2017 Annual Groundwater Summary

Brickhaven No.2 Mine Tract “A” Structural Fill

Charah, LLC

Moncure, Chatham County, North Carolina

February 19, 2018

HDR Engineering, Inc. of the Carolinas
440 S Church Street, Suite 1000, Charlotte, NC 28202-2075
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NC License F0116

2017 Annual Groundwater Summary

Brickhaven No.2 Mine Tract "A" Structural Fill Permit 19-10

The Brickhaven No.2 Mine Tract "A" Structural Fill groundwater monitoring system is designed to meet the requirements of the North Carolina Coal Ash Management Act of 2014 (CAMA) and North Carolina Department of Environmental Quality Rule 15A NCAC 13B Section .1631.

HDR conducted the required 2017 semi-annual sampling events on January 23rd - 26th and July 17th - 20th. Groundwater monitoring and sampling at the site is governed by the following:

- North Carolina - Coal Ash Management Act (CAMA) of 2014 (Senate Bill 729)
- Water Quality Monitoring Plan Brickhaven No.2 Mine Tract "A" Structural Fill, approved March 2015.
- North Carolina Department of Environmental Quality (NCDEQ)[1] Permit No. 1910-STRUC-2015, issued June 5, 2015.
- NCDEQ Solid Waste Section Guidelines for Groundwater, Soil, and Surface Water Sampling, April 2008.
- NCDEQ Division of Water Management memorandum concerning electronic document submittal for routine groundwater and surface water monitoring, November 5, 2014.
- U.S. Environmental Protection Agency (EPA) Region I, *Low Stress (low flow) Purging and Sampling Procedure for the Collection of Ground Water Samples from Monitoring Wells*, January 19, 2010.
- EPA 2009, Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance and CFR 40 257.93 (f)(3)

The spring and fall summary reports with an EPA method of statistical analysis were submitted to the NCDEQ Division of Waste Management on April 26 and October 13, 2017 respectively. The reports are attached for reference and can be found on the NCDEQ website at this location https://deq.nc.gov/about/divisions/waste-management/laserfiche. The following information has been provided in those reports:

- Status of the groundwater monitoring for the CCR structural fill;
- A summary of site conditions and key actions completed during the routine reporting period;
- Description of conditions encountered and actions employed to define the conditions;
- Key activities proposed for the upcoming year;
- A map showing the background (or upgradient) and downgradient monitoring wells; and
- Monitoring data obtained from sampling of wells, including information on the samples collected.

The findings of the groundwater sampling and laboratory testing conducted in 2017 indicate the presence of naturally occurring constituents that were detected at various levels both prior to and after CCR placement. HDR believes that due to the limited amount of background data points additional sampling is required to provide a greater confidence level in determining statistically significant increases and/or natural variation in groundwater quality. Therefore, HDR's recommendations were to incorporate the quarterly sampling performed for Chatham County in 2017 plus any additional samples moving forward while continuing semi-annual monitoring events until an adequate data set can be established for determining the next steps.

As HDR's authorized representative, I have prepared or supervised the preparation of the referenced documents above; which have been prepared in general accordance with industry standards and practices; and the information contained therein is truthful and accurate to the best of my knowledge.



Michael Plummer, PE
Sr. Project Manager

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A

Appendix A - 2017 Initial Semi-Annual Detection Monitoring Report

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DENR USE ONLY: ☐ Paper Report ☐ Electronic Data - Email CD (data loaded: Yes / No) Doc/Event #:

NC DENR
Division of Waste Management - Solid Waste

Environmental Monitoring Reporting Form

Notice: This form and any information attached to it are "Public Records" as defined in NC General Statute 132-1. As such, these documents are available for inspection and examination by any person upon request (NC General Statute 132-6).

Instructions:

- **Prepare one form for each individually monitored unit.**
- **Please type or print legibly.**
- Attach a notification table with values that attain or exceed NC 2L groundwater standards or NC 2B surface water standards. The notification must include a preliminary analysis of the cause and significance of each value. (e.g. naturally occurring, off-site source, pre-existing condition, etc.).
- Attach a notification table of any groundwater or surface water values that equal or exceed the reporting limits.
- Attach a notification table of any methane gas values that attain or exceed explosive gas levels. This includes any structures on or nearby the facility (NCAC 13B .1629 (4)(a)(i).
- Send the original signed and sealed form, any tables, and Electronic Data Deliverable to: Compliance Unit, NCDENR-DWM, Solid Waste Section, 1646 Mail Service Center, Raleigh, NC 27699-1646.

Solid Waste Monitoring Data Submittal Information

Name of entity submitting data (laboratory, consultant, facility owner):

Green Meadow - Charah, Inc.

Contact for questions about data formatting. Include data preparer's name, telephone number and E-mail address:

Name: Michael Plummer, PE Phone: 704.338.6843

E-mail: michael. plummer@hdrinc.com

Facility name:	Facility Address:	Facility Permit #	NC Landfill Rule: (.0500 or .1600)	Actual sampling dates (e.g., October 20-24, 2006)
Charah, Inc. Brickhaven No. 2 Mine Tract "A"	1271 Moncure -Flatwood Road Chatham County Moncure, North Carolina	1910- STRUC-2015	CAMA	January 23-26, 2017

Environmental Status: (Check all that apply)

☐ Initial/Background Monitoring ☒ Detection Monitoring ☐ Assessment Monitoring ☐ Corrective Action

Type of data submitted: (Check all that apply)

☒ Groundwater monitoring data from monitoring wells
☐ Groundwater monitoring data from private water supply wells
☒ Leachate monitoring data
☒ Surface water monitoring data
☐ Methane gas monitoring data
☐ Corrective action data (specify) _____
☐ Other(specify) _____

Notification attached?

☐ No. No groundwater or surface water standards were exceeded.
☒ Yes, a notification of values exceeding a groundwater or surface water standard is attached. It includes a list of groundwater and surface water monitoring points, dates, analytical values, NC 2L groundwater standard, NC 2B surface water standard or NC Solid Waste GWPS and preliminary analysis of the cause and significance of any concentration.
☐ Yes, a notification of values exceeding an explosive methane gas limit is attached. It includes the methane monitoring points, dates, sample values and explosive methane gas limits.

Certification

To the best of my knowledge, the information reported and statements made on this data submittal and attachments are true and correct. Furthermore, I have attached complete notification of any sampling values meeting or exceeding groundwater standards or explosive gas levels, and a preliminary analysis of the cause and significance of concentrations exceeding groundwater standards. I am aware that there are significant penalties for making any false statement, representation, or certification including the possibility of a fine and imprisonment.

Michael Plummer — Facility Representative Name (Print)

Project Manager — Title

704.338.6843 — (Area Code) Telephone Number

Signature

4/26/17 — Date

Affix NC Licensed/ Professional Geologist Seal

NORTH CAROLINA PROFESSIONAL SEAL 025495 ENGINEER MICHAEL D. PLUMMER

HDR Engineering, Inc. of the Carolinas, 440 S. Church St. Suite 1000, Charlotte, NC 28202

Facility Representative Address

F-0116

NC PE Firm License Number (if applicable effective May 1, 2009)

Revised 6/2009

2017 Initial Semi-Annual Detection Monitoring Report

Brickhaven No.2 Mine Tract “A” Structural Fill

Charah, LLC

Moncure, Chatham County, North Carolina
April 26, 2017

HDR Engineering, Inc. of the Carolinas
440 S Church Street, Suite 1000, Charlotte, NC 28202-2075
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List of Acronyms

µg/L	micrograms per liter
CAMA	North Carolina Coal Ash Management Act of 2014
CCR	Coal Combustion Residuals
EPA	United States Environmental Protection Agency
ft/ft	feet / foot
NCDENR	North Carolina Department of Environment and Natural Resources
NCDEQ	North Carolina Department of Environmental Quality
NCGPS	North Carolina groundwater protection standard
NTU	Nephelometric turbidity units
msl	mean sea level

1 Introduction

1.1 Purpose

This *2017 Initial Semi-Annual Detection Monitoring Report* addresses results from the initial semi-annual detection monitoring event as well as the statistical results for this monitoring event, in conjunction with the previously conducted background monitoring events at the Brickhaven No.2 Mine Tract "A" Structural Fill site in Moncure, Chatham County, North Carolina.

The second semi-annual monitoring event will take place after June 2017.

1.2 Regulatory Compliance

Groundwater monitoring and sampling at the site is governed by the following:

- North Carolina - Coal Ash Management Act (CAMA) of 2014 (Senate Bill 729)
- U.S. Environmental Protection Agency - Coal Combustion Residuals (CCR) Rule (40 CFR Parts 257 and 261)
- Water Quality Monitoring Plan Brickhaven No.2 Mine Tract "A" Structural Fill, approved March 2015.
- North Carolina Department of Environmental Quality (NCDEQ)[1] Permit No. 1910-STRUC-2015, issued June 5, 2015.
- NCDEQ Solid Waste Section Guidelines for Groundwater, Soil, and Surface Water Sampling, April 2008.
- NCDEQ Division of Water Management memorandum concerning electronic document submittal for routine groundwater and surface water monitoring, November 5, 2014.
- U.S. Environmental Protection Agency (EPA) Region I, *Low Stress (low flow) Purging and Sampling Procedure for the Collection of Ground Water Samples from Monitoring Wells*, January 19, 2010.

1.2.1 CAMA

CAMA Section §130A-309.216 addresses Groundwater requirements as follows:

"§ 130A-309.216. Design, construction, and siting requirements for projects using coal combustion products for structural fill.

(b) Liners, Leachate Collection System, Cap, and Groundwater Monitoring System Required for Large Structural Fills. –

> *(4) A groundwater monitoring system, that shall be approved by the Department and, at a minimum, consists of all of the following:*
>
> > *a. A sufficient number of wells, installed at appropriate locations and depths, to yield groundwater samples from the uppermost aquifer that represent the quality*

[1] Prior to September 18, 2015, the NCDEQ was referred to as the North Carolina Department of Environment and Natural Resources (NCDENR). Both naming conventions are used in this report, as appropriate.

of groundwater passing the relevant point of compliance as approved by the Department. A down-gradient monitoring system shall be installed at the relevant point of compliance so as to ensure detection of groundwater contamination in the uppermost aquifer.

b. A proposed monitoring plan, which shall be certified by a licensed geologist or professional engineer to be effective in providing early detection of any release of hazardous constituents from any point in a structural fill or leachate surface impoundment to the uppermost aquifer, so as to be protective of public health, safety, and welfare; the environment; and natural resources.

c. A groundwater monitoring program, which shall include consistent sampling and analysis procedures that are designed to ensure monitoring results that provide an accurate representation of groundwater quality at the background and down-gradient wells. Monitoring shall be conducted through construction and the post-closure care period. The sampling procedures and frequency shall be protective of public health, safety, and welfare; the environment; and natural resources.

d. A detection monitoring program for all Appendix I constituents. For purposes of this subdivision, the term "Appendix I" means Appendix I to 40 C.F.R. Part 258, "Appendix I Constituents for Detection Monitoring," including subsequent amendments and editions.

e. An assessment monitoring program and corrective action plan if one or more of the constituents listed in Appendix I is detected in exceedance of a groundwater protection standard."

1.2.2 EPA's CCR Rule

On April 17, 2015, EPA published its final rule *Disposal of Coal Combustion Residuals from Electric Utilities* to regulate the disposal of coal combustion residuals (CCR) as solid waste under Subtitle D of the Resource Conservation and Recovery Act (RCRA). Among other requirements, the final rule established requirements for a groundwater monitoring program consisting of detection monitoring and, if necessary, assessment monitoring and corrective action. EPA selected constituents for detection monitoring that are present in CCR, would be expected to migrate rapidly, and would thereby provide early detection as to whether contaminants were migrating from the disposal unit (80 FR 74: 21397).

The CCR Rule establishes requirements for a phased groundwater monitoring program consisting of detection monitoring and, if necessary, assessment monitoring and corrective action. The rule requires that the owner or operator of existing CCR landfills and CCR surface impoundments must comply with the following groundwater monitoring requirements no later than October 17, 2017,:

- Installation of the groundwater monitoring system;
- Development of the groundwater sampling and analysis program;
- Selection of statistical procedures to be used to evaluate detection monitoring data;

- Initiate detection monitoring program to include a minimum of eight (8) independent sampling events for each background and downgradient monitoring well; and
- Evaluate groundwater monitoring data for statistically significant increases over background concentrations for each Appendix III constituent.

The first phase of the groundwater monitoring program is detection monitoring, where monitoring will be performed to evaluate background groundwater quality at the site and to determine if downgradient groundwater has potentially been impacted by CCR. The EPA considers several parameters to be leading indicators of groundwater impacted by a CCR unit (i.e., Appendix III constituents). The Appendix III leading indicators are: boron, calcium, chloride, fluoride, pH, sulfate, and total dissolved solids (TDS).

If detection monitoring determines that there are statistically significant increases over background concentrations for Appendix III constituents, the CCR Rule requires assessment monitoring. The parameters selected for assessment monitoring include: antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, fluoride, lead, lithium, mercury, molybdenum, radium 226 and 228 (combined), selenium, and thallium (i.e., Appendix IV constituents). The CCR Rule requires that samples collected during the initial phase of detection monitoring (i.e., the minimum eight detection monitoring events) be analyzed for Appendix III and Appendix IV constituents.

If the results of assessment monitoring indicate that corrective action may be warranted, the CCR Rule requires additional assessment of corrective measures and potentially corrective action monitoring.

Groundwater monitoring and sampling at the site is conducted in general accordance with both CAMA and the U.S. EPA CCR Rule per the NCDEQ approved *Water Quality Monitoring Plan for Brickhaven No.2 Mine Tract "A" Structural Fill* (Buxton, 2015a).

1.3 Site Location and Operation

The site is located in Chatham County, approximately four miles southeast of central Moncure, North Carolina (**Figure 1**). The owner of the site is Green Meadow, LLC (Green Meadow). Charah, LLC. (Charah) is responsible for the operation and maintenance of the site. The mine property is approximately 301 acres in total; the structural fill area for CCR placement will comprise of approximately 145 acres; and the fill area including associated perimeter berms, channels, and haul roads encompasses 166 acres. The remaining acreage is still utilized for clay mining activities.

The property located within the structural fill area was previously owned by General Shale Brick, Inc., which operated the site and an adjacent property as a clay mine beginning in 1985 for their off-site brick manufacturing facility. Mined clay was stockpiled and then transported approximately 3.5 miles south to Brickhaven, North Carolina for brick manufacturing.

The area immediately surrounding the site primarily consists of rural residential (approximately 2,500 feet east, 1,000 feet southeast and 1,000 feet southwest), commercial, industrial, wooded

and agricultural property. According to information obtained from the Chatham County GIS website, municipal water supply is available to the surrounding area as of the time of this report.

Charah began CCR placement in the first composite liner containment system (Cell 1, Sub Cell 1A) on October 23, 2015. Charah plans to place approximately 12,000,000 tons of CCR in the structural fill. The placement phase is anticipated to continue for eight years, it could be less depending on the importation rate. CCRs (including fly ash, bottom ash, boiler slag, and/or flue gas desulfurization materials) have been brought to the site historically by truck and now exclusively by rail from the Duke Energy Carolinas (DEC) Riverbend Steam Station and Duke Energy Progress (DEP) L.V. Sutton Energy Complex (Sutton Plant) sites. CCRs could eventually be brought to the site from other DEC and/or DEP sites in North Carolina.

Leachate (i.e. product generated from the liquids present in the fill at the time of placement and/or stormwater that infiltrates the fill) is managed on-site through collection, storage, and disposal of the resultant liquid. Green Meadow has an approved pump and haul permits to dispose of leachate at either the City of Sanford's Big Buffalo Creek Wastewater Treatment Plant or South Harnett Regional Wastewater Treatment Plant in Spring Lake, North Carolina. Green Meadow LLC also has the ability to dispose of leachate two additional facilities including VLS Recovery Services LLC in Mauldin, South Carolina and Shamrock Environmental Corporation of Brown Summit, North Carolina, if necessary.

1.4 Groundwater Monitoring System

The site's groundwater monitoring system was designed to provide early detection of any release, in order to be protective of human health and the environment. The groundwater monitoring system was initially comprised of eight wells and currently comprises nine wells; seven downgradient/side-gradient compliance monitoring wells (MW-2, MW-3, MW-4, MW-5, MW-6, MW-7, and MW-8), one designated upgradient monitoring well (MW-1) and a background well (BG-1). Background monitoring well (BG-1) was installed in July of 2015 near the entrance of the site along Moncure-Flatwood Road. This background well location was installed to improve determination of appropriate levels of constituents existing at the site independent of the site's use as a structural fill. **Table 1** depicts Well Construction Details.

1.5 Site Topography and Geographical Setting

According to the 1993 USGS topographic quadrangle (**Figure 2**), the topography of the site and immediately surrounding area can be characterized by moderately rolling hills, which are dissected by dendritic creeks. The northwestern portion of the site generally slopes to the north and northwest from three topographically high ridges with interconnected saddles ranging from approximately 260 to 270 feet above mean sea level (msl), towards off-site intermittent tributary. The southeastern portion of the site generally slopes to the southeast, south and west from the three topographic high ridges with similar interconnected saddles ranging from approximately 260 to 270 feet msl, towards on-site intermittent tributary creeks that drain from the southern property boundary at approximately 205 feet msl.

1.6 Geologic and Hydrogeologic Setting

1.6.1 Regional Geology

The site is located within the Piedmont physiographical province of North Carolina, which is a northeast-southwest trending region extending from New York to Alabama.

According to the 1985 North Carolina Geologic Map prepared by the North Carolina Geological Survey, the site is located in the Triassic Basin Belt of the Piedmont physiographic province. The basement rocks of the Triassic Basin Belt include conglomerate, sandstone, mudstone, limestone, coal, and shale. The majority of the subject property is located within the Sanford Formation which contains conglomerate, fanglomerate, sandstone, and mudstone. The far western portion of the site is located in the Cummock Formation which contains sandstone, mudstone, gray and black coal, and carbonaceous shale. The Triassic Basin is bounded by felsic metavolcanic rock within the Carolina Slate Belt approximately 6.5 miles to the northwest; and is contacted by metamorphosed granite and by biotite gneiss and schist of the Raleigh Belt along a normal fault approximately 2.5 miles to the southeast. The Triassic Basin formations have been intruded by north northwest-south southeast trending igneous diabase dikes during the Jurassic Period (~144 to 208 Ma), and contain northeast-southwest trending normal faults, however, none of these were indicated to exist at the subject site on the 1985 geologic map (NCDENR, 1985).

In the Piedmont, the bedrock is typically overlain by a mantle of weathered rock (residuum/saprolite), which has an average thickness of approximately 25 feet. The residuum/saprolite consists of varying amounts of unconsolidated clays, silts and sands, with lesser amounts of rock fragments. Due to the range of the parent rock composition and the variable susceptibility to weathering of each rock type, the residuum/saprolite ranges widely in color, texture and thickness. Generally, the residuum/saprolite is thickest near inter-stream divides (ridges) and thins toward stream beds. In profile, the residuum/saprolite normally grades from clayey soils near the land surface to sandier, partially weathered rock above the competent bedrock (Buxton, 2014).

1.6.2 Site Geology

The geology of the site area can be subdivided into six lithologic units, which include fill, flood plain, soil horizon, residuum, partially weathered rock and layered rock. These geologic units generally grade downward from a soil horizon, to residuum, to partially weathered rock and finally layered rock. The fill materials were only identified in the road bed and berm located around the east and west sides of MW-4. The flood plain sediments were only identified at MW-4 on the southeast corner of the site. The summary of the site geologic units is based on boring logs from *Design Hydrogeologic Report* (Buxton March 2016) and is summarized below.

Fill

The fill materials were primarily identified in the road bed and berm located around the east and west sides near MW-4 and generally consisted of mottled reddish yellow, orange, brown, and light gray; sandy silty clay with quartz and brick gravel.

Flood Plain

Flood plain sediments were only located adjacent at MW-4 on the southeast corner of the site. The sediments were associated with the former adjacent intermittent tributary creek and sediments can be generally characterized by a mottled light gray; fine sandy silty clay. The flood plain sediments were only approximately 5 feet thick in this area and had been deposited above residuum. Based on geotechnical laboratory data, the flood plain sediments consisted of USCS group symbol CL.

Soil Horizon

The soil horizon can generally be characterized by mottled yellowish, brown, orange and red color consisting of silty clay and clayey silt. Root structures were common. The soil horizon at the site is formed from the continued weathering and biologic reworking of residuum, and ranges from 2 to 15 feet in thickness, when present. Based on geotechnical laboratory data, the soil horizon consisted of USCS group symbols SC, MH and CL, and had a hydraulic conductivity value of 2.86×10^{-7} cm/sec.

Residuum

The residuum can generally be characterized by a red and reddish brown color with black and gray mottles, primarily consisting of sandy silty clay with infrequent quartz gravel and cobbles. The residuum often contained a horizontal fissile characteristic (i.e. breaks in horizontal sheets). The residuum generally retains the remnant texture, structure and mineral content of the rock from which it was formed, and ranges from 5 to 15 feet in thickness. The residuum has a Standard Penetration Resistance (N) of less than 100 blows per foot. Based on geotechnical laboratory data, the residuum consisted of USCS group symbol CL and hydraulic conductivity values ranged from 7.69×10^{-8} cm/sec to 3.69×10^{-9} cm/sec.

Partially Weathered Rock

The partially weathered rock can generally be characterized by a brown, reddish gray and weak red color with light green and purple mottles and stingers, primarily consisting of silty clay and weathered mudstone, which often contain horizontal fissile characteristics. The partially weathered rock generally retains the remnant texture, structure and mineral content of the rock from which it was formed, and ranges from 5 to 40 feet in thickness. Partially weathered rock has a Standard Penetration Resistance (N) of 100 blows per foot or greater and can generally be drilled with standard hollow-stem auger drilling technology. Based on geotechnical laboratory data, the partially weathered rock consisted of USCS group symbol CL. Hydraulic conductivity values ranged from 2.433×10^{-4} cm/sec to 7.154×10^{-8} cm/sec, according slug or recovery test data (for wells screened solely in partially weathered rock).

Layered Rock

Based on rock coring activities conducted near MW-7 and visual inspection of the layered rock exposed on the north side of the MW-4 area, layered rock at the site is primarily composed of reddish to light tan gray mudstone, cross-bedded muddy sandstone, and muddy sandy

conglomerate (rounded quartz gravel and cobbles). The layered rock generally occurs as horizontally oriented and relatively thin intermittent layers (especially within the upper 15 feet of contacting layered rock) across the site, based on rock coring and the horizontal fissile nature of residuum and partially weathered rock. The layered rock contained horizontal to near vertical fracturing. Large fractures, oriented approximately N 40° to 60° E at 70 ^{o} northwest, were observed in weathered mudstone to the immediate northeast near MW-8. Rock Quality Designation (RQD) values for the MW-8 area rock core (21 inch recovery) were poor (47.6%). The occurrence of layered rock at the site was generally defined by auger refusal.

