submitted on July 27, 2017 from the Shelton C Street Landfill, PO 150074, F&BI 707388 project. There are 9 pages included in this report.

We appreciate this opportunity to be of service to you and hope you will call if you have any questions.

Sincerely,

FRIEDMAN & BRUYA, INC.

Michael Erdahl
Project Manager

Enclosures
c: data@aspectconsulting.com, Carla Brock
ASP0908R.DOC

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

CASE NARRATIVE

This case narrative encompasses samples received on July 27, 2017 by Friedman & Bruya, Inc. from the Aspect Consulting, LLC Shelton C Street Landfill, PO 150074, F&BI 707388 project. Samples were logged in under the laboratory ID's listed below.

Laboratory ID	Aspect Consulting, LLC
707388 -01	ISM-DU3-072517
707388 -02	ISM-DU2-072617
707388 -03	ISM-DU1-072617
707388 -04	DU3-P7-072617
707388 -05	DU3-P3-072617
707388 -06	DU2-L2-072617
707388 -07	DU2-L7-072617
707388 -08	DU2-G7-072617
707388 -09	DU2-G2-072617
707388 -10	DU1-C2-072617
707388 -11	Trip Blank

Several compounds in the 6020A matrix spike exceeded the acceptance criteria. The laboratory control sample met the acceptance criteria, therefore the results were likely due to matrix effect.

All other quality control requirements were acceptable.

Analysis For Total Metals By EPA Method 6020A

Client ID:	ISM-DU3-072517	Client:	Aspect Consulting, LLC
Date Received:	07/27/17	Project:	Shelton C Street Landfill, PO 150074
Date Extracted:	08/29/17	Lab ID:	707388-01
Date Analyzed:	08/30/17	Data File:	707388-01 rr.045
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	2.40
Barium	162
Cadmium	1.70
Chromium	25.5
Copper	80.6
Lead	172 ve
Mercury	0.812
Nickel	24.3
Selenium	0.540
Silver	3.62
Zinc	355

Analysis For Total Metals By EPA Method 6020A

Client ID:	ISM-DU3-072517	Client:	Aspect Consulting, LLC
Date Received:	07/27/17	Project:	Shelton C Street Landfill, PO 150074
Date Extracted:	08/29/17	Lab ID:	707388-01 x2
Date Analyzed:	08/30/17	Data File:	707388-01 x2.043
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Lead	182

Analysis For Total Metals By EPA Method 6020A

Client ID:	ISM-DU2-072617	Client:	Aspect Consulting, LLC
Date Received:	07/27/17	Project:	Shelton C Street Landfill, PO 150074
Date Extracted:	08/29/17	Lab ID:	707388-02
Date Analyzed:	08/30/17	Data File:	707388-02 rr.046
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	1.26
Barium	66.0
Cadmium	0.660
Chromium	14.5
Copper	36.7
Lead	69.6
Mercury	0.938
Nickel	11.5
Selenium	<0.5
Silver	1.65
Zinc	81.9

Analysis For Total Metals By EPA Method 6020A

Client ID:	ISM-DU1-072617	Client:	Aspect Consulting, LLC
Date Received:	07/27/17	Project:	Shelton C Street Landfill, PO 150074
Date Extracted:	08/29/17	Lab ID:	707388-03
Date Analyzed:	08/30/17	Data File:	707388-03 rr.047
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	4.40
Barium	129
Cadmium	1.54
Chromium	21.4
Copper	69.5
Lead	164 ve
Mercury	1.15
Nickel	13.2
Selenium	0.790
Silver	6.55
Zinc	134

Analysis For Total Metals By EPA Method 6020A

Client ID:	ISM-DU1-072617	Client:	Aspect Consulting, LLC
Date Received:	07/27/17	Project:	Shelton C Street Landfill, PO 150074
Date Extracted:	08/29/17	Lab ID:	707388-03 x2
Date Analyzed:	08/30/17	Data File:	707388-03 x2.044
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Lead	182

Analysis For Total Metals By EPA Method 6020A

Client ID:	Method Blank	Client:	Aspect Consulting, LLC
Date Received:	Not Applicable	Project:	Shelton C Street Landfill, PO 150074
Date Extracted:	08/29/17	Lab ID:	I7-461 mb 1/0.2
Date Analyzed:	08/29/17	Data File:	I7-461 mb 1/0.2.061
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Arsenic	<0.2
Barium	<0.2
Cadmium	<0.2
Chromium	<0.5
Copper	<0.2
Lead	<0.2
Mercury	<0.2
Nickel	<0.2
Selenium	<0.5
Silver	<0.2
Zinc	<1

Date of Report: 09/08/17
Date Received: 07/27/17
Project: Shelton C Street Landfill, PO 150074, F&BI 707388

QUALITY ASSURANCE RESULTS FOR THE ANALYSIS OF SOIL SAMPLES FOR TOTAL METALS USING EPA METHOD 6020A

Laboratory Code: 708425-04 (Matrix Spike)

Analyte	Reporting Units	Spike Level	Sample Result (Wet wt)	Percent Recovery MS	Percent Recovery MSD	Acceptance Criteria	RPD (Limit 20)
Arsenic	mg/kg (ppm)	10	0.340	83	87	75-125	5
Barium	mg/kg (ppm)	50	6.83	86	92	75-125	7
Cadmium	mg/kg (ppm)	10	<0.2	87	93	75-125	7
Chromium	mg/kg (ppm)	50	11.4	69 vo	77	75-125	11
Copper	mg/kg (ppm)	50	6.15	74 vo	79	75-125	7
Lead	mg/kg (ppm)	50	0.959	80	87	75-125	8
Mercury	mg/kg (ppm	5	<0.2	79	91	75-125	14
Nickel	mg/kg (ppm)	25	19.6	69 vo	79	75-125	14
Selenium	mg/kg (ppm)	5	<0.5	88	92	75-125	4
Silver	mg/kg (ppm)	10	<0.2	78	82	75-125	5
Zinc	mg/kg (ppm)	50	13.1	71 vo	78	75-125	9

Laboratory Code: Laboratory Control Sample

Analyte	Reporting Units	Spike Level	Percent Recovery LCS	Acceptance Criteria
Arsenic	mg/kg (ppm)	10	96	80-120
Barium	mg/kg (ppm)	50	106	80-120
Cadmium	mg/kg (ppm)	10	102	80-120
Chromium	mg/kg (ppm)	50	97	80-120
Copper	mg/kg (ppm)	50	102	80-120
Lead	mg/kg (ppm)	50	99	80-120
Mercury	mg/kg (ppm)	5	97	80-120
Nickel	mg/kg (ppm)	25	104	80-120
Selenium	mg/kg (ppm)	5	101	80-120
Silver	mg/kg (ppm)	10	95	80-120
Zinc	mg/kg (ppm)	50	99	80-120

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

Data Qualifiers & Definitions

a - The analyte was detected at a level less than five times the reporting limit. The RPD results may not provide reliable information on the variability of the analysis.

b - The analyte was spiked at a level that was less than five times that present in the sample. Matrix spike recoveries may not be meaningful.

ca - The calibration results for the analyte were outside of acceptance criteria. The value reported is an estimate.

c - The presence of the analyte may be due to carryover from previous sample injections.

cf - The sample was centrifuged prior to analysis.

d - The sample was diluted. Detection limits were raised and surrogate recoveries may not be meaningful.

dv - Insufficient sample volume was available to achieve normal reporting limits.

f - The sample was laboratory filtered prior to analysis.

fb - The analyte was detected in the method blank.

fc - The compound is a common laboratory and field contaminant.

hr - The sample and duplicate were reextracted and reanalyzed. RPD results were still outside of control limits. Variability is attributed to sample inhomogeneity.

hs - Headspace was present in the container used for analysis.

ht – The analysis was performed outside the method or client-specified holding time requirement.

ip - Recovery fell outside of control limits. Compounds in the sample matrix interfered with the quantitation of the analyte.

j - The analyte concentration is reported below the lowest calibration standard. The value reported is an estimate.