1.6.3 Regional Hydrogeology

The occurrence and movement of groundwater in the Piedmont physiographic province is within two separate but interconnected water-bearing zones that typically comprise one aquifer. A shallow water-bearing zone occurs within the residuum/saprolite and a deeper zone within the underlying bedrock.

Groundwater in the residuum/saprolite zone occurs in the interstitial pore spaces between the individual grains comprising the residuum/saprolite. Groundwater in this zone is typically under water table conditions and generally flows from topographic highs to topographic lows. The occurrence and movement of groundwater in the underlying bedrock zone is controlled by joints and fractures within the bedrock. Groundwater within this deeper zone may occur under confined or semi-confined conditions, depending on the extent of fracturing at the saprolite/bedrock interface. Deeper groundwater movement is typically controlled by the distribution of openings in the bedrock and can be variable.

No naturally occurring springs or creeks with actively flowing water recharged by the subsurface aquifer were observed within the site boundary during this reporting period.

1.7 Groundwater Flow Characteristics

Prior to each of sampling event, a synoptic round occurred to establish depth-to-water below top of casing for the nine monitoring wells. Depths-to-water ranged from 6.56 feet below top of casing (MW-6) to 59.50 feet below top of casing (MW-1). Groundwater elevations ranged from 199.31 above mean sea level (msl) (MW-8) to 224.54 above msl (MW-6). Groundwater elevations measured during the January 2017 event are shown in **Table 2**.

1.7.1 Groundwater Direction

Groundwater generally flows toward the southeastern portion of the site, although radial flow away from two topographic high points is depicted on **Figure 3**. A potentiometric surface map for groundwater elevations measured during January 2017 event are shown in **Table 2** and depicted on **Figure 3**.

1.7.2 Hydraulic Conductivity

Horizontal hydraulic conductivity of aquifer materials adjacent to the well screen were estimated through in-situ slug testing during the *Design Hydrogeologic Report* (Buxton, 2016). Results are provided in **Table 3**.

The slug and recovery test data were evaluated using AQTESOLV® software developed by Hydrosolv, Inc. (2007) and in accordance with the methods developed by Bouwer and Rice in 1976 and 1987. The Bouwer-Rice method utilized to evaluate the slug test data was developed to determine the hydraulic conductivity of the aquifer immediately surrounding the screened portion of the partially or fully penetrating wells in unconfined aquifers.

Monitoring wells were generally screened within residuum or partially weathered rock; hydraulic conductivity ranged from 4.08E-07 cm/sec at MW-3 to 4.11E-04 cm/sec at MW-1.

1.7.3 Horizontal Hydraulic Gradients

Horizontal hydraulic gradient is calculated by taking the difference in hydraulic head over the length of the flow path between two wells of similar construction. Hydraulic gradients at the site during this sampling event ranged from 0.0003 between MW-4 and MW-5 (as well as other pairings) to 0.021 between MW-6 and MW-5 (**Table 4**).

1.7.4 Groundwater Flow Velocity

Darcy's Law is an equation that describes the flow rate or flux of fluid through a porous media. To calculate the velocity that moves through a porous media, the specific discharge, or Darcy flux, is divided by the effective porosity, P_e. The result is the average linear velocity, or seepage velocity, of groundwater between two points.

The following equation was used to calculate groundwater velocities between specific wells:

$$V_S = \frac{Ki}{P_e}$$

Where:

V_s = seepage velocity
K = horizontal hydraulic conductivity
i = horizontal hydraulic gradient
P_e = effective porosity

Seepage velocities for groundwater were calculated using horizontal hydraulic gradients and horizontal hydraulic conductivity values referenced above, and estimated effective porosity values from geotechnical testing and from the literature where geotechnical data was not available. (Buxton, 2014; Sinhal and Gupta, 2010). When geotechnical data was unavailable, an effective porosity of 0.15 was used for wells primarily screened in residuum/PWR and an effective porosity of 0.075 was used for wells primarily screened in layered rock/PWR.

Seepage velocity varies on a well-by-well basis. Throughout the study area, seepage velocity ranged from nearly 0.04 feet per year (between MW-3 and MW-7) to approximately 35.9 feet per year (between MW-1 and MW-8). The site average seepage velocity is approximately 3.3 feet per year for the evaluated screen intervals and are summarized in **Table 5.** These estimates were calculated with the most recent groundwater level measurements (January 23, 2017).

2 Sampling Procedures

2.1 Groundwater Sampling Procedures

Collection of groundwater samples from all nine groundwater monitoring well locations were attempted between January 23 and 26, 2017 (**Figure 4**). A groundwater sample from monitoring well MW-7, was attempted on multiple instances but insufficient volume of groundwater could be collected for analysis. Sufficient water did exist to get a water level reading from this well. Historically, the water level in this well has continued to decrease in spite of above average precipitation over the past year. All sampling events have been conducted in compliance of the site's Water Quality Monitoring Plan. This monitoring event was conducted by Pace Analytical Services, Inc. of Huntersville, North Carolina (NC Certification #37706). Field data sheets and sampling logs along with the analytical laboratory results for this monitoring event are provided in **Appendices A, B,** and **C**.

Prior to commencing groundwater sampling, new plastic sheeting was placed around the well head, in order to prevent the sampling equipment from contacting the ground surface. The well lock was then removed from the protective stand-up-cover. New nitrile gloves were donned and static groundwater levels were obtained from below the measuring point (top-of-well polyvinyl chloride (PVC) casing) at each monitoring well to the nearest 0.01 foot with a depth-to-water electrode at each monitoring well. Low flow purging and sampling was conducted utilizing a stainless-steel Proactive SS Mega Monsoon pump with flow rate controller, which was plumbed to new polyethylene sample tubing (1/2-inch outer diameter (OD) 3/8-inch inner diameter (ID)). In the event of low recharge, a peristaltic pump was utilized to purge and sample the well. The base of the pump was set at approximately two feet off the bottom depth above the well base to reduce turbidity. The following information was recorded at timed intervals during the purging process: 1) water levels (below top of casing), 2) purge flow rate, 3) purge rate and cumulative water pumped, and 4) field parameters. Temperature, conductivity, pH, oxygen reduction potential (ORP), and dissolved oxygen (DO) were recorded with a Horiba U-52 meter; and turbidity was recorded with a Micro-TPW meter.

Purging was conducted until a minimum of three well volumes of water had been removed and the below field parameters requirements have been met and stabilized. All measurements, except turbidity, were obtained using a flow-through-cell, while turbidity measurements are obtained before water enters the flow-through-cell.

- Turbidity (10% for values greater than 5 NTU (if three turbidity values are less than 5 NTU, the values are considered stabilized)
- DO (10% for values greater than 0.5 mg/L, if three DO values are less than 0.5 mg/L, the values are considered stabilized)
- Specific conductance (3%)
- Temperature (3%)
- pH ($\pm$ 0.1 unit)
- ORP ($\pm$ 10 millivolts)

If field parameters had stabilized prior to purging three well volumes, or the well was going dry, groundwater samples were then collected. The water level meter and low flow pump were decontaminated in the field with a distilled water rinse, Alconox® wash, and a distilled water rinse, prior to and following sampling at each monitoring well. Following sampling, locks were placed back on the well stand-up covers. Purge water was discharged to the ground surface at respective well heads.

All samples for this current reporting period were shipped under proper management and Chain of Custody (COC) procedures to Pace Analytical Services, Inc. Sample handling and custody was performed according to the EPA Guidance for Field Samplers.

2.2 Surface Water Sampling Procedures

Surface water samples were collected from two locations outside of the structural fill boundary to provide for potential groundwater to surface water interactions and evaluation of potential off-site impacts. The SW-1 sampling location is downgradient of the site, approximately 3,000 feet south of the structural fill boundary along an unnamed tributary of Gulf Creek. The SW-2 sampling location is upgradient of the site, approximately 3,200 feet west of the structural fill boundary along Shaddox Creek. Approximate surface water sampling locations are depicted on **Figure 5**.

Gulf Creek and Shaddox Creek are classified as Class WS-IV Waters by NCDEQ and as such are evaluated under North Carolina Surface Water and Wetland Standards (15A NCAC 02B).

New nitrile gloves were donned prior to collecting surface water samples. Field parameters (including temperature, conductivity, pH, ORP, and DO) were recorded with a Horiba U-52 meter; turbidity was recorded with a Micro-TPW meter.

2.3 Leachate Sampling Procedures

One leachate sample was collected from on-site storage holding tanks. This leachate sample is used to provide an evaluation of potential on-site leachate impacts. The approximate leachate sampling location is depicted on **Figure 6**.

New nitrile gloves were donned prior to collecting leachate water samples. Field parameters (including temperature, conductivity, pH, ORP, and DO) were recorded with a Horiba U-52 meter; turbidity was recorded with a Micro-TPW meter.

3 Background Conditions and Results

Groundwater analytical results for the constituents listed in 40 CFR 257 Appendix III detection monitoring and 40 CFR 257 Appendix IV assessment monitoring (as previously discussed in **Section 1.2**) were compared to background concentrations to determine if any impact to groundwater is indicated. If any impact to groundwater is inferred from groundwater detection monitoring or if a potential impact is detected, Charah must notify NCDEQ within 14 days. In the event no new potential impacts are observed, Charah must submit a report of the sampling results to NCDEQ with 120 days per the approved Water Quality Plan (90 days per the CCR) of the sampling event.

Groundwater samples were analyzed for assessment monitoring constituents (EPA 40 CFR 257 Appendix IV). Assessment monitoring typically occurs if a statistically significant increase in a detection monitoring constituent is noted and will be further assessed in subsequent reporting. Per the NCDEQ approved Water Quality Monitoring Plan, Appendix IV constituents were analyzed for background events and will continue to be assessed during future semi-annual monitoring events. Groundwater monitoring samples were also analyzed for 40 CFR Part 258 Appendix I metals and volatile organic compounds (VOCs).

A summary of the laboratory parameters detected during the 2017 Initial Semi-Annual Detection Monitoring events, along with the highest detected concentration result, is provided in the sections below. Field and Sampling Logs are provided in **Appendix A**. Full laboratory data from the monitoring event is provided in **Appendix B** and electronic data deliverables (EDDs) in **Appendix C**.

3.1 Background Site Conditions

Pre-CCR placement groundwater site conditions (i.e. laboratory analysis from the first and second monitoring events) exhibited high background chloride and TDS concentrations. Several monitoring wells additionally showed continued elevated levels (i.e. same order of magnitude as the NC 2L Standard) or exceedances of NC 2L Standards for antimony, arsenic, barium, chromium, cobalt, lithium, pH, sulfate and vanadium. Surface water samples exhibited exceedances of NC Surface Water & Wetland Standards for copper.

Bromodichloromethane and dibromochloromethane detected above NCGPS in groundwater samples from MW-2, MW-3, and MW-7 during the first monitoring event were the result of municipal water utilized during previous development activities. These trihalomethanes were only detected in the first sampling event (Round 1); all VOCs were non-detect for the second through 8th sampling events. VOCs are not present naturally at the site.

A detailed discussion of background groundwater conditions can be found in the *2016 Background Sampling Report* (HDR, 2016b) and **Section 4.0** of this report will further discuss statistical results for a better understanding of predictive limits for the background well location BG-1 as well as Interwell interactions. Additionally, further discussion of groundwater flow directions, horizontal hydraulic conductivities, horizontal hydraulic gradient calculations and

groundwater flow velocities (i.e. seepage velocity) can be found in the *Design Hydrogeologic Report* (Buxton, 2015b) and all of which were used to refine site aquifer conditions.

3.2 2017 Initial Semi-Annual Detection Monitoring Groundwater Analytical Results

The primary focus of this section is the analytical results from the January 23 - 26, 2017 event. Constituent concentrations with exceedances of respective NC 2L Standards for this event are provided below. The monitoring well location of the highest concentration for a given constituent is provided in parentheses. Field and Sampling Logs are provided in **Appendix A**. Full Laboratory Data and Quality Control Data from the monitoring event is provided in **Appendix B** and electronic data deliverables (EDDs) in **Appendix C**. Kevin Godwin, Project Manager of Pace Analytical, verified the 2017 Initial Semi-Annual Detection Monitoring sampling, analytical, and quality control procedures were performed in accordance with those for all other monitoring events (**Appendix B**, Quality Control Data).

A summary of the findings from this monitoring event is provided below and depicted in **Table 6**:

EPA Appendix I VOC Detections

- All VOCs have been reported as ND in all wells

EPA Appendix I Metal Detections

- Vanadium: <0.3 µg/L to 5.3 µg/L (BG-1-background upgradient well)

EPA Appendix III Constituent Detections

- Chloride: 18,200 to 1,320,000 µg/L (MW-2)
- pH: 6.3 to 7.7 SU (MW-4)
- Sulfate: 6,000 to 338,000 µg/L (MW-2)
- Total Dissolved Solids: 220,000 to 2,780,000 µg/L (MW-2)

EPA Appendix IV Constituent Detections

- Antimony: <1.0 to 5.6 µg/L (MW-2)
- Barium: 101 to 1,360 µg/L (MW-8)
- Chromium: <7.7 µg/L to 82.0 µg/L (MW-8)

No standards have been yet to be established by North Carolina Groundwater Protection Standards (NCGPS) nor the Federal Maximum Contaminant Levels in drinking water (Federal MCL) for calcium, lithium, molybdenum and Radium 226/Radium 228.

Laboratory analytical results including exceedance from the sampling event remained constant in groundwater concentrations in most of the monitoring wells with the exception of MW-2 reporting increases in antimony, chloride, sulfate and TDS. Additionally, monitoring well MW-8 showed exceedances in barium and chromium but remained constant in groundwater concentrations.

The groundwater monitoring wells and single background monitoring well (BG-1) continue to show consistently elevated concentrations of both Appendix III and Appendix IV constituents,

which were also observed in pre-CCR placement conditions (Rounds 1 and 2). In this 2017 Initial Semi-Annual Detection Monitoring, antimony, barium, chromium, chloride, pH, sulfate, TDS and vanadium were detected within the same order of magnitude or intermittent exceedances of the NC 2L Standard/Federal MCL. Naturally occurring metals and pH exceeding NCGPS are common in North Carolina due to various geologic conditions (i.e. weathering of crystalline parent material) as was discussed in more detail in the *Initial Background Groundwater & Surface Water Monitoring Event* (Buxton, 2015c).

3.3 Surface Water Analytical Results

Surface water samples (**Figure 5**) were compared to the North Carolina Surface Water and Wetland Standards (15A NCAC 02B) or EPA National Criteria standards (utilized by North Carolina Division of Water Quality as default standards for non listed parameters). Laboratory analytical results from this sampling event indicated only copper in surface water sample SW-2 (7.5 µg/L) was in exceedance of its respective 15A NCAC 2B standard. Copper specifically showed exceedances in pre-CCR placement monitoring events at surface sampling locations.

No other surface water exceedances were detected during the 2017 Initial Semi-Annual Detection Monitoring event.

3.4 Leachate Analytical Results

Leachate generated on-site was collected during the most recent monitoring event to characterize the nature of CCR leachate (**Figure 6**). Parameters decreased or remained similar when compared to prior sampling events.

Although sampling is required for the Permit to Operate for comparison purposes only, leachate is disposed of in compliance with the Clean Water Act at either of the aforementioned permitted disposal facilities.

4 Statistics

4.1 Methodology

An analysis of the data set including the recent sampling event was performed. The data was statistically analyzed using a combination of Starpoint Software, Inc.'s ChemPoint® and ChemStat® as well as EPA's ProUCL statistical software packages. Prediction Limits (PL) and proposed site standards for constituents measured in background well BG-1 for the Site were developed in accordance with Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities - Unified Guidance. Additionally, Interwell statistical analysis was conducted for the detected groundwater results during the January 2017 sampling event in the Brickhaven No. 2 Mine Tract "A" Structure Fill Site.

The statistical summary for each parameter and well is included in **Appendix D**. The data analysis includes the following.

- Test for Outliers
- Adjustment of Non-Detects (NDs)
- Distribution Assessment
- Prediction Limits
- Interwell Comparison
- Statistically Significant Increases
- Trend Analysis

A more detailed report can be provided upon request.

4.1.1 Test for Outliers

Parameters measured during prior sampling events and the most recent monitoring period (i.e., the entire record for a parameter pooled over the 8 downgradient wells and the background well) are tested for outliers using Dixon's test (valid for sample sizes < 25). Any values identified as outliers are noted in a statistical summary table included in **Appendix D** in more detail. However, outliers are not removed from subsequent analyses unless the analytical result's quality assurance review determined that values in question were impacted and sources of impact were known. Outlier tests are not performed for Parameters that do not have any measured values greater than its MRL.

Test results identified the following outliers: Barium detected at MW-8, lithium, sulfate, and zinc detected at MW-2 during the January 2017 monitoring event are outliers relative to all these parameters' values collected over the eight sampling events from all wells. The outliers are included in the Interwell statistics.

4.1.2 Adjustment for Non-Detects (NDs)

NDs (commonly described as "non-detects") represent analytical results reported as below their Method Reporting Limits (bMRL) and are adjusted based on the percentage of bMRL values. When less than 15 percent of values for a Parameter are NDs, those values are replaced with a value equal to half of the MRL. When 15 percent to 50 percent of values are reported below the

MRL, the Aitcheson Adjustment is used for the ND data. The values for the NDs are set equal to their respective MRLs when more than 50 percent of values for a Parameter are below its MRL, and a non-parametric method is used.

4.1.3 Distribution Assessment

Data are evaluated to determine whether the distribution of each Parameter satisfies normality assumptions for further statistical analysis when less than 50 percent of the data for the Parameter are bMRL (<50% ND). Normality is evaluated using the Shapiro-Wilks test, which applies to cases where there are fewer than 50 samples. Distributions are first evaluated using non-transformed data and then, if the distribution does not satisfy normality constraints, it is tested again using natural log (ln) transformed data.

4.1.4 Predictive Limits Determination

Data are evaluated to determine whether a Parametric Prediction Limit (PPL) or a Non-parametric Prediction Limit (NPPL) can be used to estimate prediction limits for each Parameter at the background well. This evaluation depends on the percentage of measurements below their MRL and whether a distribution satisfies normality assumptions. For Parameters with less than 50 percent of measurements reported as below their MRL and a distribution that satisfies normality assumptions, a PPL is calculated. For Parameters with more than 50 percent of measurements reported as below their MRL or having a distribution that does not satisfy normality constraints, a NPPL is calculated.

The background well calculated PLs are tabulated and compared to 2L Standards or EPA Maximum Concentration Limit (MCL) in Table 1 in **Appendix D**.

4.1.5 Trend Analysis

The background well concentration data are evaluated to determine if seasonal trends exist if there are any detected results. Trends are evaluated using the Mann-Kendall test (a non-parametric test for trend).

4.1.6 Interwell Comparison

Parameter concentrations from compliance wells are compared to corresponding Prediction Limits (PLs) from the background well. Concentrations measured during the most recent sampling event represent the compliance well condition in the Interwell comparison. As previously described in the report “Prediction Limit for Background Well Parameters”, the entire record of measurements from the background well is evaluated to determine whether a Parametric Prediction Limit (PPL) or a Non-parametric Prediction Limit (NPPL) can be used to estimate background well PLs. This evaluation depends on the percentage of measurements bMRL and whether a distribution satisfies normality assumptions. For parameters with less than 50 percent of measurements from all wells reported as bMRL and a distribution that satisfies normality assumptions from the background well, a PPL is calculated. For Parameters with more than 50 percent of measurements reported as bMRL or having a distribution that does not satisfy normality assumptions, a NPPL is calculated.

The detected parameters above the MRL from each compliance well during the January 2017 sampling event is compared to the background well Parametric or non-parametric Prediction

Limit. Parameters are considered to be within compliance limits if the January 2017 sampled concentration from the compliance well is less than the background well PL. Otherwise, compliance well values are evaluated to determine the nature of any increases and trends over time.

4.1.7 Statistically Significant Increase (SSI) & Trend Assessment

If the most recently sampled compliance well value exceeds the background well UPL, then that value represents a statistically significant increase (SSI) over background. When the UPLs are exceeded, HDR will provide interpretation as to the impact of the exceedance by referencing the trend results. A statistically significant trend where concentrations are increasing over time does suggest that future samples are at a higher risk of exceedances than trends that are either flat or declining over time. The Thiel-Sen procedure ("Sen's Slope Estimator") is used to evaluate trends for each parameter where an SSI is found for the January 2017 monitoring event. The Sen's trend analysis will help to project if the result for a parameter will be increased, decreased, or unchanged. If the data had 5 or more non-detects over the 8 sampling events, no trend analysis was done as little statistical information can be gleaned at that level of censorship.

4.1.8 Time Series Plots

Graphs of concentration versus time for all wells are provided for each parameter. The trends in the time series plots graphically display changes in concentrations over time and substantiate the findings from Sen's Slope Estimator tests. The time series plots for all detected parameters can be found in the Statistics Output (**Appendix D**).

4.2 Statistical Analysis & Results

The ChemStat® statistical analysis identified the parameters with a statistically significant increase (SSI) over the background levels for the down/side gradient wells. The results are summarized in Table 1 and Table 2 of **Appendix D**.

4.2.1 Predictive Limits Results

Based on the results from the "Prediction Limits for Background Well Parameters" report, the parameters Ba, Ca, Cl, Li, Ra-226, Ra-228, SO4, and TDS from the background wells follow normal distributions. Parametric 95 percent upper prediction limits (95% UPL) were estimated for these parameters. Compliance observations for these parameters from the January 2017 sampling event were compared to their respective 95% UPLs. Both boron (B) and Fluoride (F) data in background well follow a normal distribution pattern after data conversion to natural logarithm scale. The Ln-95% UPL for both B and F were calculated and then converted back to 95% UPL. The detected B and F samples from the compliance wells were compared to their respective 95% UPLs.

For parameters with detections at or fewer than twice during the 9 sampling events from the background well (including Tl, Cr, Mo, Ni, and Zn), the UPLs were calculated using the Non-Parametric Prediction Limit (NPPL) method.

All the results are shown in the summary table (Table 1) in **Appendix D**. The results are summarized as follows:

Parameters with Statistically Significant Increase (SSI) above Background PL for the 2017 Initial Semi-Annual Detection Monitoring event:

- **Antimony**: Antimony detected from MW-2 has statistically significant increases (SSIs) above the NPPL of background well. But the results did not show any trend**.**
- **Barium:** Barium observations from MW-3 and MW-8 have statistically significant increases (SSIs) above the background 95% UPL. But barium results show no trend over time for these wells using Sen's slope estimator tests.
- **Boron**: Boron observations from MW-2 and MW-5 have SSIs compared to the background 95% UPL. But the results show no trend or downward trend over time using Sen's slope estimator tests.
- **Calcium**: Calcium observations from MW-1 to MW-4 MW-8 have SSIs compared to the background 95% UPL. But the results show no trend overtime using Sen's slope estimator test.
- **Chloride**: Chloride observations from MW-1 to MW-4 and MW-8 have SSIs compared to the background 95% UPL. But only the result for MW-2 showed upward trend over time using Sen's slope estimator tests.
- **Chromium**: Chromium detected at MW-1, MW-2, and MW-8 have SSI compared to the background NPPL; but there is no trend in the chromium results over time at this well using Sen's slope estimator test.
- **Fluoride**: Fluoride observations from MW-5 and MW-6 have SSIs compared to the background 95% UPL. But the fluoride results showed no trend or downward trend over time for these wells using Sen's slope estimator tests.
- **Lithium**: Lithium observations from MW-2 and MW-3 have SSIs compared to the background 95% UPL. The results at MW-2 showed an upward trend, but there is no trend at MW-3 over time using Sen's slope estimator tests.
- **Molybdenum**: Molybdenum observations detected at MW-2, MW-3, and MW-4 showed SSIs above the background NPPL; but the results did not show trend over time using Sen's slope estimator tests.
- **Sulfate**: Sulfate observations from MW-2, MW-3, and MW-6 have SSIs over the background 95% UPL. But the results showed no trend over time for these wells using Sen's slope estimator tests.
- **Total Dissolved Solids (TDS)**: TDS observations from MW-1, MW-2, MW-4, MW-6, and MW-8 have SSIs from the background 95% UPL. But the results show no trend over time for all wells except at MW-2 where TDS shows an upward trend using Sen's slope estimator tests.

- **Zinc**: Zinc observations detected from MW-2 and MW-8 have SSIs above the NPPL of background well; but Sen's slope test did not show any trend for zinc from all these wells over time using Sen's slope estimator tests.

With the exception of chloride, lithium, and TDS at MW-2, all constituents with SSI were determined to have no trend using Sen's slope estimator tests. All remaining monitored constituents either are not detected, not above the MRL or are not statistically significant above the background concentration levels.

5 Conclusions

The 2017 Initial Semi-Annual Detection Monitoring event was conducted at Brickhaven No. 2 Mine Tract "A" Structural Fill site from January 23 – 26, 2017. The detections (minus the outliers) are similar to the background levels and therefore do don't demonstrate impact from the structural fill placement. A summary of the findings from the 2017 Initial Semi-Annual Detection monitoring event is provided below and depicted in **Table 6.**

- Groundwater was encountered at the site from approximately six feet below top of casing to approximately 60 feet below top of casing within the uppermost aquifer.
- Groundwater samples were collected at monitoring wells MW-1, MW-2, MW-3, MW-4, MW-5, MW-6, and MW-8 as well as the background monitoring well BG-1. MW-7 was determined to be dry (as discussed in **Section 2.1**) and will be replaced prior to the next semi-annual sampling event.
- Groundwater in the vicinity of the CCR structural fill generally flows from the central portion of the Site to the west and east toward Shaddox Creek and Gulf Creek, respectively (as discussed in **Section 1.7.1**).
- Instances of the presence of constituents above established NCGPS or Federal MCL were detected in MW-1, MW-2, MW-3, MW-4, MW-6, MW-8 and the background monitoring well BG-1.
- No standards have been yet to be established by NCGPS nor the Federal MCL for calcium, lithium, molybdenum and Radium 226/Radium 228.
- Laboratory analytical results from the sampling event remained constant in groundwater concentrations for Appendix III constituents in most of the monitoring wells with the exception of MW-2 reporting increases in chloride, sulfate and TDS.
- Monitoring well MW-8 showed exceedances in barium and chromium but remained constant in groundwater concentrations when compared with pre-CCR placement conditions.
- Laboratory analytical results from this sampling event indicated only copper in surface water sample SW-2 was in exceedance of its respective 15A NCAC 2B standard. Copper specifically showed exceedances in pre-CCR placement monitoring events at surface sampling locations. Analytical data from the 2017 Semi-Annual Detection Monitoring sampling event continues to indicate surface water has not been impacted by the placement of CCR at the site.
- Leachate generated on-site was collected during the most recent monitoring event to characterize the nature of CCR leachate. Leachate sample parameters exhibited similar concentrations or decreased when compared to prior sampling events. Leachate is disposed of properly at one of the permitted facilities discussed in **Section 1.3**.
- The groundwater monitoring wells and single background monitoring well (BG-1) continue to show consistently elevated concentrations of both Appendix III and Appendix

IV constituents, which were also observed in pre-CCR placement conditions (Rounds 1 and 2). In this 2017 Initial Semi-Annual Detection Monitoring, antimony, barium, chromium, chloride, pH, sulfate, TDS and vanadium were detected within the same order of magnitude or intermittent exceedances of the NC 2L Standard/Federal.

- Naturally occurring metals and pH exceeding NCGPS are common in North Carolina due to various geologic conditions (i.e. weathering of crystalline parent material) as was discussed in more detail in the *Initial Background Groundwater & Surface Water Monitoring Event* (Buxton, 2015c).
- Further sampling and analysis will refine naturally occurring conditions and groundwater flow patterns, better incorporate outliers, and evaluate statistical and natural groundwater variation.
- Analytical data from the 2017 Initial Semi-Annual Detection Monitoring sampling event continues to indicate placement of CCR has not impacted groundwater at the site.

A summary of the statistical analysis is provided below and in **Appendix D**:

- Numerous parameters including antimony, barium, boron, calcium, chromium, fluoride, molybdenum, sulfate, and zinc show statistical significance compared to the background well NPPL, 95% UPL. However, the results show no trend and/or downward trend over time at a number of the wells using Sen's slope estimator tests.
- Lithium, sulfate, and zinc detected at MW-2 during the 2017 Initial Semi-Annual Detection Monitoring Event were determined to be outliers relative to all of the parameter values collected over the nine sampling events from all wells to date.
- Chloride observations from MW-1 to MW-4 and MW-8 have SSIs compared to the background 95% UPL. But only the result for MW-2 showed an upward trend over time using Sen's slope estimator tests.
- Lithium observations from MW-2 and MW-3 have SSIs compared to the background 95% UPL. But only the result for MW-2 showed an upward trend over time using Sen's slope estimator tests.
- TDS observations from MW-1, MW-2, MW-4, MW-6, and MW-8 have SSIs from the background 95% UPL. But the results show no trend over time for all wells except at MW-2 where TDS shows an upward trend using Sen's slope estimator tests.
- With the exception of chloride, lithium, and TDS at MW-2, all constituents with SSI were determined to have no trend using Sen's slope estimator tests. All remaining monitored parameters either are not detected, not above the MRL or are not statistically significant above the background concentration levels.
- The SSI(s) over background levels for EPA Appendix III Metals chloride, sulfate and TDS as well as EPA Appendix IV Metals lithium generally resulted from natural variation in groundwater quality and remain consistent with pre-CCR placement conditions at the site.

6 Recommendations

Based on the findings of this assessment, HDR makes the following recommendations:

- Groundwater, surface water and leachate sampling will continue to be conducted on a semi-annual basis with the second semiannual event taking place after June 2017.
- A new groundwater monitoring well, MW-7R will be installed by a North Carolina licensed driller. It was determined that MW-7 will remain onsite, due to site safety considerations, but only utilized for groundwater gauging only. This was previously discussed and approved by NCDEQ.
- Chatham County consultant Smith & Gardner, Inc. of Raleigh, North Carolina has performed 2nd Quarter Sampling in conjunction with this schedule. The most recent sampling event took place in April 2017. Data from future events should be included in future statistical analyses.
- Since the SSI(s) over background levels for EPA Appendix III Metals chloride, sulfate and TDS and EPA Appendix IV Metals lithium generally resulted from natural variation in groundwater quality further evaluation of naturally occurring conditions at the Site should be further addressed prior to subsequent semiannual sampling events.
    - Additional background well locations may be proposed at the site to better spatially and geologically define site conditions.
    - Furthermore, more frequent background only well sampling events could augment the existing statistical database and increase statistical confidence
    - Finally, utilization of geochemical sampling could provide insight into the chemical composition of onsite groundwater, soil and bedrock properties
- Continue discussions with NCDEQ related to ongoing detection monitoring and further refinement of the background statistical analysis.

7 References

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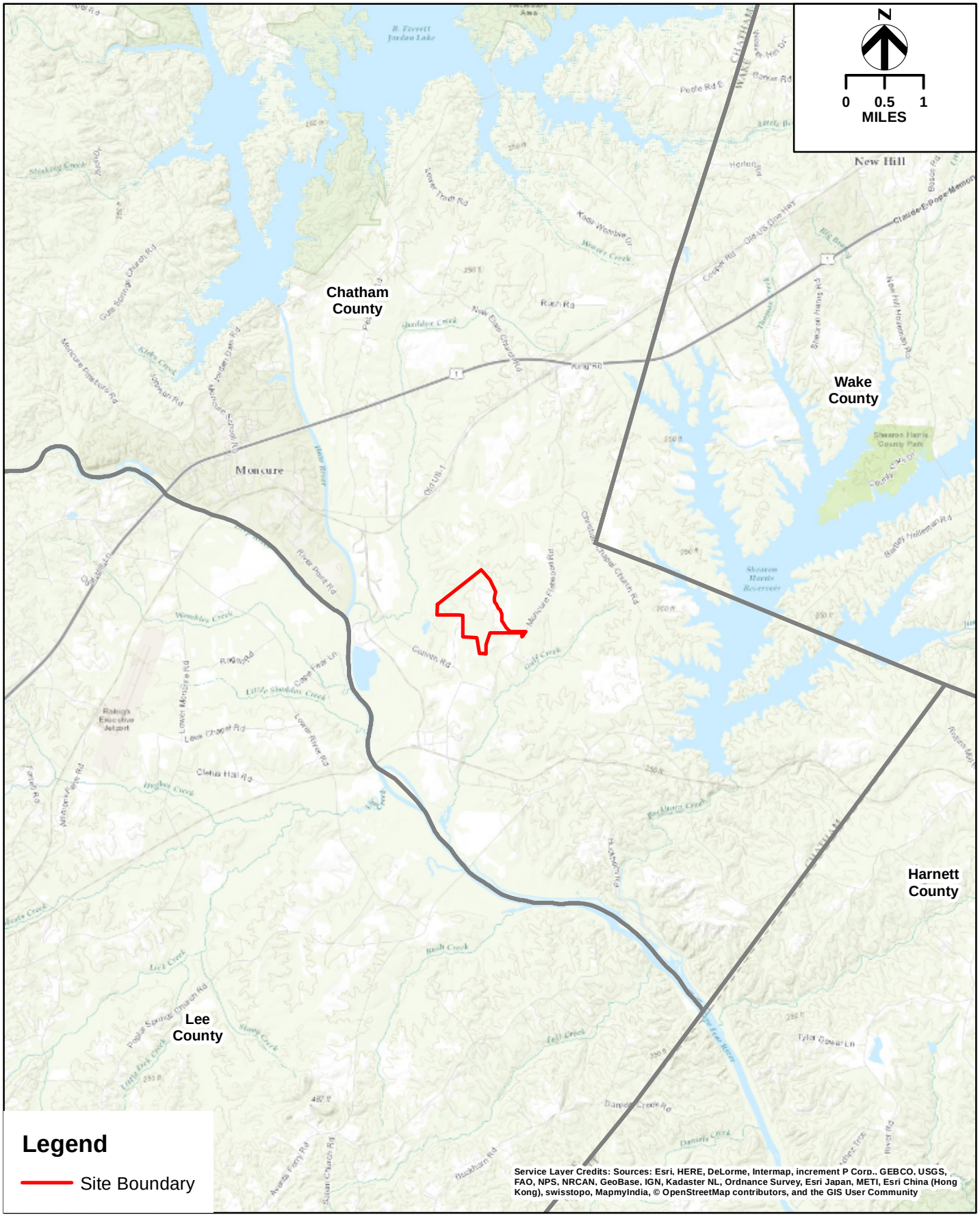
Figures

Figure 1: Regional Site Location Map
Figure 2: Regional USGS Topographic Map
Figure 3: Potentiometric Surface Map – January 2017
Figure 4: Site Layout Map with Monitoring Wells Locations
Figure 5: Surface Water Sample Location Map
Figure 6: Leachate Sample Collection Location



REGIONAL SITE LOCATION MAP
CHARAH, LLC
MONCURE, NORTH CAROLINA

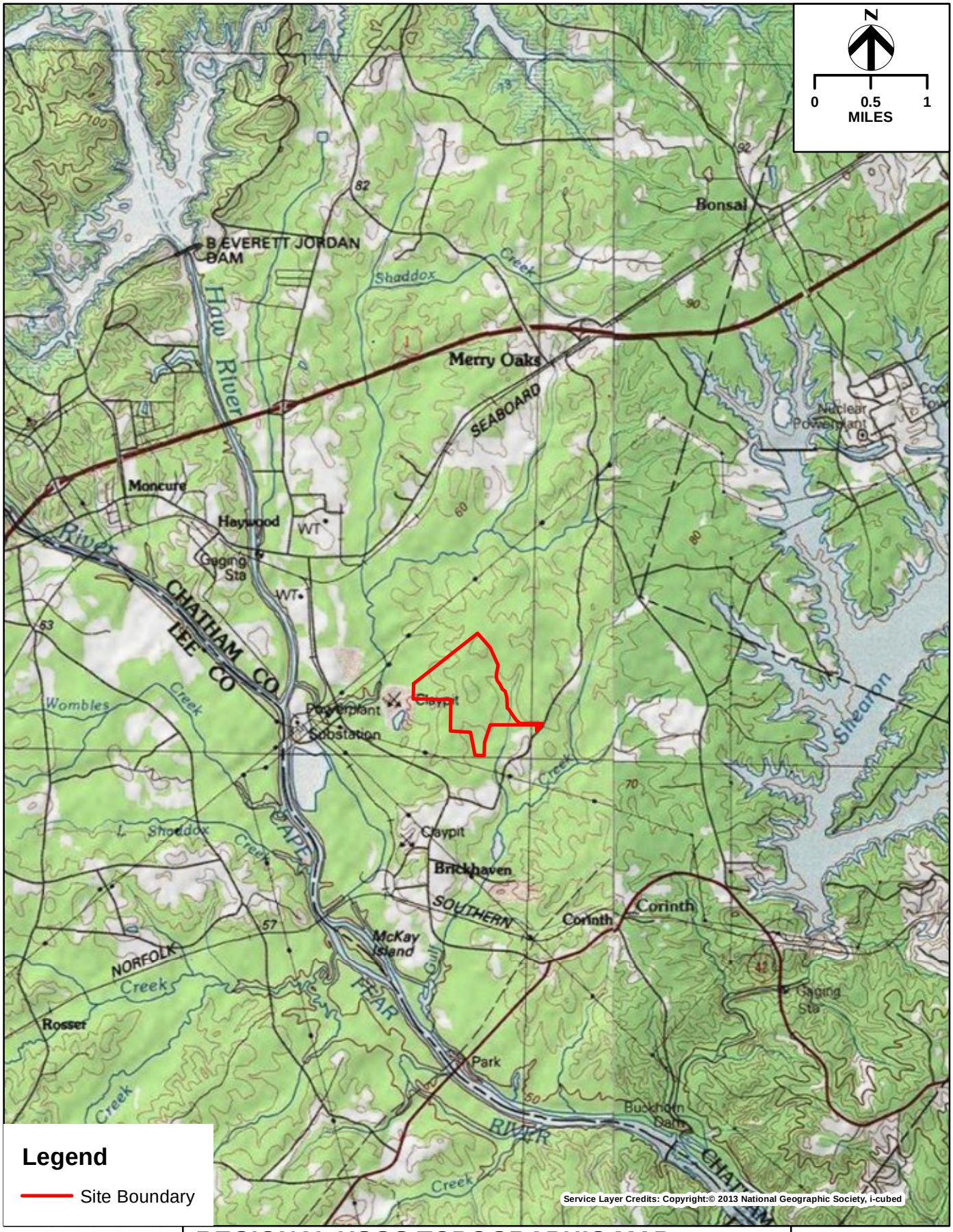
BRICKHAVEN NO. 2 MINE TRACT "A"

DATE

APRIL 2017

FIGURE

1

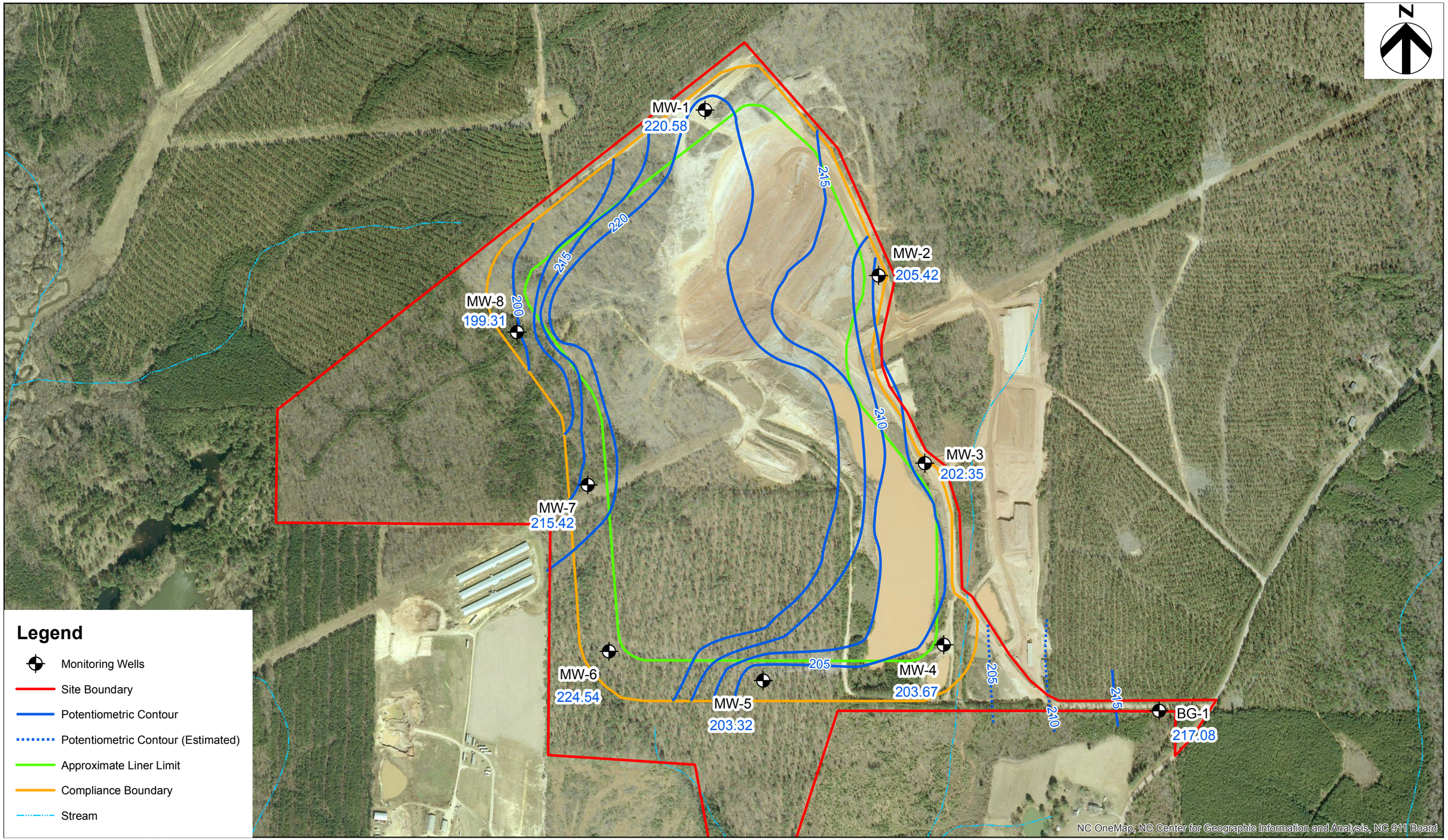


REGIONAL USGS TOPOGRAPHIC MAP
CHARAH, LLC
MONCURE, NORTH CAROLINA

BRICKHAVEN NO. 2 MINE TRACT "A"

DATE APRIL 2017

FIGURE 2



Note:
1. Groundwater data was collected by Pace Analytical Services on January 23, 2017.