J - The internal standard associated with the analyte is out of control limits. The reported concentration is an estimate.

jl - The laboratory control sample(s) percent recovery and/or RPD were out of control limits. The reported concentration should be considered an estimate.

js - The surrogate associated with the analyte is out of control limits. The reported concentration should be considered an estimate.

lc - The presence of the analyte is likely due to laboratory contamination.

L - The reported concentration was generated from a library search.

nm - The analyte was not detected in one or more of the duplicate analyses. Therefore, calculation of the RPD is not applicable.

pc - The sample was received with incorrect preservation or in a container not approved by the method. The value reported should be considered an estimate.

ve - The analyte response exceeded the valid instrument calibration range. The value reported is an estimate.

vo - The value reported fell outside the control limits established for this analyte.

x - The sample chromatographic pattern does not resemble the fuel standard used for quantitation.

3600 Fremont Ave. N.
Seattle, WA 98103
T: (206) 352-3790
F: (206) 352-7178
info@fremontanalytical.com

Friedman & Bruya
Michael Erdahl
3012 16th Ave. W.
Seattle, WA 98119

RE: 707388
Work Order Number: 1708018

August 15, 2017

Attention Michael Erdahl:

Fremont Analytical, Inc. received 3 sample(s) on 8/1/2017 for the analyses presented in the following report.

Herbicides by EPA Method 8151A
Organochlorine Pesticides by EPA Method 8081

This report consists of the following:

- Case Narrative
- Analytical Results
- Applicable Quality Control Summary Reports
- Chain of Custody

All analyses were performed consistent with the Quality Assurance program of Fremont Analytical, Inc. Please contact the laboratory if you should have any questions about the results.

Thank you for using Fremont Analytical.

Sincerely,

Mike Ridgeway
Laboratory Director

DoD/ELAP Certification #L17-135, ISO/IEC 17025:2005
ORELAP Certification: WA 100009-007 (NELAP Recognized)

CLIENT:	Friedman & Bruya	
Project:	707388	
Work Order:	1708018	

Work Order Sample Summary

Lab Sample ID	Client Sample ID	Date/Time Collected	Date/Time Received
1708018-001	ISM-DU3-072517	07/25/2017 2:07 PM	08/01/2017 12:19 PM
1708018-002	ISM-DU2-072617	07/26/2017 12:32 PM	08/01/2017 12:19 PM
1708018-003	ISM-DU1-072617	07/26/2017 3:00 PM	08/01/2017 12:19 PM

Case Narrative

WO#: **1708018**

Date: **8/15/2017**

CLIENT: Friedman & Bruya

Project: 707388

WorkOrder Narrative:
I. SAMPLE RECEIPT:
Samples receipt information is recorded on the attached Sample Receipt Checklist.

II. GENERAL REPORTING COMMENTS:
Results are reported on a wet weight basis unless dry-weight correction is denoted in the units field on the analytical report ("mg/kg-dry" or "ug/kg-dry").

Matrix Spike (MS) and MS Duplicate (MSD) samples are tested from an analytical batch of "like" matrix to check for possible matrix effect. The MS and MSD will provide site specific matrix data only for those samples which are spiked by the laboratory. The sample chosen for spike purposes may or may not have been a sample submitted in this sample delivery group. The validity of the analytical procedures for which data is reported in this analytical report is determined by the Laboratory Control Sample (LCS) and the Method Blank (MB). The LCS and the MB are processed with the samples and the MS/MSD to ensure method criteria are achieved throughout the entire analytical process.

III. ANALYSES AND EXCEPTIONS:
Exceptions associated with this report will be footnoted in the analytical results page(s) or the quality control summary page(s) and/or noted below.

Client provided percent moisture for dry-weight correction.

Qualifiers:

* - Flagged value is not within established control limits
B - Analyte detected in the associated Method Blank
D - Dilution was required
E - Value above quantitation range
H - Holding times for preparation or analysis exceeded
I - Analyte with an internal standard that does not meet established acceptance criteria
J - Analyte detected below Reporting Limit
N - Tentatively Identified Compound (TIC)
Q - Analyte with an initial or continuing calibration that does not meet established acceptance criteria (<20%RSD, <20% Drift or minimum RRF)
S - Spike recovery outside accepted recovery limits
ND - Not detected at the Reporting Limit
R - High relative percent difference observed

Acronyms:

%Rec - Percent Recovery
CCB - Continued Calibration Blank
CCV - Continued Calibration Verification
DF - Dilution Factor
HEM - Hexane Extractable Material
ICV - Initial Calibration Verification
LCS/LCSD - Laboratory Control Sample / Laboratory Control Sample Duplicate
MB or MBLANK - Method Blank
MDL - Method Detection Limit
MS/MSD - Matrix Spike / Matrix Spike Duplicate
PDS - Post Digestion Spike
Ref Val - Reference Value
RL - Reporting Limit
RPD - Relative Percent Difference
SD - Serial Dilution
SGT - Silica Gel Treatment
SPK - Spike
Surr - Surrogate

Analytical Report

Work Order: **1708018**
Date Reported: **8/15/2017**

Client: Friedman & Bruya
Project: 707388
Lab ID: 1708018-001
Client Sample ID: ISM-DU3-072517
Collection Date: 7/25/2017 2:07:00 PM
Matrix: Soil