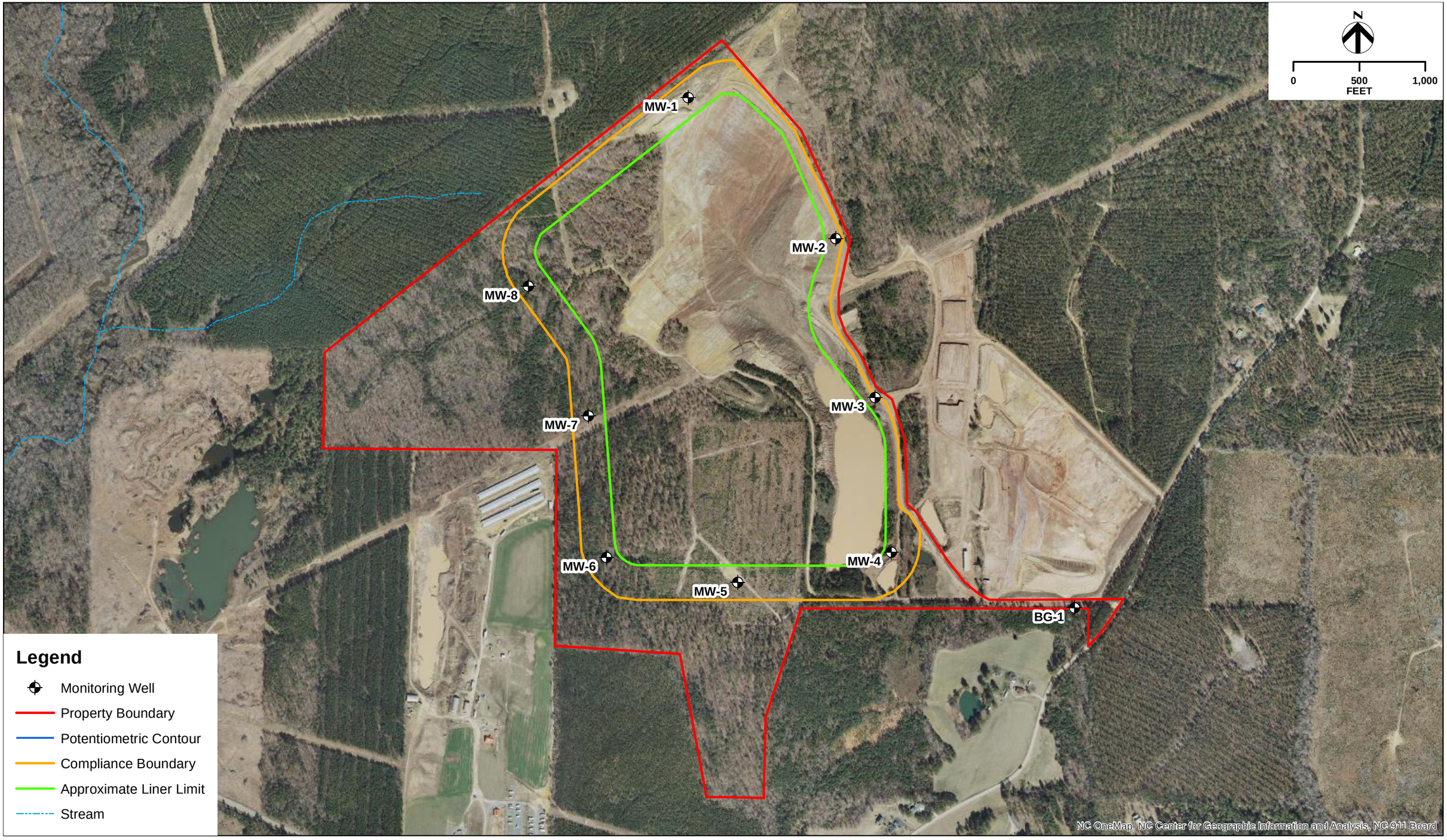
0 125 250 500 750 1,000
Feet

WATER TABLE SURFACE MAP - JANUARY 2017
CHARAH, LLC
MONCURE, NORTH CAROLINA

BRICKHAVEN NO. 2 MINE TRACT "A"

DATE APRIL 2017

FIGURE 3

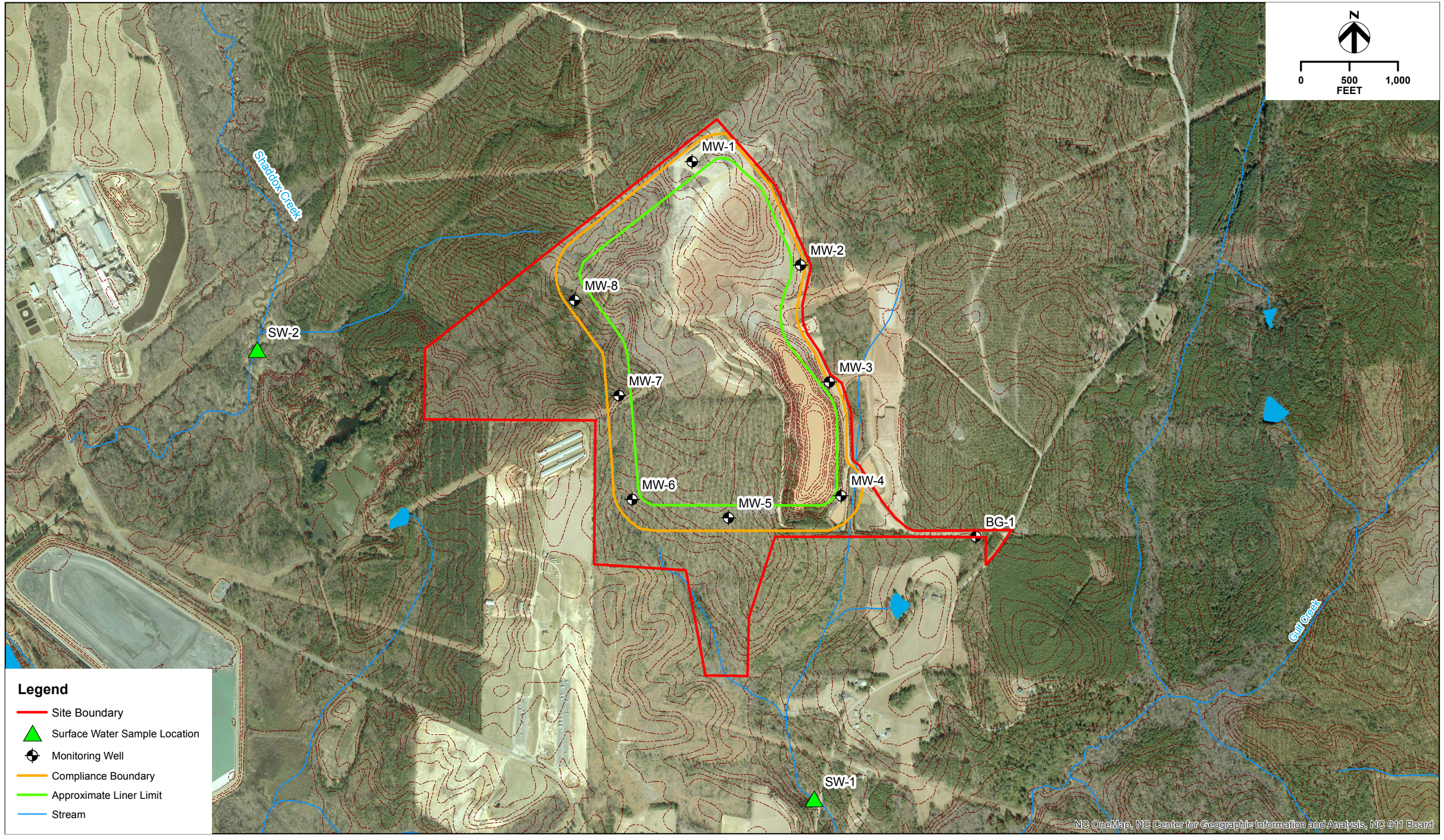


SITE LAYOUT MAP WITH MONITORING WELL LOCATIONS
CHARAH, LLC
MONCURE, NORTH CAROLINA

BRICKHAVEN NO. 2 MINE TRACT "A"

DATE
APRIL 2017

FIGURE
4

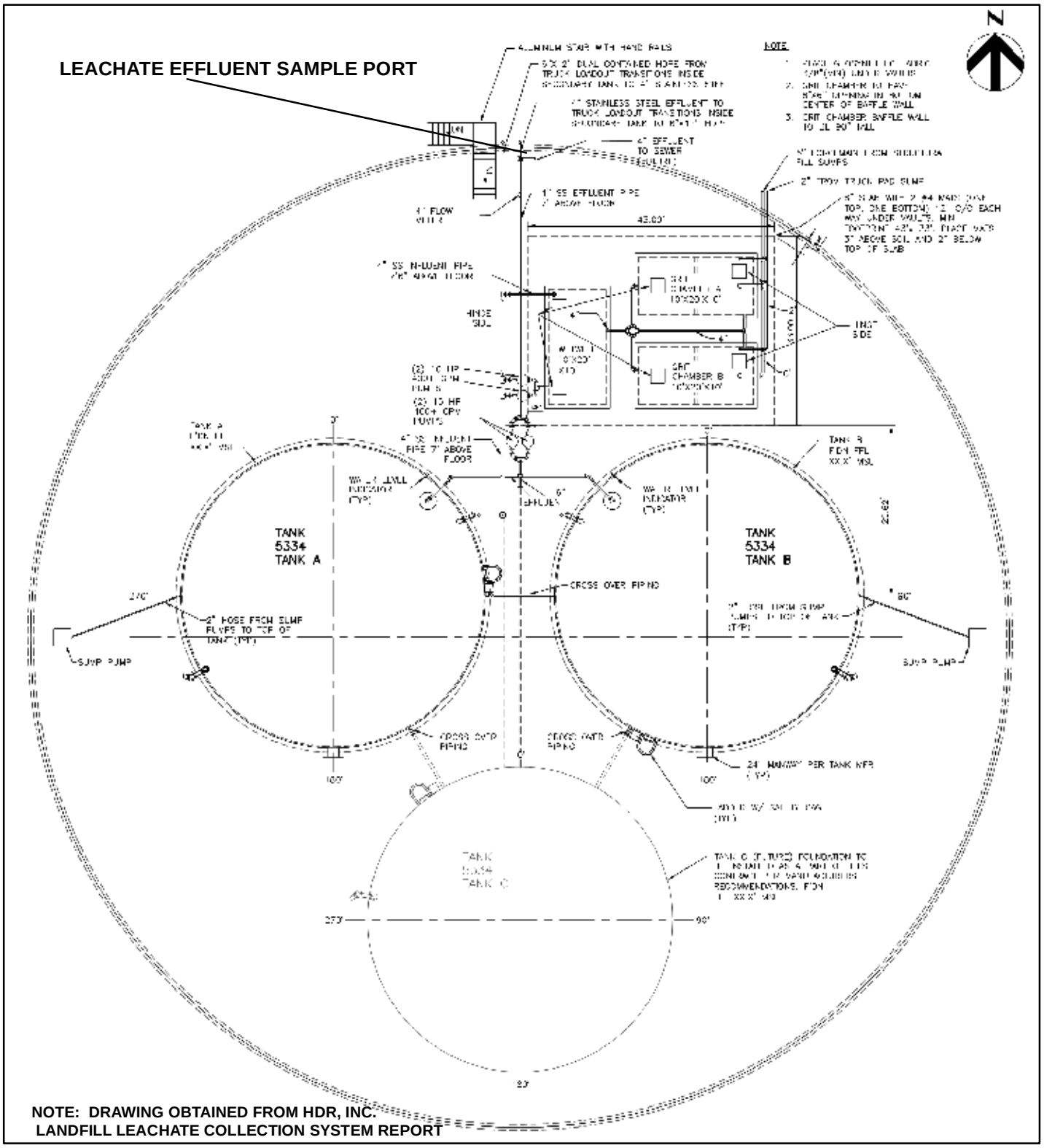


SURFACE WATER SAMPLE LOCATION MAP
CHARAH, LLC
MONCURE, NORTH CAROLINA

BRICKHAVEN NO. 2 MINE TRACT "A"

DATE
APRIL 2017

FIGURE
5



NOTE: DRAWING OBTAINED FROM HDR, INC. LANDFILL LEACHATE COLLECTION SYSTEM REPORT

LEACHATE SAMPLE COLLECTION LOCATION
CHARAH, LLC
MONCURE, NORTH CAROLINA

BRICKHAVEN NO. 2 MINE TRACT "A"

DATE APRIL 2017

FIGURE 6

Tables

Table 1: Well Construction and Survey Summary
Table 2: Groundwater Elevations – January 2017
Table 3: Hydraulic Conductivity
Table 4: Horizontal Hydraulic Gradients
Table 5: Groundwater Flow Velocities
Table 6: Detections and Exceedances

2017 Initial Semi-Annual Detection Monitoring Report

Table 1: Well Construction and Survey Summary

Well ID	Northing	Easting	Pad Elev. (msl)	TOC Elev. (msl)	TD BGS (ft)	TD BTOC (ft)	Screen Length (ft)	Screen Interval (msl)	Lithologic Unit
BG-1	670898.50	1996348.25	225.64	228.19	40.50	43.05	15	200.14 - 185.14	Layered Rock/PWR*
MW-1	674737.98	1993417.69	277.28	280.08	72.50	75.30	15	220.20 - 205.20	Layered Rock/PWR*
MW-2	673677.07	1994537.54	229.27	231.76	47.66	50.15	15	196.61 - 181.61	Layered Rock/PWR*
MW-3	672474.63	1994834.76	220.00	222.56	40.80	43.36	15	194.20 - 179.20	PWR
MW-4	671326.48	1994974.40	214.49	217.13	22.70	25.34	10	201.79 - 191.79	Residuum/PWR
MW-5	671081.19	1993779.03	242.72	244.86	44.00	46.14	10	208.72 - 198.72	PWR
MW-6	671267.60	1992793.34	228.63	231.10	27.00	29.47		216.63 - 201.63	Residuum/PWR
MW-7	672306.28	1992642.35	229.53	231.71	15.00	17.18	10	224.53 - 214.53	Residuum/PWR
MW-8	673304.83	1992200.37	233.41	236.47	46.00	49.06	15	202.41 - 187.41	PWR

Notes:

1. Top-of-casing, ground surface elevations and horizontal locations at MW-4 (PZM-1), MW-5 (PZM-22) and MW-7 (PZM-27) determined by Lawrence Surveying of Monroe, NC.
2. Top-of-casing, ground surface elevations and horizontal locations at BG-1, MW-1, MW-3, MW-6 and MW-8 determined by McAdams of Durham, NC.
3. Top-of-casing, ground surface and horizontal location at monitoring well MW-2 determined by Gregory C. Bewly.
4. TD=total depth; BGS=below ground surface;TOC=top of casing; DTW = Depth-to-Water; BTOC = below top-of-casing, msl = above mean sea level, ft.

* = interpreted lithologic unit based on relative drilling hardness and geologic judgment during well installation

Table 2: Groundwater Elevations
January 23, 2017

Well ID	Screen Interval Elevation (msl)	DTW BTOC (ft)	TOC Elev. (msl)	DTW Elevation (msl)	Lithologic Unit
BG-1	200.14 - 185.14	11.11	228.19	217.08	Layered Rock/PWR*
MW-1	220.20 - 205.20	59.50	280.08	220.58	Layered Rock/PWR*
MW-2	196.61 - 181.61	26.34	231.76	205.42	Layered Rock/PWR*
MW-3	194.20 - 179.20	20.21	222.56	202.35	PWR
MW-4	201.79 - 191.79	13.46	217.13	203.67	Residuum/PWR
MW-5	208.72 - 198.72	41.54	244.86	203.32	PWR
MW-6	216.63 - 201.63	6.56	231.10	224.54	Residuum/PWR
MW-7	224.53 - 214.53	16.29	231.71	215.42	Residuum/PWR
MW-8	202.41 - 187.41	37.16	236.47	199.31	PWR

Notes:

1. Depth to water measurements obtained on January 23, 2017 to the nearest 0.01 foot with a depth-to-water meter by Pace Analytical Inc.
2. TD=total depth; BGS=below ground surface;TOC=top of casing; DTW = Depth-to-Water; BTOC = below top-of-casing, msl = above mean sea level, ft.

* = interpreted lithologic unit based on relative drilling hardness and geologic judgment during well installation

Table 3: Hydraulic Conductivity

Well ID	DTW BTOC (ft)	Length of Water Column (ft)	Screen Length (ft)	Screen Interval (msl)	Hydraulic Conductivity (k, cm/sec)	Lithologic Unit
BG-1	11.11	31.94	15	200.14 - 185.14	7.76E-05	Layered Rock/PWR*
MW-1	59.50	15.80	15	220.20 - 205.20	4.11E-04	Layered Rock/PWR*
MW-2	26.34	23.81	15	196.61 - 181.61	3.41E-06	Layered Rock/PWR*
MW-3	20.21	23.15	15	194.20 - 179.20	4.08E-07	PWR
MW-4	13.46	11.88	10	201.79 - 191.79	1.41E-04	Residuum/PWR
MW-5	41.54	4.60	10	208.72 - 198.72	8.01E-06	PWR
MW-6	6.56	22.91	15	216.63 - 201.63	1.10E-04	
MW-7	16.29	0.89	10	224.53 - 214.53	1.26E-06	Residuum/PWR
MW-8	37.16	11.90	15	202.41 - 187.41	1.29E-04	PWR

Notes:

1. Depth to water measurements obtained during the Hydrogeologic Report were measured to the nearest 0.01 foot with a depth-to-water meter by Buxton Environmental, Inc. prior to slug testing.
2. TD=total depth; BGS=below ground surface;TOC=top of casing; DTW = Depth-to-Water; BTOC = below top-of-casing, msl = above mean sea level, ft.
3. Hydraulic conductivity values determined by Buxton Environmental, Inc. on September 10, 2015 by conducting rising head slug tests; and solved utilizing the Bouwer-Rice (unconfined slug test) solution with AQTESOLV for Windows Version 4.50 software by Hydrosolv, Inc. (1996-2007).

* = interpreted lithologic unit based on relative drilling hardness during well installation

Table 4: Horizontal Hydraulic Gradients

Horizontal Hydraulic Gradient (*i* , dh/dl)									
	BG-1	**MW-1**	**MW-2**	**MW-3**	**MW-4**	**MW-5**	**MW-6**	**MW-7**	**MW-8**
BG-1	-	0.0007					0.002		
MW-1		-					0.001		
MW-2	0.004	0.0098	-				0.01	0.00	
MW-3	0.007	0.007	0.002	-	0.001	0.001	0.009	0.006	
MW-4	0.009	0.005	0.001		-		0.009	0.00	
MW-5	0.005	0.005	0.001		0.0003	-	0.021	0.01	
MW-6							-		
MW-7	0.000	0.002					0.01	-	
MW-8	0.004	0.01	0.00	0.001	0.001	0.00	0.01	0.01	-

1. Positive horizontal hydraulic gradients calculated by dividing the difference in hydraulic head between a well pair by the lenth of the flow path between the well pair. (*i* = dh/dl)
2. All well pairs assumed to be screened in same surficial aquifer unit
3. Horizontal flow path distance calculated by $\sqrt{(Easting_1 - Easting_2)^2 + (Northing_1 - Northing_2)^2}$
4. Top-of-casing and ground surface elevations and horizontal locations at MW-4 (PZM-1), MW-5 (PZM-22) and MW-7 (PZM-27) determined by Lawrence Surveying of Monroe, NC.
5. Top-of-casing and ground surface elevations and horizontal locations at BG-1, MW-1, MW-3, MW-6 and MW-8 determined by McAdams of Durham, NC.
6. Static water level elevations from January 23, 2017 monitoring event. See **Table 2**.

Table 5: Groundwater Flow Velocities

Groundwater Flow Velocity Between Well Pairs (V_s, ft/year)									
	BG-1	MW-1	MW-2	MW-3	MW-4	MW-5	MW-6	MW-7	MW-8
BG-1	-	1.8					1.8		
MW-1		-					2.2		
MW-2	0.9	6.1	-				1.3	0.1	
MW-3	0.6	1.5	0.1	-	0.1	0.02	0.6	0.04	
MW-4	9.4	10.5	0.2		-		8.5	0.4	
MW-5	1.8	3.7	0.1		0.1	-	5.8	0.2	
MW-6							-		
MW-7	0.04	0.4					0.7	-	
MW-8	5.1	35.9	0.9	0.1	1.7	0.7	13.0	1.7	-

1. Flow velocities between well pairs estimated by $V_S = \frac{Ki}{P_e}$

   Where: V_s = groundwater flow velocity

   K = horizontal hydraulic conductivity (See **Table 3**)

   i = horizontal hydraulic gradient (See **Table 4**)

   P_e = average effective porosity between given well pairs

2. Effective porosity values from geotechnical testing and the literature (McWhorter and Sunada, 1977; Sinhal and Gupta, 2010) where geotechnical data was not available.

Brickhaven 2017 Initial Semi-Annual Detection Monitoring Report

Table 6: Analytical Detections and Exceedances

January 2017

		Groundwater Analysis											Quality Control			Surface Water Analysis			Leachate Analysis
Analyte	**CAS Number**	BG-1	MW-1	MW-2	MW-3	MW-4	MW-5	MW-6	MW-7	MW-8	***NCGPS***	***Federal MCL***	Equip. Blank	Amb. Blank	Duplicate (MW-4)	SW-1	SW-2	***NCSWWS***	Leachate-1
EPA APPENDIX III																			
Boron (µg/l)	7440-42-8	ND	ND	52.1	ND	ND	39.3	ND	NT	ND	*700*	--	ND	ND	ND	ND	27.4	*NS*	2,440
Calcium (µg/l)	7440-70-2	28,100	112,000	214,000	160,000	68,200	9,140	34,500	NT	169,000	*NS*	*NS*	ND	ND	67,900	3,850	7,650	*NS*	228,000
Chloride (µg/l)	16887-00-6	**303,000**	**401,000**	**1,320,000**	**1,060,000**	**513,000**	18,200	**263,000**	NT	**660,000**	*250,000*	--	ND	ND	**519,000**	8,900	11,000	*250,000*	13,600
Fluoride (µg/l)	16984-48-8	140	120	ND	ND	210	520	380	NT	ND	*2,000*	--	ND	ND	220	110	ND	*1,800*	250
pH* (standard units)	-	6.7	7.3	7.7	7.3	**6.4**	6.9	6.7	NT	7.0	*6.5-8.5*	--	NT	NT	NT	NT	NT	*6.0-9.0*	7.5
Sulfate (µg/l)	14808-79-8	20,000	7,000	**338,000**	174,000	10,000	3,700	145,000	NT	6,000	*250,000*	--	ND	ND	10,100	6,500	10,500	*250,000*	530,000
Total Dissolved Solids (µg/l)	-	**623,000**	**931,000**	**2,780,000**	303,000	**1,150,000**	220,000	**776,000**	NT	**1,270,000**	*500,000*	--	ND	ND	**1,180,000**	230,000	148,000	*500,000*	1,060,000
EPA APPENDIX IV																			
Antimony (µg/l)	7440-36-0	ND	ND	**5.6**	ND	ND	ND	ND	NT	ND	*1*	--	ND	ND	ND	ND	ND	*5.6*	ND
Arsenic (µg/l)	7440-38-2	ND	ND	ND	ND	ND	ND	ND	NT	ND	*10*	--	ND	ND	ND	ND	ND	*10*	ND
Barium (ug/l)	7440-39-3	321	131	203	531	330	90.7	122	NT	**1,360**	*700*	--	ND	ND	322	101	68.2	*1,000*	203
Beryllium (µg/l)	7440-41-7	ND	ND	ND	ND	ND	ND	ND	NT	ND	*4*	--	ND	ND	ND	ND	ND	*6.5*	ND
Cadmium (µg/l)	7440-43-9	ND	ND	ND	ND	ND	ND	ND	NT	ND	*2*	--	ND	ND	ND	ND	ND	*2*	ND
Chromium (µg/l)	7440-47-3	ND	6.6	**29.5**	ND	ND	ND	ND	NT	**82**	*10*	--	7.7	ND	ND	ND	ND	*50*	ND
Cobalt (µg/l)	7440-48-4	ND	ND	ND	ND	ND	ND	ND	NT	ND	*1*	--	ND	ND	ND	ND	ND	*3*	24.8
Fluoride (µg/l)	16984-48-8	140	120	ND	ND	210	520	380	NT	ND	*2,000*	--	ND	ND	ND	110	ND	*1,800*	250
Lead (µg/l)	7439-92-1	ND	ND	ND	ND	ND	ND	ND	NT	ND	*15*	--	ND	ND	ND	6.8	ND	*25*	ND
Lithium (µg/l)	7439-93-2	24.5	31.2	195	103	28.3	9.4	48.5	NT	38.3	*NS*	*NS*	ND	ND	29.4	ND	ND	*NS*	80.7
Mercury (µg/l)	7439-97-6	ND	ND	ND	ND	ND	ND	ND	NT	ND	*1*	--	ND	ND	ND	ND	ND	*0.012*	ND
Molybdenum (µg/l)	7439-98-7	ND	ND	13.1	7.2	8.9	ND	ND	NT	ND	*NS*	*NS*	ND	ND	ND	ND	ND	*160*	249
Selenium (µg/l)	7782-49-2	ND	ND	ND	ND	ND	ND	ND	NT	ND	*20*	--	ND	ND	ND	ND	ND	*5*	ND
Thallium (µg/l)	7440-28-0	ND	ND	ND	ND	ND	ND	ND	NT	ND	*0.28*	--	ND	ND	ND	ND	ND	*0.24*	0.78
Radium 226 (pCi/l)	13982-63-3	0.53	-0.19	1.02	1.25	0.22	0.07	0.13	NT	0.06	*NS*	*5 (combined)*	0	-0.13	0.14	0.32	0.15	*NS*	0.29
Radium 228 (pCi/l)	15262-20-1	0.44	0.24	0.98	0.39	0.24	1.08	0.42	NT	0.39	*NS*		0.14	0.06	-0.23	-0.22	0.30	*NS*	0.31
EPA APPENDIX I METALS																			
Copper (µg/l)	7440-50-8	ND	ND	ND	ND	ND	ND	ND	NT	ND	*1,000*	--	ND	ND	ND	ND	**7.5**	*7*	ND
Nickel (µg/l)	7440-02-0	ND	ND	15.2	ND	ND	ND	ND	NT	42.1	*100*	--	6.3	ND	5.6	ND	ND	*88*	56.5
Silver (µg/l)	7440-22-4	ND	ND	ND	ND	ND	ND	ND	NT	ND	*20*	--	ND	ND	ND	ND	ND	*0.06*	ND
Vanadium (µg/l)	7440-62-2	**5.3**	ND	ND	ND	ND	ND	ND	NT	ND	*0.3*	--	ND	ND	ND	11.2	ND	*NS*	20.5
Zinc (µg/l)	7440-66-6	ND	ND	15.8	ND	ND	ND	ND	NT	29.2	*1,000*	--	ND	ND	ND	17.5	ND	*50*	39.8
EPA APPENDIX I VOC'S																			
Acetone (µg/l)	67-64-1	ND	ND	ND	ND	ND	ND	ND	NT	ND	*6,000*	--	ND	ND	ND	ND	ND	*2,000*	ND
Bromodichloromethane (µg/l)	75-27-4	ND	ND	ND	ND	ND	ND	ND	NT	ND	*0.6*	*80 (all THM's)*	ND	ND	ND	ND	ND	*NS*	ND
Bromoform (µg/l)	75-25-2	ND	ND	ND	ND	ND	ND	ND	NT	ND	*4*		ND	ND	ND	ND	ND	*4.3*	ND
Chloroform (µg/l)	67-66-3	ND	ND	ND	ND	ND	ND	ND	NT	ND	*70*		ND	ND	ND	ND	ND	*5.6*	ND
Dibromochloromethane (µg/l)	124-48-1	ND	ND	ND	ND	ND	ND	ND	NT	ND	*0.4*		ND	ND	ND	ND	ND	*NS*	ND
Carbon Disulfide (µg/l)	75-15-0	ND	ND	ND	ND	ND	ND	ND	NT	ND	*700*	--	ND	ND	ND	ND	ND	*NS*	ND
Dibromomethane (µg/l)	74-95-3	ND	ND	ND	ND	ND	ND	ND	NT	ND	*70*	--	ND	ND	ND	ND	ND	*47*	ND
1,4-Dichlorobenzene (µg/l)	106-46-7	ND	ND	ND	ND	ND	ND	ND	NT	ND	*6*	--	ND	ND	ND	ND	ND	*63*	ND