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Organochlorine Pesticides by EPA Method 8081				Batch ID: 17824		Analyst: SG
Toxaphene	ND	0.104		mg/Kg-dry	1	8/7/2017 7:04:35 PM
Alpha BHC	ND	0.0104		mg/Kg-dry	1	8/7/2017 7:04:35 PM
Beta BHC	ND	0.0104		mg/Kg-dry	1	8/7/2017 7:04:35 PM
Gamma BHC (Lindane)	ND	0.0104		mg/Kg-dry	1	8/7/2017 7:04:35 PM
Delta BHC	ND	0.0104		mg/Kg-dry	1	8/7/2017 7:04:35 PM
Heptachlor	ND	0.0104		mg/Kg-dry	1	8/7/2017 7:04:35 PM
Aldrin	ND	0.0104		mg/Kg-dry	1	8/7/2017 7:04:35 PM
Heptachlor epoxide	ND	0.0104		mg/Kg-dry	1	8/7/2017 7:04:35 PM
gamma-Chlordane	ND	0.0104		mg/Kg-dry	1	8/7/2017 7:04:35 PM
Endosulfan I	ND	0.0104		mg/Kg-dry	1	8/7/2017 7:04:35 PM
alpha-Chlordane	ND	0.0104		mg/Kg-dry	1	8/7/2017 7:04:35 PM
Dieldrin	ND	0.0104		mg/Kg-dry	1	8/7/2017 7:04:35 PM
4,4´-DDE	ND	0.0104		mg/Kg-dry	1	8/7/2017 7:04:35 PM
Endrin	ND	0.0104		mg/Kg-dry	1	8/7/2017 7:04:35 PM
Endosulfan II	ND	0.0104		mg/Kg-dry	1	8/7/2017 7:04:35 PM
4,4´-DDD	ND	0.0104		mg/Kg-dry	1	8/7/2017 7:04:35 PM
Endrin aldehyde	ND	0.0104		mg/Kg-dry	1	8/7/2017 7:04:35 PM
Endosulfan sulfate	ND	0.0104		mg/Kg-dry	1	8/7/2017 7:04:35 PM
4,4´-DDT	0.0166	0.0104		mg/Kg-dry	1	8/7/2017 7:04:35 PM
Endrin ketone	ND	0.0104		mg/Kg-dry	1	8/7/2017 7:04:35 PM
Methoxychlor	ND	0.0104		mg/Kg-dry	1	8/7/2017 7:04:35 PM
Surr: Decachlorobiphenyl	127	17.8 - 157		%Rec	1	8/7/2017 7:04:35 PM
Surr: Tetrachloro-m-xylene	125	11 - 150		%Rec	1	8/7/2017 7:04:35 PM
Herbicides by EPA Method 8151A				Batch ID: 17825		Analyst: BT
Dicamba	ND	36.4		µg/Kg-dry	1	8/10/2017 2:54:45 AM
2,4-D	ND	31.2		µg/Kg-dry	1	8/10/2017 2:54:45 AM
2,4-DP	ND	26.0		µg/Kg-dry	1	8/10/2017 2:54:45 AM
2,4,5-TP (Silvex)	ND	20.8		µg/Kg-dry	1	8/10/2017 2:54:45 AM
2,4,5-T	ND	52.0		µg/Kg-dry	1	8/10/2017 2:54:45 AM
Dinoseb	ND	31.2		µg/Kg-dry	1	8/10/2017 2:54:45 AM
Dalapon	ND	208		µg/Kg-dry	1	8/10/2017 2:54:45 AM
2,4-DB	ND	26.0		µg/Kg-dry	1	8/10/2017 2:54:45 AM
MCPP	ND	4,580		µg/Kg-dry	1	8/10/2017 2:54:45 AM
MCPA	ND	2,910		µg/Kg-dry	1	8/10/2017 2:54:45 AM
Picloram	ND	52.0		µg/Kg-dry	1	8/10/2017 2:54:45 AM
Bentazon	ND	36.4		µg/Kg-dry	1	8/10/2017 2:54:45 AM
Chloramben	ND	20.8		µg/Kg-dry	1	8/10/2017 2:54:45 AM

Analytical Report

Work Order: **1708018**
Date Reported: **8/15/2017**

Client: Friedman & Bruya
Project: 707388
Lab ID: 1708018-001
Client Sample ID: **ISM-DU3-072517**

Collection Date: 7/25/2017 2:07:00 PM
Matrix: Soil

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Herbicides by EPA Method 8151A				Batch ID: 17825		Analyst: BT
Acifluorfen	ND	83.3		µg/Kg-dry	1	8/10/2017 2:54:45 AM
3,5-Dichlorobenzoic acid	ND	41.6		µg/Kg-dry	1	8/10/2017 2:54:45 AM
4-Nitrophenol	ND	31.2		µg/Kg-dry	1	8/10/2017 2:54:45 AM
Dacthal (DCPA)	ND	31.2		µg/Kg-dry	1	8/10/2017 2:54:45 AM
Surr: 2,4-Dichlorophenylacetic acid	44.6	20.1 - 168		%Rec	1	8/10/2017 2:54:45 AM

Client: Friedman & Bruya
Collection Date: 7/26/2017 12:32:00 PM
Project: 707388
Lab ID: 1708018-002
Matrix: Soil
Client Sample ID: ISM-DU2-072617

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Organochlorine Pesticides by EPA Method 8081				Batch ID: 17824		Analyst: SG
Toxaphene	ND	0.107		mg/Kg-dry	1	8/7/2017 7:14:34 PM
Alpha BHC	ND	0.0107		mg/Kg-dry	1	8/7/2017 7:14:34 PM
Beta BHC	ND	0.0107		mg/Kg-dry	1	8/7/2017 7:14:34 PM
Gamma BHC (Lindane)	ND	0.0107		mg/Kg-dry	1	8/7/2017 7:14:34 PM
Delta BHC	ND	0.0107		mg/Kg-dry	1	8/7/2017 7:14:34 PM
Heptachlor	ND	0.0107		mg/Kg-dry	1	8/7/2017 7:14:34 PM
Aldrin	ND	0.0107		mg/Kg-dry	1	8/7/2017 7:14:34 PM
Heptachlor epoxide	ND	0.0107		mg/Kg-dry	1	8/7/2017 7:14:34 PM
gamma-Chlordane	ND	0.0107		mg/Kg-dry	1	8/7/2017 7:14:34 PM
Endosulfan I	ND	0.0107		mg/Kg-dry	1	8/7/2017 7:14:34 PM
alpha-Chlordane	ND	0.0107		mg/Kg-dry	1	8/7/2017 7:14:34 PM
Dieldrin	ND	0.0107		mg/Kg-dry	1	8/7/2017 7:14:34 PM
4,4´-DDE	ND	0.0107		mg/Kg-dry	1	8/7/2017 7:14:34 PM
Endrin	ND	0.0107		mg/Kg-dry	1	8/7/2017 7:14:34 PM
Endosulfan II	ND	0.0107		mg/Kg-dry	1	8/7/2017 7:14:34 PM
4,4´-DDD	ND	0.0107		mg/Kg-dry	1	8/7/2017 7:14:34 PM
Endrin aldehyde	ND	0.0107		mg/Kg-dry	1	8/7/2017 7:14:34 PM
Endosulfan sulfate	ND	0.0107		mg/Kg-dry	1	8/7/2017 7:14:34 PM
4,4´-DDT	0.0130	0.0107		mg/Kg-dry	1	8/7/2017 7:14:34 PM
Endrin ketone	ND	0.0107		mg/Kg-dry	1	8/7/2017 7:14:34 PM
Methoxychlor	ND	0.0107		mg/Kg-dry	1	8/7/2017 7:14:34 PM
Surr: Decachlorobiphenyl	143	17.8 - 157		%Rec	1	8/7/2017 7:14:34 PM
Surr: Tetrachloro-m-xylene	130	11 - 150		%Rec	1	8/7/2017 7:14:34 PM
Herbicides by EPA Method 8151A				Batch ID: 17825		Analyst: BT
Dicamba	ND	37.2		µg/Kg-dry	1	8/10/2017 3:15:56 AM
2,4-D	ND	31.9		µg/Kg-dry	1	8/10/2017 3:15:56 AM
2,4-DP	ND	26.6		µg/Kg-dry	1	8/10/2017 3:15:56 AM
2,4,5-TP (Silvex)	ND	21.3		µg/Kg-dry	1	8/10/2017 3:15:56 AM
2,4,5-T	ND	53.1		µg/Kg-dry	1	8/10/2017 3:15:56 AM
Dinoseb	ND	31.9		µg/Kg-dry	1	8/10/2017 3:15:56 AM
Dalapon	ND	213		µg/Kg-dry	1	8/10/2017 3:15:56 AM
2,4-DB	ND	26.6		µg/Kg-dry	1	8/10/2017 3:15:56 AM
MCPP	ND	4,680		µg/Kg-dry	1	8/10/2017 3:15:56 AM
MCPA	ND	2,980		µg/Kg-dry	1	8/10/2017 3:15:56 AM
Picloram	ND	53.1		µg/Kg-dry	1	8/10/2017 3:15:56 AM
Bentazon	ND	37.2		µg/Kg-dry	1	8/10/2017 3:15:56 AM
Chloramben	ND	21.3		µg/Kg-dry	1	8/10/2017 3:15:56 AM