Notes:

1. Groundwater, surface water, and leachate samples collected from January 23-25, 2017 and analyzed for above parameters by Pace Analytical Laboratories
2. ND = below detection limits; NE = not established; NS = no standard; NT = not tested; VOC's = volatile organic compounds
3. NCGPS = North Carolina Groundwater Protection Standard (J-flagged data not considered)
4. Federal MCL = Federal Maximum Contaminant Level in drinking water (Federal MCL provided when no established NCGPS; or for further clarification as with THM's)
5. NCSWWS = North Carolina Surface Water and Wetland Standards (15A NCAC 02B) for Gulf Creek (SW-1) and Shaddox Creek (SW-2) which are both Class WS-IV Waters or are National Criteria per EPA
6. THM's = trihalomethanes (bromodichloromethane, bromoform, chloroform and dibromochloromethane) (all generally associated with the breakdown of chlorinated muncipal water in contact with natural water)
7. **Bold** and **shade** denotes above established NCGPS's or NCSWWS; µg/l = micrograms per liter; pCi/l - picocuries per liter
8. B = detected in method blank; J = estimated result <PQL (practical quantitation limit aka report limit (RL)) and >=MDL (method detection limit aka MDC)
9. pH was field tested by Pace Analytical Laboratories

A

Appendix A – Sampling and Field Logs

Charah Water Level Sweep

Well ID	Date	Time	Static Water Level (ft)	Total Depth (ft)
BG-1	1/23/2017	823	11.11	43.78
MW-1	1/23/2017	920	59.50	75.55
MW-2	1/23/2017	917	26.34	50.15
MW-3	1/23/2017	911	20.21	43.6
MW-4	1/23/2017	906	13.46	25.74
MW-5	1/23/2017	830	41.54	46.96
MW-6	1/23/2017	839	6.56	27.93
MW-7	1/23/2017	845	16.29	17.64
MW-8	1/23/2017	854	37.16	49.68

Notes:
1) ft - feet
2) btoc - below top of casing

Field Data Sheet

Client: Charah Location: Brickhaven, NC Project #: Brickhaven

Name and Afiliation (Sampler(s)): WBT JFA

Name and Afiliation (Inspector): ———

Well Information

Well ID: MW-2 Well Locked: (YES / NO)

Well Diameter: 2 Construction: (PVC/Steel/Stainless Steel)

Total Well Depth: 50.15 ft Multi Factor*: .163 [*(Radius/12)2 x 3.14 x 7.48]

Static Water Level: 26.44 ft Casing Volume: 3.9 gallons

Height of Water Column: 23.71 ft Cal. 3 Volumes: 11.7 gallons

Pump Intake: 47 ft

Purge Information

Date Purged: 1/26/17 Start: 1415 Finish: 1550 Purge Rate: 120 mL/min → 40 mL/min

Purging Method: Mega Monsoon Total Volume Purged: 11400 (gallons/mls)

Sampling Information

Date Collected: 1/26/17 Time Collected: 1600 (am/pm)

Sampling Equipment Used: Mega Monsoon Instrument ID: YSI Pro Plus #2244

Bottle Type	Preservation	Analysis Required

Field Measurements/Observations

Sample Temp (°C): ~~18.7~~ WBT 17.5 Time: 1600 Turbidity (ntu): 8.5 Time: 1600

Diss Oxy (mg/L): 1.1 Time: 1600 Fe 2+ mg/L: ND Time: 1600

Specific Cond. (uS): 4535 Time: 1600 Res. Cl (mg/L)/(µg/L): — Time: ———

Sample pH (s.u.): 7.7 Time: 1600 Odor: ND Time: 1600

ReDox (mV): 80.5 Time: 1600 Appearance: Clear Time: 1600

ReDox (EH value):YSI ProPlus +200mV 280.5 Other: ——— Time: ———

General/Weather Observations: Could not catch recharge

(sunny/cloudy/rainy) Temp. 60 (°F) Wind 7 (mph)

Sampler Signature: [signature] Date: 1-26-17

Stabilization Test

Time Purged	Temp. (°C)	Diss Oxy. (mg/L)	Spec. Cond. (uS)	pH (s.u.)	ReDox (mV)	Turbidity (ntu)	Volume removed (gallons/mls)	Water level (ft)	Other
1420	18.8	1.7	4536	7.7	-45.3	41.6	600	27.80	
1425	18.8	1.3	4553	7.7	-59.0	40.0	1200	28.53	Decreased to 100mL/min
1430	18.8	1.3	4550	7.6	-37.1	38.4	1800	29.00	
1435	18.8	1.3	4549	7.7	-9.1	38.0	2400	29.40	
1440	18.6	1.2	4545	7.6	+13.9	28.4	3000	29.80	

Pace Analytical	Document Name: Field Data Sheet	Document Issued: July 28, 2016 Page 2 of ≤
	Document Number: F-CAR-FLD-001.rev.01	Issueing Authority: Pace Huntersville Quality Office

Client: Charah

Location: Brickhaven

Project: Brickhaven

Well ID: MW-2

Well Diameter	Multiplication Factor*
1	0.0408
1.2	0.0918
1.625	0.1080
2	0.1630
3	0.3670
4	0.6530
6	1.4680
8	2.6100

Stabilization Test

Time Purged	Temp. (°C)	Diss Oxy. (mg/L)	Spec. Cond. (uS)	pH (s.u.)	ReDox (mV)	Turbidity (ntu)	Volume Removed (gallons/mls) circle one	Water level (ft)	Other
1445	18.6	1.2	4528	7.6	40.0	29.8	3600	30.16	Decreased to 80ml/min
1450	18.7	1.2	4533	7.6	50.8	27.1	4200	30.25	
1500	18.5	1.2	4541	7.7	63.4	24.9	5400	30.78	
1510	18.5	1.2	4542	7.7	71.6	21.1	WTF ~~200~~ 6600	31.20	Decreased to 40ml/min
1520	18.5	1.1	4535	7.7	78.4	16.1	7800	31.68	
1530	18.5	1.1	4545	7.7	80.1	12.5	9000	32.16	
1540	18.0	1.2	4560	7.7	82.1	13.6	10200	32.6	
1550	17.5	1.2	4551	7.7	81.4	8.7	11400		

Field Data Sheet

Client: Charah Location: Brickhaven, NC Project #: Brickhaven

Name and Afiliation (Sampler(s)): WBT JFA

Name and Afiliation (Inspector): _____

Well Information

Well ID: MW-3 Well Locked: (YES / NO)

Well Diameter: 2" Construction: (PVC/Steel/Stainless Steel)

Total Well Depth: 43.65 ft Multi Factor*: .163 [*(Radius/12)2 x 3.14 x 7.48]

Static Water Level: 20.23 ft Casing Volume: 3.82 gallons

Height of Water Column: 23.42 ft Cal. 3 Volumes: 11.46 gallons

Pump Intake: 40 ft

Purge Information

Date Purged: 1/24/17 Start: 1515 Finish: 1530 Purge Rate: 100 mL/min

Purging Method: Peristaltic Total Volume Purged: 1500 (gallons/mls)

Sampling Information

Date Collected: 1/24/17 Time Collected: 1535 (am/pm)

Sampling Equipment Used: Peristaltic Instrument ID: YSI Pro Plus #2244

Bottle Type	Preservation	Analysis Required

Field Measurements/Observations

Sample Temp (°C): 17.6 Time: 1535 Turbidity (ntu): 3.4 Time: 1535

Diss Oxy (mg/L): 0.5 Time: 1535 Fe 2+ mg/L: ND Time: 1535

Specific Cond. (uS): 4094 Time: 1535 Res. Cl (mg/L)/(µg/L): — Time: —

Sample pH (s.u.): 7.3 Time: 1535 Odor: ND Time: 1535

ReDox (mV): 79.6 Time: 1535 Appearance: Clear Time: 1535

ReDox (EH value):YSI ProPlus +200mV 279.6 Other: — Time: 1535

General/Weather Observations: _____

(sunny/cloudy/rainy) Temp. 65 (°F) Wind 2 (mph)

Sampler Signature: Willie 2 Date: 1-24-17

Stabilization Test

Time Purged	Temp. (°C)	Diss Oxy. (mg/L)	Spec. Cond. (uS)	pH (s.u.)	ReDox (mV)	Turbidity (ntu)	Volume removed (gallons/mls)	Water level (ft)	Other
1520	17.8	0.5	4103	7.3	102.2	5.2	500	21.22	
1525	17.6	0.4	4127	7.3	86.6	6.7	1000	21.45	
1530	17.5	0.4	4106	7.3	80.6	5.6	1500	21.91	

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Field Data Sheet

Client: Charah Location: Brickhaven, NC Project #: Brickhaven

Name and Afiliation (Sampler(s): WBT JFA

Name and Afiliation (Inspector): —

Well Information

Well ID: MW-1 Well Locked: (YES / NO)

Well Diameter: 2 Construction: (PVC/Steel/Stainless Steel)

Total Well Depth: 75.55 ft Multi Factor*: .163 [*(Radius/12)2 x 3.14 x 7.48]

Static Water Level: 59.59 ft Casing Volume: 2.60 gallons

Height of Water Column: 15.96 ft Cal. 3 Volumes: 7.80 gallons

Pump Intake: 7.3 ft

Purge Information

Date Purged: 1 / 25 / 17 Start: 1610 Finish: 1730 Purge Rate: 100 mL/min

Purging Method: Mega Monsoon Total Volume Purged: 8000 (gallons/mls)

Sampling Information

Date Collected: 1 /25/17 Time Collected: 1735 (am/pm)

Sampling Equipment Used: Mega Monsoon Instrument ID: YSI Pro Plus #2244

Bottle Type	Preservation	Analysis Required

Field Measurements/Observations

Sample Temp (°C): 18.7 Time: 1735 Turbidity (ntu): 8.6 Time: 1735

Diss Oxy (mg/L): 0.2 Time: 1735 Fe 2+ mg/L: ND Time: 1735

Specific Cond. (uS): 1337 Time: 1735 Res. Cl (mg/L)/(µg/L): — Time: —

Sample pH (s.u.): 6.8 Time: 1735 Odor: ND Time: 1735

ReDox (mV): 11.4 Time: 1735 Appearance: Clear Time: 1735

ReDox (EH value):YSI ProPlus +200mV 211.4 Other: — Time: —

General/Weather Observations:

(sunny/cloudy/rainy) Temp. 60 (°F) Wind 1 (mph)

Sampler Signature: [signature] Date: 1-25-17

Stabilization Test

Time Purged	Temp. (°C)	Diss Oxy. (mg/L)	Spec. Cond. (uS)	pH (s.u.)	ReDox (mV)	Turbidity (ntu)	Volume removed (gallons/mls)	Water level (ft)	Other
1615	19.1	0.5	516.3	7.3	-83.9	188.9	500 mL	59.65	
1620	19.2	0.4	510.1	7.2	-81.6	196.0	1000	59.65	
1625	19.4	0.4	506.1	7.2	-70.7	220.8	1500	59.66	
1630	19.1	0.3	504.9	7.2	-64.5	170.2	2000	59.66	
1635	19.9	0.2	503.9	7.2	-61.7	164.2	2500	59.66	

Client: Church

Location: Brickhaven, NC

Project: Brickhaven

Well ID: MW-1

Well Diameter	Multiplication Factor*
1	0.0408
1.2	0.0918
1.625	0.1080
2	0.1630
3	0.3670
4	0.6530
6	1.4680
8	2.6100

Stabilization Test

Time Purged	pH (s.u.)	Spec. Cond. (uS)	ReDox (mV)	Turbidity (ntu)	Diss Oxy. (mg/L)	Temp. (°C)	Volume Removed mLs	Other
1640	7.2	501.0	-51.5	128.5	0.3	19.3	3000	
1645	7.2	500.6	-42.0	90.5	0.3	19.0	3500	
1650	7.2	502.1	-37.8	40.6	0.2	18.9	4000	
1655	7.2	550.9	-35.5	23.2	0.2	18.8	4500	
1700	7.1	634.0	-31.5	21.7	0.1	18.7	5000	
1705	7.0	837	-19.2	19.0	0.2	18.7	5500	
1710	7.0	922	-14.0	16.5	0.2	18.6	6000	
1715	6.9	1085	-4.2	15.5	0.2	18.6	6500	
1720	6.9	1214	3.9	14.0	0.2	18.6	7000	
1725	6.8	1265	8.1	12.0	0.2	18.7	7500	
1730	6.8	1329	10.4	9.9	0.2	18.7	8000	

Field Data Sheet

Client: Charah Location: Brickhaven Project #: Brickhaven

Name and Afiliation (Sampler(s)): WBT JFA

Name and Afiliation (Inspector): —

Well Information

Well ID: MW-4

Well Diameter: 2

Total Well Depth: 25.74 ft

Static Water Level: 13.73 ft

Height of Water Column: 12.01 ft

Well Locked: (YES / NO)

Construction: (PVC/Steel/Stainless Steel)

Multi Factor*: .163 [*(Radius/12)2 x 3.14 x 7.48]

Casing Volume: 1.96 gallons

Cal. 3 Volumes: 5.88 gallons

Pump Intake: 23 ft

Purge Information

Date Purged: 1/25/16 Start: 0830 Finish: 0940 Purge Rate: 120 mL/min

Purging Method: Peristaltic Total Volume Purged: 8400 (gallons/mls)

Sampling Information

Date Collected: 1/25/16 Time Collected: 0945 (am/pm)

Sampling Equipment Used: Peristaltic Instrument ID: YSI Pro Plus #22444

Bottle Type	Preservation	Analysis Required

Field Measurements/Observations

Sample Temp (°C): 14.7 Time: 0945 Turbidity (ntu): 9.7 Time: 0945

Diss Oxy (mg/L): 0.2 Time: 0945 Fe 2+ mg/L: 3.0 Time: 0945

Specific Cond. (uS): 2079 Time: 0945 Res. Cl (mg/L)/(µg/L): — Time: —

Sample pH (s.u.): 6.3 Time: 0945 Odor: Organic smell Time: 0945

ReDox (mV): -29.7 Time: 0945 Appearance: Clear Time: 0945

ReDox (EH value):YSI ProPlus +200mV 170.3 Other: — Time: —

General/Weather Observations: —

(sunny/cloudy/rainy) Temp. 40 (°F) Wind 1 (mph)

Sampler Signature: Willi2 Date: 1/25/17

Stabilization Test

Time Purged	Temp. (°C)	Diss Oxy. (mg/L)	Spec. Cond. (uS)	pH (s.u.)	ReDox (mV)	Turbidity (ntu)	Volume removed (gallons/mls)	Water level (ft)	Other
0835	14.2	0.7	1573	6.4	37.7	98.4	600	14.32	
0840	14.1	0.6	1626	6.4	33.7	92.6	1200	14.53	
0845	13.9	0.4	1903	6.3	-40.8	42.0	1800	14.60	
0850	14.2	0.4	1924	6.3	-52.5	33.1	2400	14.64	
0855	14.5	0.3	2072	6.3	-51.2	29.1	3000	14.68	

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Client: Charah

Location: Brickhaven, NC

Project: Charah - Brickhaven

Well ID: MW-4

Well Diameter	Multiplication Factor*
1	0.0408
1.2	0.0918
1.625	0.1080
2	0.1630
3	0.3670
4	0.6530
6	1.4680
8	2.6100

Stabilization Test

Time Purged	Temp. (°C)	Diss Oxy. (mg/L)	Spec. Cond. (uS)	pH (s.u.)	ReDox (mV)	Turbidity (ntu)	Volume Removed (gallons/mls) circle one	Water level (ft)	Other
0900	14.8	0.3	2030	6.3	-48.1	27.2	3600	14.68	
0905	14.5	0.3	2054	6.3	-44.3	26.0	4200	14.69	
0915	14.8	0.2	2062	6.3	-40.5	16.8	5400	14.69	
0925	15.0	0.2	2068	6.3	-37.1	14.2	6600	14.69	
0935	15.0	0.2	2078	6.3	-32.8	11.3	7800	14.69	
0940	14.7	0.2	2074	6.3	-30.7	9.9	8400	14.69	

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Field Data Sheet

Client: CHARLIT Location: BRICK HAVEN Project #: BRICK HAVEN

Name and Afiliation (Sampler(s): MBT - JLH - PACE ANALYTICAL

Name and Afiliation (Inspector): ZH

Well Information

Well ID: SW-1 Well Locked: (YES / NO)

Well Diameter: _____ Construction: (PVC/Steel/Stainless Steel)

Total Well Depth: _____ ft Multi Factor*: _____ [*(Radius/12)2 x 3.14 x 7.48]

Static Water Level: _____ ft Casing Volume: _____ gallons

Height of Water Column: _____ ft Cal. 3 Volumes: _____ gallons

Pump Intake: _____ ft

Purge Information

Date Purged: 1/25/17 Start: 1205 Finish: — Purge Rate: —

Purging Method: — Total Volume Purged: — (gallons/mls)

Sampling Information

Date Collected: 1/25/17 Time Collected: 1205 (am/(pm))

Sampling Equipment Used: 1 L AMBER, GLASS Instrument ID: YSI PRO PLUS 2244

Bottle Type	Preservation	Analysis Required

Field Measurements/Observations

Sample Temp (°C): 9.0 Time: 1705 Turbidity (ntu): 194.7 Time: 1205

Diss Oxy (mg/L): 11.1 Time: 1205 Fe 2+ mg/L: ND Time: 1205

Specific Cond. (uS): 665 Time: 1205 Res. Cl (mg/L)/(µg/L): — Time: —

Sample pH (s.u.): 6.5 Time: 1205 Odor: ND Time: 1205

ReDox (mV): 86.5 Time: 1205 Appearance: muddy Time: 1205

ReDox (EH value):YSI ProPlus +200mV 286.5 Other: — Time: —

General/Weather Observations: _____

(sunny/cloudy/rainy) Temp. 60 (°F) Wind 1 (mph)

Sampler Signature: [signature] Date: 1-25-17

Stabilization Test

Time Purged	Temp. (°C)	Diss Oxy. (mg/L)	Spec. Cond. (uS)	pH (s.u.)	ReDox (mV)	Turbidity (ntu)	Volume removed (gallons/mls)	Water level (ft)	Other

Pace Analytical	Document Name: Field data Sheet	Date Issued: July 28, 2016 Page: 1 of 1
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Field Data Sheet

Client: Charah Location: Brickhaven Project #: Brickhaven

Name and Afiliation (Sampler(s): WBT JFA

Name and Afiliation (Inspector): _____

Well Information

Well ID: SW-2 Well Locked: (YES / NO)

Well Diameter: _____ Construction: (PVC/Steel/Stainless Steel)

Total Well Depth: _____ ft Multi Factor*: _____ [*(Radius/12)2 x 3.14 x 7.48]

Static Water Level: _____ ft Casing Volume: _____ gallons

Height of Water Column: _____ ft Cal. 3 Volumes: _____ gallons

Pump Intake: _____ ft

Purge Information

Date Purged: ____/____/____ Start : _____ Finish: _____ Purge Rate: _____

Purging Method: _____ Total Volume Purged: _____ (gallons/mls)

Sampling Information

Date Collected: 1/25/17 Time Collected: 1315 (am/pm)