Analytical Report

Fremont Analytical

Work Order: **1708018**
Date Reported: **8/15/2017**

Client: Friedman & Bruya
Project: 707388
Lab ID: 1708018-002
Client Sample ID: ISM-DU2-072617

Collection Date: 7/26/2017 12:32:00 PM
Matrix: Soil

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Herbicides by EPA Method 8151A				Batch ID: 17825		Analyst: BT
Acifluorfen	ND	85.0		µg/Kg-dry	1	8/10/2017 3:15:56 AM
3,5-Dichlorobenzoic acid	ND	42.5		µg/Kg-dry	1	8/10/2017 3:15:56 AM
4-Nitrophenol	ND	31.9		µg/Kg-dry	1	8/10/2017 3:15:56 AM
Dacthal (DCPA)	ND	31.9		µg/Kg-dry	1	8/10/2017 3:15:56 AM
Surr: 2,4-Dichlorophenylacetic acid	51.3	20.1 - 168		%Rec	1	8/10/2017 3:15:56 AM

Client: Friedman & Bruya
Project: 707388
Lab ID: 1708018-003
Client Sample ID: **ISM-DU1-072617**

Collection Date: 7/26/2017 3:00:00 PM
Matrix: Soil

Organochlorine Pesticides by EPA Method 8081

Batch ID: 17824   Analyst: SG

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Toxaphene	ND	0.111		mg/Kg-dry	1	8/7/2017 7:24:35 PM
Alpha BHC	ND	0.0111		mg/Kg-dry	1	8/7/2017 7:24:35 PM
Beta BHC	ND	0.0111		mg/Kg-dry	1	8/7/2017 7:24:35 PM
Gamma BHC (Lindane)	ND	0.0111		mg/Kg-dry	1	8/7/2017 7:24:35 PM
Delta BHC	ND	0.0111		mg/Kg-dry	1	8/7/2017 7:24:35 PM
Heptachlor	ND	0.0111		mg/Kg-dry	1	8/7/2017 7:24:35 PM
Aldrin	ND	0.0111		mg/Kg-dry	1	8/7/2017 7:24:35 PM
Heptachlor epoxide	ND	0.0111		mg/Kg-dry	1	8/7/2017 7:24:35 PM
gamma-Chlordane	ND	0.0111		mg/Kg-dry	1	8/7/2017 7:24:35 PM
Endosulfan I	ND	0.0111		mg/Kg-dry	1	8/7/2017 7:24:35 PM
alpha-Chlordane	ND	0.0111		mg/Kg-dry	1	8/7/2017 7:24:35 PM
Dieldrin	ND	0.0111		mg/Kg-dry	1	8/7/2017 7:24:35 PM
4,4´-DDE	ND	0.0111		mg/Kg-dry	1	8/7/2017 7:24:35 PM
Endrin	ND	0.0111		mg/Kg-dry	1	8/7/2017 7:24:35 PM
Endosulfan II	ND	0.0111		mg/Kg-dry	1	8/7/2017 7:24:35 PM
4,4´-DDD	ND	0.0111		mg/Kg-dry	1	8/7/2017 7:24:35 PM
Endrin aldehyde	ND	0.0111		mg/Kg-dry	1	8/7/2017 7:24:35 PM
Endosulfan sulfate	ND	0.0111		mg/Kg-dry	1	8/7/2017 7:24:35 PM
4,4´-DDT	0.0163	0.0111		mg/Kg-dry	1	8/7/2017 7:24:35 PM
Endrin ketone	ND	0.0111		mg/Kg-dry	1	8/7/2017 7:24:35 PM
Methoxychlor	ND	0.0111		mg/Kg-dry	1	8/7/2017 7:24:35 PM
Surr: Decachlorobiphenyl	8.48	17.8 - 157	S	%Rec	1	8/7/2017 7:24:35 PM
Surr: Tetrachloro-m-xylene	13.8	11 - 150		%Rec	1	8/7/2017 7:24:35 PM

NOTES:
S - Outlying surrogate recovery(ies) observed. All other laboratory and field samples recovered within range.

Herbicides by EPA Method 8151A

Batch ID: 17825   Analyst: BT

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Dicamba	ND	39.2		µg/Kg-dry	1	8/10/2017 3:37:12 AM
2,4-D	ND	33.6		µg/Kg-dry	1	8/10/2017 3:37:12 AM
2,4-DP	ND	28.0		µg/Kg-dry	1	8/10/2017 3:37:12 AM
2,4,5-TP (Silvex)	ND	22.4		µg/Kg-dry	1	8/10/2017 3:37:12 AM
2,4,5-T	ND	56.0		µg/Kg-dry	1	8/10/2017 3:37:12 AM
Dinoseb	ND	33.6		µg/Kg-dry	1	8/10/2017 3:37:12 AM
Dalapon	ND	224		µg/Kg-dry	1	8/10/2017 3:37:12 AM
2,4-DB	ND	28.0		µg/Kg-dry	1	8/10/2017 3:37:12 AM
MCPP	ND	4,930		µg/Kg-dry	1	8/10/2017 3:37:12 AM
MCPA	ND	3,140		µg/Kg-dry	1	8/10/2017 3:37:12 AM
Picloram	ND	56.0		µg/Kg-dry	1	8/10/2017 3:37:12 AM

Client: Friedman & Bruya
Project: 707388
Lab ID: 1708018-003
Client Sample ID: ISM-DU1-072617

Collection Date: 7/26/2017 3:00:00 PM
Matrix: Soil

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Herbicides by EPA Method 8151A				Batch ID: 17825		Analyst: BT
Bentazon	ND	39.2		µg/Kg-dry	1	8/10/2017 3:37:12 AM
Chloramben	ND	22.4		µg/Kg-dry	1	8/10/2017 3:37:12 AM
Acifluorfen	ND	89.6		µg/Kg-dry	1	8/10/2017 3:37:12 AM
3,5-Dichlorobenzoic acid	ND	44.8		µg/Kg-dry	1	8/10/2017 3:37:12 AM
4-Nitrophenol	ND	33.6		µg/Kg-dry	1	8/10/2017 3:37:12 AM
Dacthal (DCPA)	ND	33.6		µg/Kg-dry	1	8/10/2017 3:37:12 AM
Surr: 2,4-Dichlorophenylacetic acid	56.8	20.1 - 168		%Rec	1	8/10/2017 3:37:12 AM

Work Order: 1708018
CLIENT: Friedman & Bruya
Project: 707388

QC SUMMARY REPORT

Herbicides by EPA Method 8151A

Sample ID **MB-17825**	SampType: **MBLK**		Units: **µg/Kg**		Prep Date: **8/4/2017**		RunNo: **37948**			
Client ID: **MBLKS**	Batch ID: **17825**				Analysis Date: **8/9/2017**		SeqNo: **729321**			
Analyte	**Result**	**RL**	**SPK value**	**SPK Ref Val**	**%REC**	**LowLimit**	**HighLimit**	**RPD Ref Val**	**%RPD**	**RPDLimit**	**Qual**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Dicamba	ND	35.0									
2,4-D	ND	30.0									
2,4-DP	ND	25.0									
2,4,5-TP (Silvex)	ND	20.0									
2,4,5-T	ND	50.0									
Dinoseb	ND	30.0									
Dalapon	ND	200									
2,4-DB	ND	25.0									
MCPP	ND	4,400									
MCPA	ND	2,800									
Picloram	ND	50.0									
Bentazon	ND	35.0									
Chloramben	ND	20.0									
Acifluorfen	ND	80.0									
3,5-Dichlorobenzoic acid	ND	40.0									
4-Nitrophenol	ND	30.0									
Dacthal (DCPA)	ND	30.0									
Surr: 2,4-Dichlorophenylacetic acid	716		1,000		71.6	20.1	168				

Sample ID **LCS-17825**	SampType: **LCS**		Units: **µg/Kg**		Prep Date: **8/4/2017**		RunNo: **37948**			
Client ID: **LCSS**	Batch ID: **17825**				Analysis Date: **8/9/2017**		SeqNo: **729322**			

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Dicamba	160	35.0	200.0	0	80.2	24.7	141				
2,4-D	179	30.0	200.0	0	89.6	22.4	130				
2,4-DP	166	25.0	200.0	0	83.2	26.4	130				
2,4,5-TP (Silvex)	180	20.0	200.0	0	90.0	21.2	138				
2,4,5-T	165	50.0	200.0	0	82.6	22.8	144				
Dinoseb	140	30.0	200.0	0	69.8	5	165				
Dalapon	930	200	1,000	0	93.0	18.4	162				

Date: *8/15/2017*

Work Order: 1708018
CLIENT: Friedman & Bruya
Project: 707388

QC SUMMARY REPORT

Herbicides by EPA Method 8151A

Sample ID **LCS-17825** SampType: **LCS** Units: **µg/Kg** Prep Date: **8/4/2017** RunNo: **37948**
Client ID: **LCSS** Batch ID: **17825** Analysis Date: **8/9/2017** SeqNo: **729322**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
2,4-DB	190	25.0	200.0	0	94.8	5	164				
MCPP	826	4,400	1,000	0	82.6	22.2	157				
MCPA	883	2,800	1,000	0	88.3	47.4	128				
Picloram	171	50.0	200.0	0	85.7	5	175				
Bentazon	122	35.0	200.0	0	61.0	7.59	162				
Chloramben	64.5	20.0	200.0	0	32.3	5	147				
Acifluorfen	196	80.0	200.0	0	97.9	5	163				
3,5-Dichlorobenzoic acid	160	40.0	200.0	0	79.9	18.7	139				
4-Nitrophenol	146	30.0	200.0	0	73.0	5	163				
Dacthal (DCPA)	120	30.0	200.0	0	60.2	5	164				
Surr: 2,4-Dichlorophenylacetic acid	786		1,000		78.6	20.1	168				

Sample ID **1707301-001ADUP** SampType: **DUP** Units: **µg/Kg-dry** Prep Date: **8/4/2017** RunNo: **37948**
Client ID: **BATCH** Batch ID: **17825** Analysis Date: **8/10/2017** SeqNo: **729336**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Dicamba	ND	32.6						0		30	
2,4-D	ND	27.9						0		30	
2,4-DP	ND	23.3						0		30	
2,4,5-TP (Silvex)	ND	18.6						0		30	
2,4,5-T	ND	46.5						0		30	
Dinoseb	ND	27.9						0		30	
Dalapon	ND	186						0		30	
2,4-DB	ND	23.3						0		30	
MCPP	ND	4,090						0		30	
MCPA	ND	2,610						0		30	
Picloram	ND	46.5						0		30	
Bentazon	ND	32.6						0		30	
Chloramben	ND	18.6						0		30	
Acifluorfen	ND	74.5						0		30	

Date: *8/15/2017*

Work Order: 1708018
CLIENT: Friedman & Bruya
Project: 707388

QC SUMMARY REPORT

Herbicides by EPA Method 8151A

Sample ID **1707301-001ADUP**	SampType: **DUP**			Units: **µg/Kg-dry**		Prep Date: **8/4/2017**			RunNo: **37948**		
Client ID: **BATCH**	Batch ID: **17825**					Analysis Date: **8/10/2017**			SeqNo: **729336**		
Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
3,5-Dichlorobenzoic acid	ND	37.2						0		30	
4-Nitrophenol	ND	27.9						0		30	
Dacthal (DCPA)	ND	27.9						0		30	
Surr: 2,4-Dichlorophenylacetic acid	451		930.7		48.4	20.1	168		0		

Sample ID **1707301-001AMS**	SampType: **MS**			Units: **µg/Kg-dry**		Prep Date: **8/4/2017**			RunNo: **37948**		
Client ID: **BATCH**	Batch ID: **17825**					Analysis Date: **8/10/2017**			SeqNo: **729337**		
Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Dicamba	154	35.7	204.3	0	75.6	31.9	118				
2,4-D	173	30.6	204.3	0	84.8	12.4	134				
2,4-DP	164	25.5	204.3	0	80.2	27.2	129				
2,4,5-TP (Silvex)	178	20.4	204.3	0	87.3	28.6	134				
2,4,5-T	153	51.1	204.3	0	74.7	13.1	147				
Dinoseb	208	30.6	204.3	0	102	10	179				
Dalapon	865	204	1,021	0	84.7	24.9	139				
2,4-DB	191	25.5	204.3	0	93.6	50.2	152				
MCPP	795	4,490	1,021	0	77.8	37.8	140				
MCPA	867	2,860	1,021	0	84.9	13.7	147				
Picloram	309	51.1	204.3	0	151	5	153				
Bentazon	153	35.7	204.3	0	75.1	15	140				
Chloramben	126	20.4	204.3	0	61.6	5	162				
Acifluorfen	251	81.7	204.3	0	123	15	140				
3,5-Dichlorobenzoic acid	157	40.9	204.3	0	77.0	10	164				
4-Nitrophenol	52.9	30.6	204.3	0	25.9	44.8	125				S
Dacthal (DCPA)	133	30.6	204.3	0	64.9	5	132				
Surr: 2,4-Dichlorophenylacetic acid	735		1,021		72.0	20.1	168				

NOTES:

S - Outlying spike recovery(ies) observed. A duplicate analysis was performed with similar results indicating a possible matrix effect.