Sampling Equipment Used: Grab Instrument ID: YSI Pro Plus #2244

Bottle Type	Preservation	Analysis Required

Field Measurements/Observations

Sample Temp (°C): 12.6 Time: 1315 Turbidity (ntu): 23.1 Time: 1315

Diss Oxy (mg/L): 11.3 Time: 1315 Fe 2+ mg/L: ND Time: 1315

Specific Cond. (uS): 1185 Time: 1315 Res. Cl (mg/L)/(µg/L): — Time: —

Sample pH (s.u.): 6.5 Time: 1315 Odor: ND Time: 1315

ReDox (mV): 92.9 Time: 1315 Appearance: Clear Time: 1315

ReDox (EH value):YSI ProPlus +200mV 292.9 Other: — Time: —

General/Weather Observations: GPS: 35° 35' 52" N 79° 2' 20" W

(sunny/cloudy/rainy) Temp 60 (°F) Wind 1 (mph)

Sampler Signature: Will Date: 1-25-17

Stabilization Test

Time Purged	Temp. (°C)	Diss Oxy. (mg/L)	Spec. Cond. (uS)	pH (s.u.)	ReDox (mV)	Turbidity (ntu)	Volume removed (gallons/mls)	Water level (ft)	Other

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Field Data Sheet

Client: ~~CHARRAH~~ CHARAH Location: BRICKHAVEN NC Project #: BRICKHAVEN

Name and Afiliation (Sampler(s): JFA. WBT PACE ANALYTICAL

Name and Afiliation (Inspector): NA

Well Information

Well ID: MW 6 Well Locked: (YES / NO)

Well Diameter: 2 Construction: (PVC/Steel/Stainless Steel)

Total Well Depth: 27.93 ft Multi Factor*: .163 [*(Radius/12)2 x 3.14 x 7.48]

Static Water Level: 6.79 ft Casing Volume: 3.45 gallons

Height of Water Column: 21.14 ft Cal. 3 Volumes: 10.35 gallons

Pump Intake: 25 ft

Purge Information

Date Purged: 1 / 24 / 17 Start: 0840 Finish: 0905 Purge Rate: 100 mL/min

Purging Method: Peristaltic Total Volume Purged: 2500 (gallons/mls)

Sampling Information

Date Collected: 1 / 24 / 17 Time Collected: 0910 (am/pm)

Sampling Equipment Used: Peristaltic Instrument ID: YSI ProPlus #2244

Bottle Type	Preservation	Analysis Required

Field Measurements/Observations

Sample Temp (°C): 15.3 Time: 0910 Turbidity (ntu): 8.5 Time: 0910

Diss Oxy (mg/L): 1.1 Time: 0910 Fe 2+ mg/L: ~~45~~ WBT ND Time: 0910

Specific Cond. (uS): 1526 Time: 0910 Res. Cl (mg/L)/(µg/L): — Time: —

Sample pH (s.u.): 6.7 Time: 0910 Odor: ND Time: 0910

ReDox (mV): 111.8 Time: 0910 Appearance: Clear Time: 0910

ReDox (EH value):YSI ProPlus +200mV 311.8 Other: — Time: —

General/Weather Observations:

(sunny/cloudy/rainy) Temp. 45 (°F) Wind — (mph)

Sampler Signature: [signature] Date: 1-24-17

Stabilization Test

Time Purged	Temp. (°C)	Diss Oxy. (mg/L)	Spec. Cond. (uS)	pH (s.u.)	ReDox (mV)	Turbidity (ntu)	Volume removed (gallons/mls)	Water level (ft)	Other
0845	14.5	1.5	1546	6.7	133.0	9.1	500	7.15	
0850	14.7	1.2	1537	6.7	117.5	21.6	1000	7.25	
0855	14.6	1.1	1534	6.7	112.0	14.2	1500	7.26	
0900	14.7	1.1	1532	6.7	112.1	11.0	2000	7.31	
0905	15.2	1.1	1526	6.7	112.2	8.9	2500	7.35	

Field Data Sheet

Client: Charah Location: Brickhaven, NC Project #: Brickhaven

Name and Afiliation (Sampler(s)): WBT JFA

Name and Afiliation (Inspector): _____

Well Information

Well ID: MW-7 Well Locked: (YES / NO)

Well Diameter: 2" Construction: (PVC/Steel/Stainless Steel)

Total Well Depth: 17.63 ft Multi Factor*: .163 [*(Radius/12)2 x 3.14 x 7.48]

Static Water Level: 16.31 ft Casing Volume: 0.22 gallons

Height of Water Column: 1.32 ft Cal. 3 Volumes: 0.66 gallons

Pump Intake: 17 ft

Purge Information

Date Purged: 1 / 24 / 17 Start: 1105 Finish: 1143 Purge Rate: 100 mL

Purging Method: Peristaltic Total Volume Purged: 3500 (gallons/(mls))

Sampling Information

Date Collected: — / — / — Time Collected: — (am/pm)

Sampling Equipment Used: — Instrument ID: —

Bottle Type	Preservation	Analysis Required

Field Measurements/Observations

Sample Temp (°C): _____ Time: _____ Turbidity (ntu): _____ Time: _____

Diss Oxy (mg/L): _____ Time: _____ Fe 2+ mg/L: _____ Time: _____

Specific Cond. (uS): _____ Time: _____ Res. Cl (mg/L)/(µg/L): _____ Time: _____

Sample pH (s.u.): _____ Time: _____ Odor: _____ Time: _____

ReDox (mV): _____ Time: _____ Appearance: _____ Time: _____

ReDox (EH value): YSI ProPlus +200mV _____ Other: _____ Time: _____

General/Weather Observations: Insufficient Volume to Sample

_____ (sunny/cloudy/rainy) Temp. _____ (°F) Wind _____ (mph)

Sampler Signature: Willie Z Date: 1-24-17

Stabilization Test

Time Purged	Temp. (°C)	Diss Oxy. (mg/L)	Spec. Cond. (uS)	pH (s.u.)	ReDox (mV)	Turbidity (ntu)	Volume removed (gallons/(mls))	Water level (ft)	Other
1110	15.6	4.4	1953	7.0	112.3	41.8	500 mls	16.45	
1115	15.7	3.7	1953	7.0	81.9	10.7	1000	16.66	
1120	15.8	3.5	1974	7.0	81.8	1.8	1500	16.80	
1125	15.7	2.5	1967	7.0	68.7	1.8	2000	16.93	
1130	15.4	1.7	1971	7.0	43.5	1.1	2500	17.15	

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Client: Charah

Location: Brickhaven, NC

Project: Brickhaven

Well ID: MW-7

Well Diameter	Multiplication Factor*
1	0.0408
1.2	0.0918
1.625	0.1080
2	0.1630
3	0.3670
4	0.6530
6	1.4680
8	2.6100

Stabilization Test

Time Purged	Temp. (°C)	Diss Oxy. (mg/L)	Spec. Cond. (uS)	pH (s.u.)	ReDox (mV)	Turbidity (ntu)	Volume Removed (gallons/mls) circle one	Water level (ft)	Other
1135	15.8	1.0	1953	6.9	-12.1	0.9	3000	17.22	
1140	15.6	.9	1939	6.7	-47.3	1.4	3500	17.33	

Field Data Sheet

Client: Charah Location: Brickhaven, NC Project #: Brickhaven

Name and Afiliation (Sampler(s)): WBT JFA

Name and Afiliation (Inspector): _____

Well Information

Well ID: MW-8 Well Locked: (~~YES~~/ NO)

Well Diameter: 2" Construction: (PVC/Steel/Stainless Steel)

Total Well Depth: 49.68 ft Multi Factor*: .163 [*(Radius/12)2 x 3.14 x 7.48]

Static Water Level: 36.97 ft Casing Volume: 2.07 gallons

Height of Water Column: 12.71 ft Cal. 3 Volumes: 6.21 gallons

Pump Intake: 45 ft

Purge Information

Date Purged: 1 / 24 / 17 Start: 1220 Finish: 1325 Purge Rate: 100 mL/min

Purging Method: Peristaltic Total Volume Purged: 6500 (gallons/mls)

Sampling Information

Date Collected: 1 / 24 / 17 Time Collected: 1330 (am/pm)

Sampling Equipment Used: Peristaltic Instrument ID: YSI ProPlus #2244

Bottle Type	Preservation	Analysis Required

Field Measurements/Observations

Sample Temp (°C): 18.2 Time: 1330 Turbidity (ntu): 4.2 Time: 1330

Diss Oxy (mg/L): 2.8 Time: 1330 Fe 2+ mg/L: ND Time: 1330

Specific Cond. (uS): 2881 Time: 1330 Res. Cl (mg/L)/(µg/L): — Time: —

Sample pH (s.u.): 7.0 Time: 1330 Odor: ND Time: _____

ReDox (mV): 39.2 Time: 1330 Appearance: Clear Time: _____

ReDox (EH value):YSI ProPlus +200mV 239.2 Other: — Time: —

General/Weather Observations: _____

(sunny/cloudy/rainy) Temp. 64 (°F) Wind 2 (mph)

Sampler Signature: Will Date: 1-24-17

Stabilization Test

Time Purged	Temp. (°C)	Diss Oxy. (mg/L)	Spec. Cond. (uS)	pH (s.u.)	ReDox (mV)	Turbidity (ntu)	Volume removed (gallons/mls)	Water level (ft)	Other
1225	17.1	3.0	2987	7.0	35.8	24.6	500	37.17	
1230	17.6	2.8	2960	7.0	52.0	18.4	1000	37.27	
1235	18.1	2.7	2913	7.0	65.0	20.7	1500	37.28	
1240	18.3	2.8	2918	7.0	72.7	21.3	2000	37.32	
1245	18.4	2.8	2945	7.0	75.1	18.9	2500	37.35	

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Client: Charah

Location: Brickhaven, NC

Project: Brickhaven

Well ID: MW-8

Well Diameter	Multiplication Factor*
1	0.0408
1.2	0.0918
1.625	0.1080
2	0.1630
3	0.3670
4	0.6530
6	1.4680
8	2.6100

Stabilization Test

Time Purged	Temp. (°C)	Diss Oxy. (mg/L)	Spec. Cond. (uS)	pH (s.u.)	ReDox (mV)	Turbidity (ntu)	Volume Removed (gallons/mls) circle one	Water level (ft)	Other
1250	17.7	2.6	2966	7.0	61.9	15.8	3000	37.38	
1255	18.4	2.8	2970	7.0	58.4	16.0	3500	37.39	
1300	18.4	2.8	2987	7.0	49.7	19.7	4000	37.38	
1310	18.2	2.7	2953	7.0	41.1	19.3	5008	37.38	
1320	18.9	2.9	2969	7.0	17.4	12.7	6000	37.73	
1325	18.6	2.7	2889	7.0	36.2	8.0	6500		

Field Data Sheet

Client: CHARAH Location: BRICKHAVEN NC Project #: BRICKHAVEN

Name and Affiliation (Sampler(s)): JAH - MBT PACE ANALYTICAL

Name and Affiliation (Inspector): NA

Well Information

Well ID: BG-1 Well Locked: (YES / NO)

Well Diameter: 2 Construction: (PVC/Steel/Stainless Steel)

Total Well Depth: 43.78 ft Multi Factor*: .163 [*(Radius/12)2 x 3.14 x 7.48]

Static Water Level: 11.11 ft Casing Volume: 5.32 gallons

Height of Water Column: 32.67 ft Cal. 3 Volumes: 19.96 gallons

Pump Intake: 40 +/- ft

Purge Information

Date Purged: 1/23/17 Start: 1050 Finish: 1125 Purge Rate: 100

Purging Method: Peristaltic Total Volume Purged: 3500 (gallons/mls)

Sampling Information

Date Collected: 1/23/17 Time Collected: 1130 (am/pm)

Sampling Equipment Used: Peristaltic Instrument ID: YSI Pro Plus #22944

Bottle Type	Preservation	Analysis Required

Field Measurements/Observations

Sample Temp (°C): 15.5 Time: 1130 Turbidity (ntu): .6 Time: 1130

Diss Oxy (mg/L): 1.4 Time: 1130 Fe 2+ mg/L: ND Time: 1130

Specific Cond. (uS): 1158 Time: 1130 Res. Cl (mg/L)/(µg/L): — Time: —

Sample pH (s.u.): 6.6 Time: 1130 Odor: NO Time: 1130

ReDox (mV): 115.3 Time: 1130 Appearance: CLEAR Time: 1130

ReDox (EH value):YSI ProPlus +200mV 315.3 Other: — Time: —

General/Weather Observations:

(sunny/cloudy/rainy) Temp. 64 (°F) Wind Calm (mph)

Sampler Signature: [signature] Date: 1-23-17

Stabilization Test

Time Purged	Temp. (°C)	Diss Oxy. (mg/L)	Spec. Cond. (uS)	pH (s.u.)	ReDox (mV)	Turbidity (ntu)	Volume removed (gallons/mls)	Water level (ft)	Other
1055	15.1	.74	1222	6.6	94.0	2.7	500	11.61	
1100	14.9	.9	1198	6.6	82.8	1.6	1000	11.70	
1105	14.9	1.7	1185	6.7	90.9	2.9	1500	11.77	
1110	14.9	1.7	1183	6.7	98.2	1.6	2000	11.81	
1115	15.0	1.4	1171	6.7	110.4	1.0	2500	11.82	

Client: CHARAH

Location: BRICKHAVEN

Project: BRICKHAVEN

Well ID: BG-1

Well Diameter	Multiplication Factor*
1	0.0408
1.2	0.0918
1.625	0.1080
2	0.1630
3	0.3670
4	0.6530
6	1.4680
8	2.6100

Stabilization Test

Time Purged	Temp. (°C)	Diss Oxy. (mg/L)	Spec. Cond. (uS)	pH (s.u.)	ReDox (mV)	Turbidity (ntu)	Volume Removed (gallons/mls) circle one	Water level (ft)	Other
1120	14.9	1.2	1165	6.6	114.2	3.8	3000	11.78	
1125	15.0	1.2	1159	6.6	116.3	2.5	3500	11.78	

Field Data Sheet

Client: Charah Location: Brick haven, NC Project #: Brickhaven

Name and Afiliation (Sampler(s)): WBT JFA - Pace Analytical

Name and Afiliation (Inspector): —

Well Information

Well ID: LST-E-SD LEACHATE Well Locked: (YES / NO)

Well Diameter: — Construction: (PVC/Steel/Stainless Steel)

Total Well Depth: — ft Multi Factor*: — [*(Radius/12)2 x 3.14 x 7.48]

Static Water Level: — ft Casing Volume: — gallons

Height of Water Column: — ft Cal. 3 Volumes: — gallons

Pump Intake: — ft

Purge Information

Date Purged: —/—/— Start : — Finish: — Purge Rate: —

Purging Method: — Total Volume Purged: — (gallons/mls)

Sampling Information

Date Collected: 1/23/16 Time Collected: 1357 (am/pm)

Sampling Equipment Used: Grab Instrument ID: YSI Pro Plus #2244

Bottle Type	Preservation	Analysis Required

Field Measurements/Observations

Sample Temp (°C): 16.0 Time: 1357 Turbidity (ntu): 165.1 Time: 1357

Diss Oxy (mg/L): 9.06 Time: 1357 Fe 2+ mg/L: 0.5 Time: 1357

Specific Cond. (uS): 1337 Time: 1357 Res. Cl (mg/L)/(µg/L): — Time: —

Sample pH (s.u.): 7.5 Time: 1357 Odor: no Time: 1357

ReDox (mV): 89.0 Time: 1357 Appearance: cloudy Time: 1357

ReDox (EH value):YSI ProPlus +200mV 289.0 Other: — Time: —

General/Weather Observations: —

(sunny/cloudy/rainy) Temp. 50 (°F) Wind 2 (mph)

Sampler Signature: Date: 1-23-17

Stabilization Test

Time Purged	Temp. (°C)	Diss Oxy. (mg/L)	Spec. Cond. (uS)	pH (s.u.)	ReDox (mV)	Turbidity (ntu)	Volume removed (gallons/mls)	Water level (ft)	Other
1357	16.0	9.06	1337	7.5	89.0	165.1	—	—	

Pace Analytical	Document Name: Field data Sheet	Date Issued: July 28, 2016 Page: 1 of 1
	Document Number: F-CAR-FLD-001-rev.01	Issuing Authority: Pace Huntersville Quality Office

Field Data Sheet

Client: CHARAH Location: BRICKHAVEN NC Project #: BRICKHAVEN

Name and Afiliation (Sampler(s): JF-PACE ANALYTICAL

Name and Afiliation (Inspector): NA

Well Information

Well ID: MW ~~2~~ 24 5 Well Locked: (YES / NO)

Well Diameter: 2 Construction: (PVC / Steel / Stainless Steel)

Total Well Depth: 46.96 ft Multi Factor*: .163 [*(Radius/12)2 x 3.14 x 7.48]

Static Water Level: 22.50 ft Casing Volume: 3.99 gallons

Height of Water Column: 24.46 ft Cal. 3 Volumes: 11.7 gallons

Pump Intake: 40.5 ft

Purge Information

Date Purged: 1/23/17 Start: 1440 Finish: 1455 Purge Rate: 100 V - 50

Purging Method: Peristaltic Total Volume Purged: 1600 (gallons / mls)

Sampling Information

Date Collected: 1/23/17 Time Collected: 1500 (am / pm)

Sampling Equipment Used: Peristaltic Instrument ID: YSI PRO PLUS 2244

Bottle Type	Preservation	Analysis Required

Field Measurements/Observations

Sample Temp (°C): 15.4 Time: 1500 Turbidity (ntu): 8.8 Time: 1500

Diss Oxy (mg/L): 0.7 Time: 1500 Fe 2+ mg/L: ND Time: 1500

Specific Cond. (uS): 312.4 Time: 1500 Res. Cl (mg/L)/(µg/L): — Time: —

Sample pH (s.u.): 6.8 Time: 1500 Odor: ND Time: 1500

ReDox (mV): 170.6 Time: 1500 Appearance: Cloudy Time: 1500

ReDox (EH value):YSI ProPlus +200mV 320.6 Other: — Time: —

General/Weather Observations: —

(sunny / cloudy / rainy) Temp. 55 (°F) Wind 2 (mph)

Sampler Signature: Willi Z Date: 1/23/17

Stabilization Test

Time Purged	Temp. (°C)	Diss Oxy. (mg/L)	Spec. Cond. (uS)	pH (s.u.)	ReDox (mV)	Turbidity (ntu)	Volume removed (gallons / mls)	Water level (ft)	Other
1440	16.0	0.8	339.1	6.9	106.7	16.3	400	23.25	
1445	15.8	0.6	328.4	6.9	114.9	8.4	800	23.4	
1450	15.7	0.6	319.7	6.9	116.6	7.2	1200	23.61	
1455	15.6	0.6	314.5	6.9	119.2	6.5	1600	23.84	

B

Appendix B – Laboratory Reports, Chains of Custody, & Quality Control Data

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

February 15, 2017

Sean Quarry
HDR Engineering
440 South Church Street
Suite 1000
Charlotte, NC 28202

RE: Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327477

Dear Sean Quarry:
Enclosed are the analytical results for sample(s) received by the laboratory on January 23, 2017. The results relate only to the samples included in this report. Results reported herein conform to the most current, applicable TNI/NELAC standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Kevin Godwin
kevin.godwin@pacelabs.com
Project Manager

Enclosures

cc: Mike Plummer, HDR

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CERTIFICATIONS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327477

Pennsylvania Certification IDs

1638 Roseytown Rd Suites 2,3&4, Greensburg, PA 15601
L-A-B DOD-ELAP Accreditation #: L2417
Alabama Certification #: 41590
Arizona Certification #: AZ0734
Arkansas Certification
California Certification #: 04222CA
Colorado Certification
Connecticut Certification #: PH-0694
Delaware Certification
Florida/TNI Certification #: E87683
Georgia Certification #: C040
Guam Certification
Hawaii Certification
Idaho Certification
Illinois Certification
Indiana Certification
Iowa Certification #: 391
Kansas/TNI Certification #: E-10358
Kentucky Certification #: 90133
Louisiana DHH/TNI Certification #: LA140008
Louisiana DEQ/TNI Certification #: 4086
Maine Certification #: PA00091
Maryland Certification #: 308
Massachusetts Certification #: M-PA1457
Michigan/PADEP Certification
Missouri Certification #: 235
Montana Certification #: Cert 0082
Nebraska Certification #: NE-05-29-14
Nevada Certification #: PA014572015-1
New Hampshire/TNI Certification #: 2976
New Jersey/TNI Certification #: PA 051
New Mexico Certification #: PA01457
New York/TNI Certification #: 10888
North Carolina Certification #: 42706
North Dakota Certification #: R-190
Oregon/TNI Certification #: PA200002
Pennsylvania/TNI Certification #: 65-00282
Puerto Rico Certification #: PA01457
Rhode Island Certification #: 65-00282
South Dakota Certification
Tennessee Certification #: TN2867
Texas/TNI Certification #: T104704188-14-8
Utah/TNI Certification #: PA014572015-5
USDA Soil Permit #: P330-14-00213
Vermont Dept. of Health: ID# VT-0282
Virgin Island/PADEP Certification
Virginia/VELAP Certification #: 460198
Washington Certification #: C868
West Virginia DEP Certification #: 143
West Virginia DHHR Certification #: 9964C
Wisconsin Certification
Wyoming Certification #: 8TMS-L

Charlotte Certification IDs

9800 Kincey Ave. Ste 100, Huntersville, NC 28078
North Carolina Drinking Water Certification #: 37706
North Carolina Field Services Certification #: 5342
North Carolina Wastewater Certification #: 12
South Carolina Certification #: 99006001
Florida/NELAP Certification #: E87627
Kentucky UST Certification #: 84
Virginia/VELAP Certification #: 460221

Asheville Certification IDs

2225 Riverside Drive, Asheville, NC 28804
Florida/NELAP Certification #: E87648
Massachusetts Certification #: M-NC030
North Carolina Drinking Water Certification #: 37712
North Carolina Wastewater Certification #: 40
South Carolina Certification #: 99030001
Virginia/VELAP Certification #: 460222

Greenwood Certification IDs

816 Durst Avenue East, Greenwood, SC 29649
South Carolina Laboratory ID #: 24562
North Carolina Divison of Water Resources Certification number 25
Florida Certification number E87633
Virginia VELAP ID: 460250
Asbestos NVLAP accreditation: 101410-0

REPORT OF LABORATORY ANALYSIS

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9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