Work Order: 1708018
CLIENT: Friedman & Bruya
Project: 707388

QC SUMMARY REPORT

Herbicides by EPA Method 8151A

Sample ID **1707301-001AMSD** SampType: **MSD** Units: **µg/Kg-dry** Prep Date: **8/4/2017** RunNo: **37948**
Client ID: **BATCH** Batch ID: **17825** Analysis Date: **8/10/2017** SeqNo: **729338**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Dicamba	142	34.5	196.9	0	72.1	31.9	118	154.3	8.30	30	
2,4-D	161	29.5	196.9	0	81.6	12.4	134	173.1	7.42	30	
2,4-DP	146	24.6	196.9	0	73.9	27.2	129	163.8	11.8	30	
2,4,5-TP (Silvex)	159	19.7	196.9	0	81.0	28.6	134	178.3	11.1	30	
2,4,5-T	166	49.2	196.9	0	84.5	13.1	147	152.6	8.60	30	
Dinoseb	187	29.5	196.9	0	95.1	10	179	207.6	10.3	30	
Dalapon	875	197	984.5	0	88.9	24.9	139	864.6	1.18	30	
2,4-DB	175	24.6	196.9	0	88.9	50.2	152	191.3	8.80	30	
MCPP	789	4,330	984.5	0	80.1	37.8	140	0		30	
MCPA	867	2,760	984.5	0	88.0	13.7	147	0		30	
Picloram	270	49.2	196.9	0	137	5	153	308.9	13.5	30	
Bentazon	133	34.5	196.9	0	67.5	15	140	153.4	14.4	30	
Chloramben	81.5	19.7	196.9	0	41.4	5	162	125.8	42.7	30	R
Acifluorfen	200	78.8	196.9	0	102	15	140	251.4	22.8	30	
3,5-Dichlorobenzoic acid	146	39.4	196.9	0	74.0	10	164	157.3	7.61	30	
4-Nitrophenol	55.9	29.5	196.9	0	28.4	44.8	125	52.91	5.56	30	S
Dacthal (DCPA)	114	29.5	196.9	0	58.1	5	132	132.5	14.7	30	
Surr: 2,4-Dichlorophenylacetic acid	691		984.5		70.2	20.1	168		0		

NOTES:

S - Outlying spike recovery(ies) observed. A duplicate analysis was performed with similar results indicating a possible matrix effect.

R - High RPD observed, spike recovery is within range.

Date: *8/15/2017*

Work Order: 1708018
CLIENT: Friedman & Bruya
Project: 707388

QC SUMMARY REPORT

Organochlorine Pesticides by EPA Method 8081

Sample ID **TOX CCV A 17824**	SampType: **CCV**			Units: **mg/L**		Prep Date: **8/7/2017**		RunNo: **37836**			
Client ID: **CCV**	Batch ID: **17824**					Analysis Date: **8/7/2017**		SeqNo: **727576**			
Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Toxaphene	930	0.100	1,000	0	93.0	80	120				

Sample ID **MB-17824**	SampType: **MBLK**			Units: **mg/Kg**		Prep Date: **8/4/2017**		RunNo: **37836**			
Client ID: **MBLKS**	Batch ID: **17824**					Analysis Date: **8/7/2017**		SeqNo: **727577**			
Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Toxaphene	ND	0.100									
Alpha BHC	ND	0.0100									
Beta BHC	ND	0.0100									
Gamma BHC (Lindane)	ND	0.0100									
Delta BHC	ND	0.0100									
Heptachlor	ND	0.0100									
Aldrin	ND	0.0100									
Heptachlor epoxide	ND	0.0100									
gamma-Chlordane	ND	0.0100									
Endosulfan I	ND	0.0100									
alpha-Chlordane	ND	0.0100									
Dieldrin	ND	0.0100									
4,4´-DDE	ND	0.0100									
Endrin	ND	0.0100									
Endosulfan II	ND	0.0100									
4,4´-DDD	ND	0.0100									
Endrin aldehyde	ND	0.0100									
Endosulfan sulfate	ND	0.0100									
4,4´-DDT	ND	0.0100									
Endrin ketone	ND	0.0100									
Methoxychlor	ND	0.0100									
Surr: Decachlorobiphenyl	0.0480		0.05000		95.9	17.8	157				
Surr: Tetrachloro-m-xylene	0.0469		0.05000		93.9	11	150				

Fremont Analytical

Date: *8/15/2017*

Work Order: 1708018
CLIENT: Friedman & Bruya
Project: 707388

QC SUMMARY REPORT

Organochlorine Pesticides by EPA Method 8081

Sample ID **LCS-17824**	SampType: **LCS**	Units: **mg/Kg**	Prep Date: **8/4/2017**	RunNo: **37836**
Client ID: **LCSS**	Batch ID: **17824**		Analysis Date: **8/7/2017**	SeqNo: **727578**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Alpha BHC	0.195	0.0100	0.2000	0	97.7	54.2	139				
Beta BHC	0.183	0.0100	0.2000	0	91.7	56.5	142				
Gamma BHC (Lindane)	0.195	0.0100	0.2000	0	97.5	55.5	142				
Delta BHC	0.193	0.0100	0.2000	0	96.6	47.4	157				
Heptachlor	0.209	0.0100	0.2000	0	105	50.9	153				
Aldrin	0.174	0.0100	0.2000	0	87.0	43.7	147				
Heptachlor epoxide	0.180	0.0100	0.2000	0	90.0	56.2	137				
gamma-Chlordane	0.172	0.0100	0.2000	0	86.1	58.5	136				
Endosulfan I	0.177	0.0100	0.2000	0	88.4	60	132				
alpha-Chlordane	0.173	0.0100	0.2000	0	86.6	46.1	140				
Dieldrin	0.177	0.0100	0.2000	0	88.6	61.2	133				
4,4´-DDE	0.187	0.0100	0.2000	0	93.4	55.4	142				
Endrin	0.181	0.0100	0.2000	0	90.4	56.5	143				
Endosulfan II	0.175	0.0100	0.2000	0	87.7	62	143				
4,4´-DDD	0.177	0.0100	0.2000	0	88.5	53.3	145				
Endrin aldehyde	0.168	0.0100	0.2000	0	83.8	39.5	153				
Endosulfan sulfate	0.181	0.0100	0.2000	0	90.3	53.8	148				
4,4´-DDT	0.208	0.0100	0.2000	0	104	48.2	152				
Endrin ketone	0.189	0.0100	0.2000	0	94.5	28.5	162				
Methoxychlor	0.222	0.0100	0.2000	0	111	34.6	159				
Surr: Decachlorobiphenyl	0.0516		0.05000		103	17.8	157				
Surr: Tetrachloro-m-xylene	0.0524		0.05000		105	11	150				

Sample ID **1707301-001ADUP**	SampType: **DUP**	Units: **mg/Kg-dry**	Prep Date: **8/4/2017**	RunNo: **37836**
Client ID: **BATCH**	Batch ID: **17824**		Analysis Date: **8/7/2017**	SeqNo: **727580**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Toxaphene	ND	0.101							0	30	
Alpha BHC	ND	0.0101							0	30	
Beta BHC	ND	0.0101							0	30	

Date: *8/15/2017*

Work Order: 1708018
CLIENT: Friedman & Bruya
Project: 707388

QC SUMMARY REPORT

Organochlorine Pesticides by EPA Method 8081

Sample ID **1707301-001ADUP**	SampType: **DUP**			Units: **mg/Kg-dry**		Prep Date: **8/4/2017**		RunNo: **37836**				
Client ID: **BATCH**	Batch ID: **17824**					Analysis Date: **8/7/2017**		SeqNo: **727580**				
Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual	
Gamma BHC (Lindane)	ND	0.0101						0		30		
Delta BHC	ND	0.0101						0		30		
Heptachlor	ND	0.0101						0		30		
Aldrin	ND	0.0101						0		30		
Heptachlor epoxide	ND	0.0101						0		30		
gamma-Chlordane	ND	0.0101						0		30		
Endosulfan I	ND	0.0101						0		30		
alpha-Chlordane	ND	0.0101						0		30		
Dieldrin	ND	0.0101						0		30		
4,4´-DDE	ND	0.0101						0		30		
Endrin	ND	0.0101						0		30		
Endosulfan II	ND	0.0101						0		30		
4,4´-DDD	ND	0.0101						0		30		
Endrin aldehyde	ND	0.0101						0		30		
Endosulfan sulfate	ND	0.0101						0		30		
4,4´-DDT	ND	0.0101						0		30		
Endrin ketone	ND	0.0101						0		30		
Methoxychlor	ND	0.0101						0		30		
Surr: Decachlorobiphenyl	0.0471		0.05057		93.2	17.8	157		0			
Surr: Tetrachloro-m-xylene	0.0469		0.05057		92.8	11	150		0			

Sample ID **1707301-001AMS**	SampType: **MS**			Units: **mg/Kg-dry**		Prep Date: **8/4/2017**		RunNo: **37836**			
Client ID: **BATCH**	Batch ID: **17824**					Analysis Date: **8/7/2017**		SeqNo: **727581**			
Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Alpha BHC	0.135	0.00929	0.1858	0	72.5	49.1	158				
Beta BHC	0.129	0.00929	0.1858	0	69.4	30.1	161				
Gamma BHC (Lindane)	0.136	0.00929	0.1858	0	73.2	40.5	158				
Delta BHC	0.136	0.00929	0.1858	0	73.0	31.5	153				
Heptachlor	0.147	0.00929	0.1858	0	79.0	37.9	156				

Work Order: 1708018
CLIENT: Friedman & Bruya
Project: 707388

QC SUMMARY REPORT

Organochlorine Pesticides by EPA Method 8081

Sample ID **1707301-001AMS** SampType: **MS** Units: **mg/Kg-dry** Prep Date: **8/4/2017** RunNo: **37836**
Client ID: **BATCH** Batch ID: **17824** Analysis Date: **8/7/2017** SeqNo: **727581**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Aldrin	0.121	0.00929	0.1858	0	64.9	41.9	130				
Heptachlor epoxide	0.128	0.00929	0.1858	0	68.9	41	161				
gamma-Chlordane	0.124	0.00929	0.1858	0	66.5	40.9	132				
Endosulfan I	0.126	0.00929	0.1858	0	68.0	44.7	162				
alpha-Chlordane	0.125	0.00929	0.1858	0	67.2	41.4	132				
Dieldrin	0.128	0.00929	0.1858	0	69.0	43.9	155				
4,4´-DDE	0.136	0.00929	0.1858	0	73.1	34	166				
Endrin	0.134	0.00929	0.1858	0	72.1	50.5	166				
Endosulfan II	0.134	0.00929	0.1858	0	72.3	37.9	154				
4,4´-DDD	0.135	0.00929	0.1858	0	72.4	38.9	144				
Endrin aldehyde	0.125	0.00929	0.1858	0	67.5	38.3	156				
Endosulfan sulfate	0.135	0.00929	0.1858	0	72.7	25.2	144				
4,4´-DDT	0.163	0.00929	0.1858	0	87.7	38.4	160				
Endrin ketone	0.148	0.00929	0.1858	0	79.8	40.2	119				
Methoxychlor	0.185	0.00929	0.1858	0	99.5	43.4	178				
Surr: Decachlorobiphenyl	0.0441		0.04645		94.9	17.8	157				
Surr: Tetrachloro-m-xylene	0.0372		0.04645		80.1	11	150				

Sample ID **1707301-001AMSD** SampType: **MSD** Units: **mg/Kg-dry** Prep Date: **8/4/2017** RunNo: **37836**
Client ID: **BATCH** Batch ID: **17824** Analysis Date: **8/7/2017** SeqNo: **727582**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Alpha BHC	0.140	0.00954	0.1907	0	73.3	49.1	158	0.1347	3.73	30	
Beta BHC	0.130	0.00954	0.1907	0	68.1	30.1	161	0.1289	0.700	30	
Gamma BHC (Lindane)	0.140	0.00954	0.1907	0	73.4	40.5	158	0.1360	2.85	30	
Delta BHC	0.135	0.00954	0.1907	0	70.5	31.5	153	0.1357	0.890	30	
Heptachlor	0.153	0.00954	0.1907	0	80.1	37.9	156	0.1468	3.97	30	
Aldrin	0.124	0.00954	0.1907	0	65.2	41.9	130	0.1206	3.10	30	
Heptachlor epoxide	0.130	0.00954	0.1907	0	68.3	41	161	0.1280	1.81	30	
gamma-Chlordane	0.125	0.00954	0.1907	0	65.4	40.9	132	0.1235	0.975	30	

Date: *8/15/2017*

Work Order: 1708018
CLIENT: Friedman & Bruya
Project: 707388

QC SUMMARY REPORT

Organochlorine Pesticides by EPA Method 8081

Sample ID **1707301-001AMSD** SampType: **MSD** Units: **mg/Kg-dry** Prep Date: **8/4/2017** RunNo: **37836**
Client ID: **BATCH** Batch ID: **17824** Analysis Date: **8/7/2017** SeqNo: **727582**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Endosulfan I	0.127	0.00954	0.1907	0	66.4	44.7	162	0.1264	0.211	30	
alpha-Chlordane	0.126	0.00954	0.1907	0	66.0	41.4	132	0.1248	0.909	30	
Dieldrin	0.127	0.00954	0.1907	0	66.6	43.9	155	0.1282	0.926	30	
4,4´-DDE	0.135	0.00954	0.1907	0	70.6	34	166	0.1358	0.768	30	
Endrin	0.131	0.00954	0.1907	0	68.5	50.5	166	0.1341	2.50	30	
Endosulfan II	0.126	0.00954	0.1907	0	65.9	37.9	154	0.1344	6.61	30	
4,4´-DDD	0.128	0.00954	0.1907	0	67.2	38.9	144	0.1345	4.88	30	
Endrin aldehyde	0.109	0.00954	0.1907	0	57.1	38.3	156	0.1254	14.1	30	
Endosulfan sulfate	0.122	0.00954	0.1907	0	63.8	25.2	144	0.1351	10.5	30	
4,4´-DDT	0.154	0.00954	0.1907	0	81.0	38.4	160	0.1630	5.34	30	
Endrin ketone	0.133	0.00954	0.1907	0	69.7	40.2	119	0.1483	11.0	30	
Methoxychlor	0.168	0.00954	0.1907	0	88.0	43.4	178	0.1849	9.64	30	
Surr: Decachlorobiphenyl	0.0354		0.04769		74.3	17.8	157		0		
Surr: Tetrachloro-m-xylene	0.0372		0.04769		78.1	11	150		0		