SAMPLE SUMMARY

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327477

Lab ID	Sample ID	Matrix	Date Collected	Date Received
92327477001	**BG-1**	Water	01/23/17 11:30	01/23/17 17:45
92327477002	**LEACHATE**	Water	01/23/17 13:57	01/23/17 17:45
92327477003	**MW-5**	Water	01/23/17 15:00	01/23/17 17:45
92327477004	**EQ BLANK**	Water	01/23/17 17:00	01/23/17 17:45
92327477005	**AMB-BLANK**	Water	01/23/17 17:10	01/23/17 17:45
92327477006	**TRIP BLANK**	Water	01/23/17 00:00	01/23/17 17:45

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SAMPLE ANALYTE COUNT

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327477

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
92327477001	**BG-1**	EPA 300.0	EIC	3	PASI-W
		EPA 6010	SH1	16	PASI-A
		EPA 6020B	CDF	3	PASI-A
		EPA 7470	WAB	1	PASI-A
		EPA 8260	ZDO	48	PASI-C
		EPA 903.1	WRR	1	PASI-PA
		EPA 904.0	JJY	1	PASI-PA
		SM 2540C	MJS1	1	PASI-A
92327477002	**LEACHATE**	EPA 300.0	EIC	3	PASI-W
		EPA 6010	SH1	16	PASI-A
		EPA 6020B	CDF	3	PASI-A
		EPA 7470	WAB	1	PASI-A
		EPA 8260	ZDO	48	PASI-C
		EPA 903.1	WRR	1	PASI-PA
		EPA 904.0	JJY	1	PASI-PA
		SM 2540C	MJS1	1	PASI-A
92327477003	**MW-5**	EPA 300.0	EIC	3	PASI-W
		EPA 6010	SH1	16	PASI-A
		EPA 6020B	CDF	3	PASI-A
		EPA 7470	WAB	1	PASI-A
		EPA 8260	ZDO	48	PASI-C
		EPA 903.1	WRR	1	PASI-PA
		EPA 904.0	JJY	1	PASI-PA
		SM 2540C	MJS1	1	PASI-A
92327477004	**EQ BLANK**	EPA 300.0	EIC	3	PASI-W
		EPA 6010	SH1	16	PASI-A
		EPA 6020B	CDF	3	PASI-A
		EPA 7470	WAB	1	PASI-A
		EPA 8260	ZDO	48	PASI-C
		EPA 903.1	WRR	1	PASI-PA
		EPA 904.0	JJY	1	PASI-PA
		SM 2540C	MJS1	1	PASI-A
92327477005	**AMB-BLANK**	EPA 300.0	EIC	3	PASI-W
		EPA 6010	SH1	16	PASI-A
		EPA 6020B	CDF	3	PASI-A
		EPA 7470	WAB	1	PASI-A
		EPA 8260	ZDO	48	PASI-C

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SAMPLE ANALYTE COUNT

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327477

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
		EPA 903.1	WRR	1	PASI-PA
		EPA 904.0	JJY	1	PASI-PA
		SM 2540C	MJS1	1	PASI-A
92327477006	**TRIP BLANK**	EPA 8260	ZDO	48	PASI-C

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SUMMARY OF DETECTION

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327477

Lab Sample ID / Method	Client Sample ID / Parameters	Result	Units	Report Limit	Analyzed	Qualifiers
92327477001	**BG-1**					
EPA 300.0	Chloride	303	mg/L	6.0	01/26/17 23:11	
EPA 300.0	Fluoride	0.14	mg/L	0.10	01/26/17 18:12	M1
EPA 300.0	Sulfate	20.0	mg/L	1.0	01/26/17 18:12	
EPA 6010	Barium	321	ug/L	5.0	01/27/17 11:49	
EPA 6010	Calcium	28100	ug/L	100	01/27/17 11:49	
EPA 6010	Vanadium	5.3	ug/L	5.0	01/27/17 11:49	
EPA 6020B	Lithium	24.5	ug/L	2.5	01/27/17 13:51	
EPA 903.1	Radium-226	0.532 ± 0.498 (0.705) C:NA T:89%	pCi/L		02/15/17 11:43	
EPA 904.0	Radium-228	0.442 ± 0.459 (0.950) C:62% T:83%	pCi/L		02/13/17 12:12	
SM 2540C	Total Dissolved Solids	623	mg/L	25.0	01/25/17 18:57	
92327477002	**LEACHATE**					
EPA 300.0	Chloride	13.6	mg/L	1.0	01/26/17 19:06	
EPA 300.0	Fluoride	0.25	mg/L	0.10	01/26/17 19:06	
EPA 300.0	Sulfate	530	mg/L	11.0	01/27/17 00:23	
EPA 6010	Barium	203	ug/L	5.0	01/27/17 11:58	
EPA 6010	Calcium	228000	ug/L	1000	01/27/17 14:47	
EPA 6010	Cobalt	24.8	ug/L	5.0	01/27/17 11:58	
EPA 6010	Molybdenum	249	ug/L	5.0	01/27/17 11:58	
EPA 6010	Nickel	56.5	ug/L	5.0	01/27/17 11:58	
EPA 6010	Vanadium	20.5	ug/L	5.0	01/27/17 11:58	
EPA 6010	Zinc	39.8	ug/L	10.0	01/27/17 11:58	
EPA 6020B	Boron	2440	ug/L	500	01/27/17 15:23	
EPA 6020B	Lithium	80.7	ug/L	2.5	01/27/17 13:57	
EPA 6020B	Thallium	0.78	ug/L	0.10	01/27/17 13:57	
EPA 903.1	Radium-226	0.287 ± 0.446 (0.773) C:NA T:89%	pCi/L		02/15/17 11:43	
EPA 904.0	Radium-228	0.306 ± 0.440 (0.946) C:62% T:84%	pCi/L		02/13/17 12:12	
SM 2540C	Total Dissolved Solids	1060	mg/L	25.0	01/25/17 18:57	
92327477003	**MW-5**					
EPA 300.0	Chloride	18.2	mg/L	1.0	01/26/17 19:23	
EPA 300.0	Fluoride	0.52	mg/L	0.10	01/26/17 19:23	
EPA 300.0	Sulfate	3.7	mg/L	1.0	01/26/17 19:23	
EPA 6010	Barium	90.7	ug/L	5.0	01/27/17 12:01	
EPA 6010	Calcium	9140	ug/L	100	01/27/17 12:01	
EPA 6020B	Boron	39.3	ug/L	25.0	01/27/17 13:59	
EPA 6020B	Lithium	9.4	ug/L	2.5	01/27/17 13:59	

REPORT OF LABORATORY ANALYSIS

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(704)875-9092

SUMMARY OF DETECTION

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327477

Lab Sample ID / Method	Client Sample ID / Parameters	Result	Units	Report Limit	Analyzed	Qualifiers
92327477003	**MW-5**					
EPA 903.1	Radium-226	0.0732 ± 0.334 (0.539) C:NA T:89%	pCi/L		02/15/17 11:55	
EPA 904.0	Radium-228	1.08 ± 0.730 (1.42) C:51% T:78%	pCi/L		02/13/17 12:12	
SM 2540C	Total Dissolved Solids	220	mg/L	25.0	01/25/17 18:57	
92327477004	**EQ BLANK**					
EPA 903.1	Radium-226	0.000 ± 0.391 (0.631) C:NA T:81%	pCi/L		02/15/17 11:43	
EPA 904.0	Radium-228	0.142 ± 0.491 (1.11) C:59% T:80%	pCi/L		02/13/17 12:11	
92327477005	**AMB-BLANK**					
EPA 903.1	Radium-226	0.000 ± 0.663 (1.34) C:NA T:82%	pCi/L		02/15/17 11:43	
EPA 904.0	Radium-228	-0.0930 ± 0.469 (1.11) C:57% T:79%	pCi/L		02/13/17 12:12	
92327477006	**TRIP BLANK**					
EPA 8260	Methylene Chloride	1.7	ug/L	1.0	01/25/17 21:35	C9

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327477

Sample: BG-1 **Lab ID: 92327477001** Collected: 01/23/17 11:30 Received: 01/23/17 17:45 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
3000 IC Anions 28 Days, GWD	Analytical Method: EPA 300.0							
Chloride	**303**	mg/L	6.0	6		01/26/17 23:11	16887-00-6	
Fluoride	**0.14**	mg/L	0.10	1		01/26/17 18:12	16984-48-8	M1
Sulfate	**20.0**	mg/L	1.0	1		01/26/17 18:12	14808-79-8	
6010 MET ICP	Analytical Method: EPA 6010 Preparation Method: EPA 3010A							
Antimony	ND	ug/L	5.0	1	01/26/17 22:15	01/27/17 11:49	7440-36-0	
Arsenic	ND	ug/L	10.0	1	01/26/17 22:15	01/27/17 11:49	7440-38-2	
Barium	**321**	ug/L	5.0	1	01/26/17 22:15	01/27/17 11:49	7440-39-3	
Beryllium	ND	ug/L	1.0	1	01/26/17 22:15	01/27/17 11:49	7440-41-7	
Cadmium	ND	ug/L	1.0	1	01/26/17 22:15	01/27/17 11:49	7440-43-9	
Calcium	**28100**	ug/L	100	1	01/26/17 22:15	01/27/17 11:49	7440-70-2	
Chromium	ND	ug/L	5.0	1	01/26/17 22:15	01/27/17 11:49	7440-47-3	
Cobalt	ND	ug/L	5.0	1	01/26/17 22:15	01/27/17 11:49	7440-48-4	
Copper	ND	ug/L	5.0	1	01/26/17 22:15	01/27/17 11:49	7440-50-8	
Lead	ND	ug/L	5.0	1	01/26/17 22:15	01/27/17 11:49	7439-92-1	
Molybdenum	ND	ug/L	5.0	1	01/26/17 22:15	01/27/17 11:49	7439-98-7	
Nickel	ND	ug/L	5.0	1	01/26/17 22:15	01/27/17 11:49	7440-02-0	
Selenium	ND	ug/L	10.0	1	01/26/17 22:15	01/27/17 11:49	7782-49-2	
Silver	ND	ug/L	5.0	1	01/26/17 22:15	01/27/17 11:49	7440-22-4	
Vanadium	**5.3**	ug/L	5.0	1	01/26/17 22:15	01/27/17 11:49	7440-62-2	
Zinc	ND	ug/L	10.0	1	01/26/17 22:15	01/27/17 11:49	7440-66-6	
6020 MET ICPMS	Analytical Method: EPA 6020B Preparation Method: EPA 3010A							
Boron	ND	ug/L	25.0	1	01/26/17 17:55	01/27/17 13:51	7440-42-8	
Lithium	**24.5**	ug/L	2.5	1	01/26/17 17:55	01/27/17 13:51	7439-93-2	
Thallium	ND	ug/L	0.10	1	01/26/17 17:55	01/27/17 13:51	7440-28-0	
7470 Mercury	Analytical Method: EPA 7470 Preparation Method: EPA 7470							
Mercury	ND	ug/L	0.20	1	01/26/17 01:45	01/27/17 04:26	7439-97-6	
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
Acetone	ND	ug/L	25.0	1		01/25/17 19:50	67-64-1	
Acrylonitrile	ND	ug/L	10.0	1		01/25/17 19:50	107-13-1	
Benzene	ND	ug/L	1.0	1		01/25/17 19:50	71-43-2	
Bromochloromethane	ND	ug/L	1.0	1		01/25/17 19:50	74-97-5	
Bromodichloromethane	ND	ug/L	1.0	1		01/25/17 19:50	75-27-4	
Bromoform	ND	ug/L	1.0	1		01/25/17 19:50	75-25-2	
Bromomethane	ND	ug/L	2.0	1		01/25/17 19:50	74-83-9	
2-Butanone (MEK)	ND	ug/L	5.0	1		01/25/17 19:50	78-93-3	
Carbon disulfide	ND	ug/L	2.0	1		01/25/17 19:50	75-15-0	
Carbon tetrachloride	ND	ug/L	1.0	1		01/25/17 19:50	56-23-5	
Chlorobenzene	ND	ug/L	1.0	1		01/25/17 19:50	108-90-7	
Chloroethane	ND	ug/L	1.0	1		01/25/17 19:50	75-00-3	
Chloroform	ND	ug/L	1.0	1		01/25/17 19:50	67-66-3	
Chloromethane	ND	ug/L	1.0	1		01/25/17 19:50	74-87-3	
Dibromochloromethane	ND	ug/L	1.0	1		01/25/17 19:50	124-48-1	

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327477

Sample: BG-1 **Lab ID: 92327477001** Collected: 01/23/17 11:30 Received: 01/23/17 17:45 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
Dibromomethane	ND	ug/L	1.0	1		01/25/17 19:50	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	1.0	1		01/25/17 19:50	95-50-1	
1,4-Dichlorobenzene	ND	ug/L	1.0	1		01/25/17 19:50	106-46-7	
trans-1,4-Dichloro-2-butene	ND	ug/L	1.0	1		01/25/17 19:50	110-57-6	
1,1-Dichloroethane	ND	ug/L	1.0	1		01/25/17 19:50	75-34-3	
1,2-Dichloroethane	ND	ug/L	1.0	1		01/25/17 19:50	107-06-2	
1,1-Dichloroethene	ND	ug/L	1.0	1		01/25/17 19:50	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	1.0	1		01/25/17 19:50	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	1.0	1		01/25/17 19:50	156-60-5	
1,2-Dichloropropane	ND	ug/L	1.0	1		01/25/17 19:50	78-87-5	
cis-1,3-Dichloropropene	ND	ug/L	1.0	1		01/25/17 19:50	10061-01-5	
trans-1,3-Dichloropropene	ND	ug/L	1.0	1		01/25/17 19:50	10061-02-6	
Ethylbenzene	ND	ug/L	1.0	1		01/25/17 19:50	100-41-4	
2-Hexanone	ND	ug/L	5.0	1		01/25/17 19:50	591-78-6	
Iodomethane	ND	ug/L	5.0	1		01/25/17 19:50	74-88-4	
Methylene Chloride	ND	ug/L	1.0	1		01/25/17 19:50	75-09-2	
4-Methyl-2-pentanone (MIBK)	ND	ug/L	5.0	1		01/25/17 19:50	108-10-1	
Styrene	ND	ug/L	1.0	1		01/25/17 19:50	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0	1		01/25/17 19:50	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0	1		01/25/17 19:50	79-34-5	
Tetrachloroethene	ND	ug/L	1.0	1		01/25/17 19:50	127-18-4	
Toluene	ND	ug/L	1.0	1		01/25/17 19:50	108-88-3	
1,1,1-Trichloroethane	ND	ug/L	1.0	1		01/25/17 19:50	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	1.0	1		01/25/17 19:50	79-00-5	
Trichloroethene	ND	ug/L	1.0	1		01/25/17 19:50	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0	1		01/25/17 19:50	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0	1		01/25/17 19:50	96-18-4	
Vinyl acetate	ND	ug/L	2.0	1		01/25/17 19:50	108-05-4	
Vinyl chloride	ND	ug/L	1.0	1		01/25/17 19:50	75-01-4	
Xylene (Total)	ND	ug/L	1.0	1		01/25/17 19:50	1330-20-7	
Surrogates								
4-Bromofluorobenzene (S)	100	%	70-130	1		01/25/17 19:50	460-00-4	
1,2-Dichloroethane-d4 (S)	99	%	70-130	1		01/25/17 19:50	17060-07-0	
Toluene-d8 (S)	106	%	70-130	1		01/25/17 19:50	2037-26-5	
2540C Total Dissolved Solids	Analytical Method: SM 2540C							
Total Dissolved Solids	**623**	mg/L	25.0	1		01/25/17 18:57		

REPORT OF LABORATORY ANALYSIS

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9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

ANALYTICAL RESULTS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327477

Sample: LEACHATE **Lab ID: 92327477002** Collected: 01/23/17 13:57 Received: 01/23/17 17:45 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
3000 IC Anions 28 Days, GWD	Analytical Method: EPA 300.0							
Chloride	**13.6**	mg/L	1.0	1		01/26/17 19:06	16887-00-6	
Fluoride	**0.25**	mg/L	0.10	1		01/26/17 19:06	16984-48-8	
Sulfate	**530**	mg/L	11.0	11		01/27/17 00:23	14808-79-8	
6010 MET ICP	Analytical Method: EPA 6010 Preparation Method: EPA 3010A							
Antimony	ND	ug/L	5.0	1	01/26/17 22:15	01/27/17 11:58	7440-36-0	
Arsenic	ND	ug/L	10.0	1	01/26/17 22:15	01/27/17 11:58	7440-38-2	
Barium	**203**	ug/L	5.0	1	01/26/17 22:15	01/27/17 11:58	7440-39-3	
Beryllium	ND	ug/L	1.0	1	01/26/17 22:15	01/27/17 11:58	7440-41-7	
Cadmium	ND	ug/L	1.0	1	01/26/17 22:15	01/27/17 11:58	7440-43-9	
Calcium	**228000**	ug/L	1000	10	01/26/17 22:15	01/27/17 14:47	7440-70-2	
Chromium	ND	ug/L	5.0	1	01/26/17 22:15	01/27/17 11:58	7440-47-3	
Cobalt	**24.8**	ug/L	5.0	1	01/26/17 22:15	01/27/17 11:58	7440-48-4	
Copper	ND	ug/L	5.0	1	01/26/17 22:15	01/27/17 11:58	7440-50-8	
Lead	ND	ug/L	5.0	1	01/26/17 22:15	01/27/17 11:58	7439-92-1	
Molybdenum	**249**	ug/L	5.0	1	01/26/17 22:15	01/27/17 11:58	7439-98-7	
Nickel	**56.5**	ug/L	5.0	1	01/26/17 22:15	01/27/17 11:58	7440-02-0	
Selenium	ND	ug/L	10.0	1	01/26/17 22:15	01/27/17 11:58	7782-49-2	
Silver	ND	ug/L	5.0	1	01/26/17 22:15	01/27/17 11:58	7440-22-4	
Vanadium	**20.5**	ug/L	5.0	1	01/26/17 22:15	01/27/17 11:58	7440-62-2	
Zinc	**39.8**	ug/L	10.0	1	01/26/17 22:15	01/27/17 11:58	7440-66-6	
6020 MET ICPMS	Analytical Method: EPA 6020B Preparation Method: EPA 3010A							
Boron	**2440**	ug/L	500	20	01/26/17 17:55	01/27/17 15:23	7440-42-8	
Lithium	**80.7**	ug/L	2.5	1	01/26/17 17:55	01/27/17 13:57	7439-93-2	
Thallium	**0.78**	ug/L	0.10	1	01/26/17 17:55	01/27/17 13:57	7440-28-0	
7470 Mercury	Analytical Method: EPA 7470 Preparation Method: EPA 7470							
Mercury	ND	ug/L	0.20	1	01/26/17 01:45	01/27/17 04:37	7439-97-6	
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
Acetone	ND	ug/L	25.0	1		01/25/17 20:08	67-64-1	
Acrylonitrile	ND	ug/L	10.0	1		01/25/17 20:08	107-13-1	
Benzene	ND	ug/L	1.0	1		01/25/17 20:08	71-43-2	
Bromochloromethane	ND	ug/L	1.0	1		01/25/17 20:08	74-97-5	
Bromodichloromethane	ND	ug/L	1.0	1		01/25/17 20:08	75-27-4	
Bromoform	ND	ug/L	1.0	1		01/25/17 20:08	75-25-2	
Bromomethane	ND	ug/L	2.0	1		01/25/17 20:08	74-83-9	M1
2-Butanone (MEK)	ND	ug/L	5.0	1		01/25/17 20:08	78-93-3	
Carbon disulfide	ND	ug/L	2.0	1		01/25/17 20:08	75-15-0	M1
Carbon tetrachloride	ND	ug/L	1.0	1		01/25/17 20:08	56-23-5	
Chlorobenzene	ND	ug/L	1.0	1		01/25/17 20:08	108-90-7	
Chloroethane	ND	ug/L	1.0	1		01/25/17 20:08	75-00-3	M1
Chloroform	ND	ug/L	1.0	1		01/25/17 20:08	67-66-3	
Chloromethane	ND	ug/L	1.0	1		01/25/17 20:08	74-87-3	M1
Dibromochloromethane	ND	ug/L	1.0	1		01/25/17 20:08	124-48-1	

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ANALYTICAL RESULTS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327477

Sample: LEACHATE **Lab ID: 92327477002** Collected: 01/23/17 13:57 Received: 01/23/17 17:45 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
Dibromomethane	ND	ug/L	1.0	1		01/25/17 20:08	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	1.0	1		01/25/17 20:08	95-50-1	
1,4-Dichlorobenzene	ND	ug/L	1.0	1		01/25/17 20:08	106-46-7	
trans-1,4-Dichloro-2-butene	ND	ug/L	1.0	1		01/25/17 20:08	110-57-6	
1,1-Dichloroethane	ND	ug/L	1.0	1		01/25/17 20:08	75-34-3	
1,2-Dichloroethane	ND	ug/L	1.0	1		01/25/17 20:08	107-06-2	
1,1-Dichloroethene	ND	ug/L	1.0	1		01/25/17 20:08	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	1.0	1		01/25/17 20:08	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	1.0	1		01/25/17 20:08	156-60-5	
1,2-Dichloropropane	ND	ug/L	1.0	1		01/25/17 20:08	78-87-5	
cis-1,3-Dichloropropene	ND	ug/L	1.0	1		01/25/17 20:08	10061-01-5	
trans-1,3-Dichloropropene	ND	ug/L	1.0	1		01/25/17 20:08	10061-02-6	
Ethylbenzene	ND	ug/L	1.0	1		01/25/17 20:08	100-41-4	
2-Hexanone	ND	ug/L	5.0	1		01/25/17 20:08	591-78-6	
Iodomethane	ND	ug/L	5.0	1		01/25/17 20:08	74-88-4	
Methylene Chloride	ND	ug/L	1.0	1		01/25/17 20:08	75-09-2	
4-Methyl-2-pentanone (MIBK)	ND	ug/L	5.0	1		01/25/17 20:08	108-10-1	
Styrene	ND	ug/L	1.0	1		01/25/17 20:08	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0	1		01/25/17 20:08	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0	1		01/25/17 20:08	79-34-5	
Tetrachloroethene	ND	ug/L	1.0	1		01/25/17 20:08	127-18-4	
Toluene	ND	ug/L	1.0	1		01/25/17 20:08	108-88-3	
1,1,1-Trichloroethane	ND	ug/L	1.0	1		01/25/17 20:08	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	1.0	1		01/25/17 20:08	79-00-5	
Trichloroethene	ND	ug/L	1.0	1		01/25/17 20:08	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0	1		01/25/17 20:08	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0	1		01/25/17 20:08	96-18-4	
Vinyl acetate	ND	ug/L	2.0	1		01/25/17 20:08	108-05-4	
Vinyl chloride	ND	ug/L	1.0	1		01/25/17 20:08	75-01-4	
Xylene (Total)	ND	ug/L	1.0	1		01/25/17 20:08	1330-20-7	
Surrogates								
4-Bromofluorobenzene (S)	99	%	70-130	1		01/25/17 20:08	460-00-4	
1,2-Dichloroethane-d4 (S)	97	%	70-130	1		01/25/17 20:08	17060-07-0	
Toluene-d8 (S)	106	%	70-130	1		01/25/17 20:08	2037-26-5	
2540C Total Dissolved Solids	Analytical Method: SM 2540C							
Total Dissolved Solids	**1060**	mg/L	25.0	1		01/25/17 18:57		