Sample Log-In Check List

Client Name:	**FB**	Work Order Number:	**1708018**
Logged by:	**Clare Griggs**	Date Received:	**8/1/2017 12:19:00 PM**

Chain of Custody

1. Is Chain of Custody complete? Yes ☑ No ☐ Not Present ☐
2. How was the sample delivered? FedEx

Log In

3. Coolers are present? Yes ☑ No ☐ NA ☐
4. Shipping container/cooler in good condition? Yes ☑ No ☐
5. Custody Seals present on shipping container/cooler? (Refer to comments for Custody Seals not intact) Yes ☐ No ☐ Not Required ☑
6. Was an attempt made to cool the samples? Yes ☑ No ☐ NA ☐
7. Were all items received at a temperature of >0°C to 10.0°C* Yes ☑ No ☐ NA ☐
8. Sample(s) in proper container(s)? Yes ☑ No ☐
9. Sufficient sample volume for indicated test(s)? Yes ☑ No ☐
10. Are samples properly preserved? Yes ☑ No ☐
11. Was preservative added to bottles? Yes ☐ No ☑ NA ☐
12. Is there headspace in the VOA vials? Yes ☐ No ☐ NA ☑
13. Did all samples containers arrive in good condition(unbroken)? Yes ☑ No ☐
14. Does paperwork match bottle labels? Yes ☑ No ☐
15. Are matrices correctly identified on Chain of Custody? Yes ☑ No ☐
16. Is it clear what analyses were requested? Yes ☑ No ☐
17. Were all holding times able to be met? Yes ☑ No ☐

Special Handling (if applicable)

18. Was client notified of all discrepancies with this order? Yes ☐ No ☐ NA ☑

Person Notified: Date:

By Whom: Via: ☐ eMail ☐ Phone ☐ Fax ☐ In Person

Regarding:

Client Instructions:

19. Additional remarks:

Item Information

Item #	Temp ºC
Cooler	4.6
Sample	2.7

* Note: DoD/ELAP and TNI require items to be received at 4°C +/- 2°C

SUBCONTRACT SAMPLE CHAIN OF CUSTODY 1708018

Page # 1 of 1

Send Report To Michael Erdahl

Company Friedman and Bruya, Inc.

Address 3012 16th Ave W

City, State, ZIP Seattle, WA 98119

Phone # (206) 285-8282 Fax # (206) 283-5044

SUBCONTRACTER Fremont	
PROJECT NAME/NO. 707388	PO # F-26
REMARKS Please Email Results	

TURNAROUND TIME
- ☐ Standard (2 Weeks)
- ☐ RUSH
- Rush charges authorized by:

SAMPLE DISPOSAL
- ☐ Dispose after 30 days
- ☐ Return samples
- ☐ Will call with instructions

Sample ID	Lab ID	Date Sampled	Time Sampled	Matrix	# of jars	Dioxins/Furans	EPH	VPH	Nitrate	Sulfate	Alkalinity	TOC-9060M	Chlorinated Pesticides	Chlorinated Herbicides	Dioxins/Furans	Notes
ISM-DU3-072517		7/25/17	1407	Soil	3								X	X		10g in each vial
ISM-DU2-072617		7/26/17	1232	↓	3								X	X		↓
ISM-DU1-072617		↓	1500	↓	3								X	X		↓
																Dry weight will
																be forwarded
																upon completion

Friedman & Bruya, Inc.
3012 16th Avenue West
Seattle, WA 98119-2029
Ph. (206) 285-8282
Fax (206) 283-5044

SIGNATURE	PRINT NAME	COMPANY	DATE	TIME
Relinquished by: [signature]	Michael Erdahl	Friedman and Bruya	8/1/17	Noon
Received by:				
Relinquished by:				
Received by: [signature]			8/1/17	1219

707388 [redacted]

SAMPLE CHAIN OF CUSTODY ME 07-27-17

B14 / VS2 / VW1

Report To: ATI Cochrane & Carla Brock

Company: Aspect Consulting

Address:

City, State, ZIP: Seattle Office

Phone: Email:

SAMPLERS (signature): Kat Beck [redacted]

PROJECT NAME: Shelton C Street Landfill

PO #: 150074

REMARKS:

INVOICE TO: Accts Payable

Page # 1 of 1

TURNAROUND TIME
- ☒ Standard Turnaround
- ☐ RUSH
- Rush charges authorized by:

SAMPLE DISPOSAL
- ☒ Dispose after 30 days
- ☐ Archive Samples
- ☐ Other

ANALYSES REQUESTED

Sample ID	Lab ID	Date Sampled	Time Sampled	Sample Type	# of Jars	TPH-HCID	TPH-Diesel	TPH-Gasoline	BTEX by 8021B	VOCs by 8260C	SVOCs by 8270D	PAHs 8270D SIM	~~ISM~~ PCBs	Dioxins/furans	chlorinated pesticides	herbicides	METALS	Notes
ISM-DU3-072517	01	7/25/17	1407	soil	1		X	X			X		X	X	X	X	✓	✓ - per AC 08/23/17
ISM-DU2-072617	02	7/26/17	1232	soil	1		X	X			X		X	X	X	X	✓	
ISM-DU1-072617	03	7/26/17	1500	soil	1		X	X			X		X	X	X	X	✓	
DU3-P7-072617	04 A-D	↓	1605	↓	4			X		X								
DU3-P3-072617	05		1556		4			X		X								
DU2-L2-072617	06		1545		4			X		X								
DU2-L7-072617	07		1539		4			X		X								
DU2-G7-072617	08		1527		4			X		X								
DU2-G2-072617	09		1517		4			X		X								Samples received at 3 °C
~~DU~~ DU1-C2-072617	10	↓	1503	↓	4			X		X								Trip Blank added in lab

Trip Blank 11

SIGNATURE		PRINT NAME	COMPANY	DATE	TIME
Relinquished by:	Kat Beck	Kristin Beck	Aspect	7/27/17	
Received by:	[signature]	Eric Vasorla	FedEx	7-27-17	840 am
Relinquished by:					
Received by:	[signature]	David	F+BI	7-27-17	9:45

Friedman & Bruya, Inc.
3012 16th Avenue West
Seattle, WA 98119-2029
Ph. (206) 285-8282