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(704)875-9092

ANALYTICAL RESULTS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327477

Sample: MW-5 **Lab ID: 92327477003** Collected: 01/23/17 15:00 Received: 01/23/17 17:45 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
3000 IC Anions 28 Days, GWD	Analytical Method: EPA 300.0							
Chloride	**18.2**	mg/L	1.0	1		01/26/17 19:23	16887-00-6	
Fluoride	**0.52**	mg/L	0.10	1		01/26/17 19:23	16984-48-8	
Sulfate	**3.7**	mg/L	1.0	1		01/26/17 19:23	14808-79-8	
6010 MET ICP	Analytical Method: EPA 6010 Preparation Method: EPA 3010A							
Antimony	ND	ug/L	5.0	1	01/26/17 22:15	01/27/17 12:01	7440-36-0	
Arsenic	ND	ug/L	10.0	1	01/26/17 22:15	01/27/17 12:01	7440-38-2	
Barium	**90.7**	ug/L	5.0	1	01/26/17 22:15	01/27/17 12:01	7440-39-3	
Beryllium	ND	ug/L	1.0	1	01/26/17 22:15	01/27/17 12:01	7440-41-7	
Cadmium	ND	ug/L	1.0	1	01/26/17 22:15	01/27/17 12:01	7440-43-9	
Calcium	**9140**	ug/L	100	1	01/26/17 22:15	01/27/17 12:01	7440-70-2	
Chromium	ND	ug/L	5.0	1	01/26/17 22:15	01/27/17 12:01	7440-47-3	
Cobalt	ND	ug/L	5.0	1	01/26/17 22:15	01/27/17 12:01	7440-48-4	
Copper	ND	ug/L	5.0	1	01/26/17 22:15	01/27/17 12:01	7440-50-8	
Lead	ND	ug/L	5.0	1	01/26/17 22:15	01/27/17 12:01	7439-92-1	
Molybdenum	ND	ug/L	5.0	1	01/26/17 22:15	01/27/17 12:01	7439-98-7	
Nickel	ND	ug/L	5.0	1	01/26/17 22:15	01/27/17 12:01	7440-02-0	
Selenium	ND	ug/L	10.0	1	01/26/17 22:15	01/27/17 12:01	7782-49-2	
Silver	ND	ug/L	5.0	1	01/26/17 22:15	01/27/17 12:01	7440-22-4	
Vanadium	ND	ug/L	5.0	1	01/26/17 22:15	01/27/17 12:01	7440-62-2	
Zinc	ND	ug/L	10.0	1	01/26/17 22:15	01/27/17 12:01	7440-66-6	
6020 MET ICPMS	Analytical Method: EPA 6020B Preparation Method: EPA 3010A							
Boron	**39.3**	ug/L	25.0	1	01/26/17 17:55	01/27/17 13:59	7440-42-8	
Lithium	**9.4**	ug/L	2.5	1	01/26/17 17:55	01/27/17 13:59	7439-93-2	
Thallium	ND	ug/L	0.10	1	01/26/17 17:55	01/27/17 13:59	7440-28-0	
7470 Mercury	Analytical Method: EPA 7470 Preparation Method: EPA 7470							
Mercury	ND	ug/L	0.20	1	01/26/17 01:45	01/27/17 04:40	7439-97-6	
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
Acetone	ND	ug/L	25.0	1		01/25/17 20:25	67-64-1	
Acrylonitrile	ND	ug/L	10.0	1		01/25/17 20:25	107-13-1	
Benzene	ND	ug/L	1.0	1		01/25/17 20:25	71-43-2	
Bromochloromethane	ND	ug/L	1.0	1		01/25/17 20:25	74-97-5	
Bromodichloromethane	ND	ug/L	1.0	1		01/25/17 20:25	75-27-4	
Bromoform	ND	ug/L	1.0	1		01/25/17 20:25	75-25-2	
Bromomethane	ND	ug/L	2.0	1		01/25/17 20:25	74-83-9	
2-Butanone (MEK)	ND	ug/L	5.0	1		01/25/17 20:25	78-93-3	
Carbon disulfide	ND	ug/L	2.0	1		01/25/17 20:25	75-15-0	
Carbon tetrachloride	ND	ug/L	1.0	1		01/25/17 20:25	56-23-5	
Chlorobenzene	ND	ug/L	1.0	1		01/25/17 20:25	108-90-7	
Chloroethane	ND	ug/L	1.0	1		01/25/17 20:25	75-00-3	
Chloroform	ND	ug/L	1.0	1		01/25/17 20:25	67-66-3	
Chloromethane	ND	ug/L	1.0	1		01/25/17 20:25	74-87-3	
Dibromochloromethane	ND	ug/L	1.0	1		01/25/17 20:25	124-48-1	

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ANALYTICAL RESULTS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327477

Sample: MW-5 **Lab ID: 92327477003** Collected: 01/23/17 15:00 Received: 01/23/17 17:45 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
Dibromomethane	ND	ug/L	1.0	1		01/25/17 20:25	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	1.0	1		01/25/17 20:25	95-50-1	
1,4-Dichlorobenzene	ND	ug/L	1.0	1		01/25/17 20:25	106-46-7	
trans-1,4-Dichloro-2-butene	ND	ug/L	1.0	1		01/25/17 20:25	110-57-6	
1,1-Dichloroethane	ND	ug/L	1.0	1		01/25/17 20:25	75-34-3	
1,2-Dichloroethane	ND	ug/L	1.0	1		01/25/17 20:25	107-06-2	
1,1-Dichloroethene	ND	ug/L	1.0	1		01/25/17 20:25	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	1.0	1		01/25/17 20:25	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	1.0	1		01/25/17 20:25	156-60-5	
1,2-Dichloropropane	ND	ug/L	1.0	1		01/25/17 20:25	78-87-5	
cis-1,3-Dichloropropene	ND	ug/L	1.0	1		01/25/17 20:25	10061-01-5	
trans-1,3-Dichloropropene	ND	ug/L	1.0	1		01/25/17 20:25	10061-02-6	
Ethylbenzene	ND	ug/L	1.0	1		01/25/17 20:25	100-41-4	
2-Hexanone	ND	ug/L	5.0	1		01/25/17 20:25	591-78-6	
Iodomethane	ND	ug/L	5.0	1		01/25/17 20:25	74-88-4	
Methylene Chloride	ND	ug/L	1.0	1		01/25/17 20:25	75-09-2	
4-Methyl-2-pentanone (MIBK)	ND	ug/L	5.0	1		01/25/17 20:25	108-10-1	
Styrene	ND	ug/L	1.0	1		01/25/17 20:25	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0	1		01/25/17 20:25	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0	1		01/25/17 20:25	79-34-5	
Tetrachloroethene	ND	ug/L	1.0	1		01/25/17 20:25	127-18-4	
Toluene	ND	ug/L	1.0	1		01/25/17 20:25	108-88-3	
1,1,1-Trichloroethane	ND	ug/L	1.0	1		01/25/17 20:25	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	1.0	1		01/25/17 20:25	79-00-5	
Trichloroethene	ND	ug/L	1.0	1		01/25/17 20:25	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0	1		01/25/17 20:25	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0	1		01/25/17 20:25	96-18-4	
Vinyl acetate	ND	ug/L	2.0	1		01/25/17 20:25	108-05-4	
Vinyl chloride	ND	ug/L	1.0	1		01/25/17 20:25	75-01-4	
Xylene (Total)	ND	ug/L	1.0	1		01/25/17 20:25	1330-20-7	
Surrogates								
4-Bromofluorobenzene (S)	98	%	70-130	1		01/25/17 20:25	460-00-4	
1,2-Dichloroethane-d4 (S)	98	%	70-130	1		01/25/17 20:25	17060-07-0	
Toluene-d8 (S)	107	%	70-130	1		01/25/17 20:25	2037-26-5	
2540C Total Dissolved Solids	Analytical Method: SM 2540C							
Total Dissolved Solids	**220**	mg/L	25.0	1		01/25/17 18:57		

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Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

ANALYTICAL RESULTS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327477

Sample: EQ BLANK **Lab ID: 92327477004** Collected: 01/23/17 17:00 Received: 01/23/17 17:45 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
3000 IC Anions 28 Days, GWD	Analytical Method: EPA 300.0							
Chloride	ND	mg/L	1.0	1		01/26/17 19:41	16887-00-6	
Fluoride	ND	mg/L	0.10	1		01/26/17 19:41	16984-48-8	
Sulfate	ND	mg/L	1.0	1		01/26/17 19:41	14808-79-8	
6010 MET ICP	Analytical Method: EPA 6010 Preparation Method: EPA 3010A							
Antimony	ND	ug/L	5.0	1	01/26/17 22:15	01/27/17 12:04	7440-36-0	
Arsenic	ND	ug/L	10.0	1	01/26/17 22:15	01/27/17 12:04	7440-38-2	
Barium	ND	ug/L	5.0	1	01/26/17 22:15	01/27/17 12:04	7440-39-3	
Beryllium	ND	ug/L	1.0	1	01/26/17 22:15	01/27/17 12:04	7440-41-7	
Cadmium	ND	ug/L	1.0	1	01/26/17 22:15	01/27/17 12:04	7440-43-9	
Calcium	ND	ug/L	100	1	01/26/17 22:15	01/27/17 12:04	7440-70-2	
Chromium	ND	ug/L	5.0	1	01/26/17 22:15	01/27/17 12:04	7440-47-3	
Cobalt	ND	ug/L	5.0	1	01/26/17 22:15	01/27/17 12:04	7440-48-4	
Copper	ND	ug/L	5.0	1	01/26/17 22:15	01/27/17 12:04	7440-50-8	
Lead	ND	ug/L	5.0	1	01/26/17 22:15	01/27/17 12:04	7439-92-1	
Molybdenum	ND	ug/L	5.0	1	01/26/17 22:15	01/27/17 12:04	7439-98-7	
Nickel	ND	ug/L	5.0	1	01/26/17 22:15	01/27/17 12:04	7440-02-0	
Selenium	ND	ug/L	10.0	1	01/26/17 22:15	01/27/17 12:04	7782-49-2	
Silver	ND	ug/L	5.0	1	01/26/17 22:15	01/27/17 12:04	7440-22-4	
Vanadium	ND	ug/L	5.0	1	01/26/17 22:15	01/27/17 12:04	7440-62-2	
Zinc	ND	ug/L	10.0	1	01/26/17 22:15	01/27/17 12:04	7440-66-6	
6020 MET ICPMS	Analytical Method: EPA 6020B Preparation Method: EPA 3010A							
Boron	ND	ug/L	25.0	1	01/26/17 17:55	01/27/17 14:01	7440-42-8	
Lithium	ND	ug/L	2.5	1	01/26/17 17:55	01/27/17 14:01	7439-93-2	
Thallium	ND	ug/L	0.10	1	01/26/17 17:55	01/27/17 14:01	7440-28-0	
7470 Mercury	Analytical Method: EPA 7470 Preparation Method: EPA 7470							
Mercury	ND	ug/L	0.20	1	01/26/17 01:45	01/27/17 04:42	7439-97-6	
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
Acetone	ND	ug/L	25.0	1		01/25/17 21:00	67-64-1	
Acrylonitrile	ND	ug/L	10.0	1		01/25/17 21:00	107-13-1	
Benzene	ND	ug/L	1.0	1		01/25/17 21:00	71-43-2	
Bromochloromethane	ND	ug/L	1.0	1		01/25/17 21:00	74-97-5	
Bromodichloromethane	ND	ug/L	1.0	1		01/25/17 21:00	75-27-4	
Bromoform	ND	ug/L	1.0	1		01/25/17 21:00	75-25-2	
Bromomethane	ND	ug/L	2.0	1		01/25/17 21:00	74-83-9	
2-Butanone (MEK)	ND	ug/L	5.0	1		01/25/17 21:00	78-93-3	
Carbon disulfide	ND	ug/L	2.0	1		01/25/17 21:00	75-15-0	
Carbon tetrachloride	ND	ug/L	1.0	1		01/25/17 21:00	56-23-5	
Chlorobenzene	ND	ug/L	1.0	1		01/25/17 21:00	108-90-7	
Chloroethane	ND	ug/L	1.0	1		01/25/17 21:00	75-00-3	
Chloroform	ND	ug/L	1.0	1		01/25/17 21:00	67-66-3	
Chloromethane	ND	ug/L	1.0	1		01/25/17 21:00	74-87-3	
Dibromochloromethane	ND	ug/L	1.0	1		01/25/17 21:00	124-48-1	

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327477

Sample: EQ BLANK **Lab ID: 92327477004** Collected: 01/23/17 17:00 Received: 01/23/17 17:45 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
Dibromomethane	ND	ug/L	1.0	1		01/25/17 21:00	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	1.0	1		01/25/17 21:00	95-50-1	
1,4-Dichlorobenzene	ND	ug/L	1.0	1		01/25/17 21:00	106-46-7	
trans-1,4-Dichloro-2-butene	ND	ug/L	1.0	1		01/25/17 21:00	110-57-6	
1,1-Dichloroethane	ND	ug/L	1.0	1		01/25/17 21:00	75-34-3	
1,2-Dichloroethane	ND	ug/L	1.0	1		01/25/17 21:00	107-06-2	
1,1-Dichloroethene	ND	ug/L	1.0	1		01/25/17 21:00	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	1.0	1		01/25/17 21:00	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	1.0	1		01/25/17 21:00	156-60-5	
1,2-Dichloropropane	ND	ug/L	1.0	1		01/25/17 21:00	78-87-5	
cis-1,3-Dichloropropene	ND	ug/L	1.0	1		01/25/17 21:00	10061-01-5	
trans-1,3-Dichloropropene	ND	ug/L	1.0	1		01/25/17 21:00	10061-02-6	
Ethylbenzene	ND	ug/L	1.0	1		01/25/17 21:00	100-41-4	
2-Hexanone	ND	ug/L	5.0	1		01/25/17 21:00	591-78-6	
Iodomethane	ND	ug/L	5.0	1		01/25/17 21:00	74-88-4	
Methylene Chloride	ND	ug/L	1.0	1		01/25/17 21:00	75-09-2	
4-Methyl-2-pentanone (MIBK)	ND	ug/L	5.0	1		01/25/17 21:00	108-10-1	
Styrene	ND	ug/L	1.0	1		01/25/17 21:00	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0	1		01/25/17 21:00	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0	1		01/25/17 21:00	79-34-5	
Tetrachloroethene	ND	ug/L	1.0	1		01/25/17 21:00	127-18-4	
Toluene	ND	ug/L	1.0	1		01/25/17 21:00	108-88-3	
1,1,1-Trichloroethane	ND	ug/L	1.0	1		01/25/17 21:00	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	1.0	1		01/25/17 21:00	79-00-5	
Trichloroethene	ND	ug/L	1.0	1		01/25/17 21:00	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0	1		01/25/17 21:00	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0	1		01/25/17 21:00	96-18-4	
Vinyl acetate	ND	ug/L	2.0	1		01/25/17 21:00	108-05-4	
Vinyl chloride	ND	ug/L	1.0	1		01/25/17 21:00	75-01-4	
Xylene (Total)	ND	ug/L	1.0	1		01/25/17 21:00	1330-20-7	
Surrogates								
4-Bromofluorobenzene (S)	100	%	70-130	1		01/25/17 21:00	460-00-4	
1,2-Dichloroethane-d4 (S)	96	%	70-130	1		01/25/17 21:00	17060-07-0	
Toluene-d8 (S)	104	%	70-130	1		01/25/17 21:00	2037-26-5	
2540C Total Dissolved Solids	Analytical Method: SM 2540C							
Total Dissolved Solids	ND	mg/L	25.0	1		01/25/17 18:58		

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(704)875-9092

ANALYTICAL RESULTS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327477

Sample: AMB-BLANK **Lab ID: 92327477005** Collected: 01/23/17 17:10 Received: 01/23/17 17:45 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
3000 IC Anions 28 Days, GWD	Analytical Method: EPA 300.0							
Chloride	ND	mg/L	1.0	1		01/26/17 19:59	16887-00-6	
Fluoride	ND	mg/L	0.10	1		01/26/17 19:59	16984-48-8	
Sulfate	ND	mg/L	1.0	1		01/26/17 19:59	14808-79-8	
6010 MET ICP	Analytical Method: EPA 6010 Preparation Method: EPA 3010A							
Antimony	ND	ug/L	5.0	1	01/26/17 22:15	01/27/17 12:07	7440-36-0	
Arsenic	ND	ug/L	10.0	1	01/26/17 22:15	01/27/17 12:07	7440-38-2	
Barium	ND	ug/L	5.0	1	01/26/17 22:15	01/27/17 12:07	7440-39-3	
Beryllium	ND	ug/L	1.0	1	01/26/17 22:15	01/27/17 12:07	7440-41-7	
Cadmium	ND	ug/L	1.0	1	01/26/17 22:15	01/27/17 12:07	7440-43-9	
Calcium	ND	ug/L	100	1	01/26/17 22:15	01/27/17 12:07	7440-70-2	
Chromium	ND	ug/L	5.0	1	01/26/17 22:15	01/27/17 12:07	7440-47-3	
Cobalt	ND	ug/L	5.0	1	01/26/17 22:15	01/27/17 12:07	7440-48-4	
Copper	ND	ug/L	5.0	1	01/26/17 22:15	01/27/17 12:07	7440-50-8	
Lead	ND	ug/L	5.0	1	01/26/17 22:15	01/27/17 12:07	7439-92-1	
Molybdenum	ND	ug/L	5.0	1	01/26/17 22:15	01/27/17 12:07	7439-98-7	
Nickel	ND	ug/L	5.0	1	01/26/17 22:15	01/27/17 12:07	7440-02-0	
Selenium	ND	ug/L	10.0	1	01/26/17 22:15	01/27/17 12:07	7782-49-2	
Silver	ND	ug/L	5.0	1	01/26/17 22:15	01/27/17 12:07	7440-22-4	
Vanadium	ND	ug/L	5.0	1	01/26/17 22:15	01/27/17 12:07	7440-62-2	
Zinc	ND	ug/L	10.0	1	01/26/17 22:15	01/27/17 12:07	7440-66-6	
6020 MET ICPMS	Analytical Method: EPA 6020B Preparation Method: EPA 3010A							
Boron	ND	ug/L	25.0	1	01/26/17 17:55	01/27/17 14:03	7440-42-8	
Lithium	ND	ug/L	2.5	1	01/26/17 17:55	01/27/17 14:03	7439-93-2	
Thallium	ND	ug/L	0.10	1	01/26/17 17:55	01/27/17 14:03	7440-28-0	
7470 Mercury	Analytical Method: EPA 7470 Preparation Method: EPA 7470							
Mercury	ND	ug/L	0.20	1	01/26/17 01:45	01/27/17 04:45	7439-97-6	
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
Acetone	ND	ug/L	25.0	1		01/25/17 21:18	67-64-1	
Acrylonitrile	ND	ug/L	10.0	1		01/25/17 21:18	107-13-1	
Benzene	ND	ug/L	1.0	1		01/25/17 21:18	71-43-2	
Bromochloromethane	ND	ug/L	1.0	1		01/25/17 21:18	74-97-5	
Bromodichloromethane	ND	ug/L	1.0	1		01/25/17 21:18	75-27-4	
Bromoform	ND	ug/L	1.0	1		01/25/17 21:18	75-25-2	
Bromomethane	ND	ug/L	2.0	1		01/25/17 21:18	74-83-9	
2-Butanone (MEK)	ND	ug/L	5.0	1		01/25/17 21:18	78-93-3	
Carbon disulfide	ND	ug/L	2.0	1		01/25/17 21:18	75-15-0	
Carbon tetrachloride	ND	ug/L	1.0	1		01/25/17 21:18	56-23-5	
Chlorobenzene	ND	ug/L	1.0	1		01/25/17 21:18	108-90-7	
Chloroethane	ND	ug/L	1.0	1		01/25/17 21:18	75-00-3	
Chloroform	ND	ug/L	1.0	1		01/25/17 21:18	67-66-3	
Chloromethane	ND	ug/L	1.0	1		01/25/17 21:18	74-87-3	
Dibromochloromethane	ND	ug/L	1.0	1		01/25/17 21:18	124-48-1	

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ANALYTICAL RESULTS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327477

Sample: AMB-BLANK **Lab ID: 92327477005** Collected: 01/23/17 17:10 Received: 01/23/17 17:45 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
Dibromomethane	ND	ug/L	1.0	1		01/25/17 21:18	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	1.0	1		01/25/17 21:18	95-50-1	
1,4-Dichlorobenzene	ND	ug/L	1.0	1		01/25/17 21:18	106-46-7	
trans-1,4-Dichloro-2-butene	ND	ug/L	1.0	1		01/25/17 21:18	110-57-6	
1,1-Dichloroethane	ND	ug/L	1.0	1		01/25/17 21:18	75-34-3	
1,2-Dichloroethane	ND	ug/L	1.0	1		01/25/17 21:18	107-06-2	
1,1-Dichloroethene	ND	ug/L	1.0	1		01/25/17 21:18	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	1.0	1		01/25/17 21:18	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	1.0	1		01/25/17 21:18	156-60-5	
1,2-Dichloropropane	ND	ug/L	1.0	1		01/25/17 21:18	78-87-5	
cis-1,3-Dichloropropene	ND	ug/L	1.0	1		01/25/17 21:18	10061-01-5	
trans-1,3-Dichloropropene	ND	ug/L	1.0	1		01/25/17 21:18	10061-02-6	
Ethylbenzene	ND	ug/L	1.0	1		01/25/17 21:18	100-41-4	
2-Hexanone	ND	ug/L	5.0	1		01/25/17 21:18	591-78-6	
Iodomethane	ND	ug/L	5.0	1		01/25/17 21:18	74-88-4	
Methylene Chloride	ND	ug/L	1.0	1		01/25/17 21:18	75-09-2	
4-Methyl-2-pentanone (MIBK)	ND	ug/L	5.0	1		01/25/17 21:18	108-10-1	
Styrene	ND	ug/L	1.0	1		01/25/17 21:18	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0	1		01/25/17 21:18	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0	1		01/25/17 21:18	79-34-5	
Tetrachloroethene	ND	ug/L	1.0	1		01/25/17 21:18	127-18-4	
Toluene	ND	ug/L	1.0	1		01/25/17 21:18	108-88-3	
1,1,1-Trichloroethane	ND	ug/L	1.0	1		01/25/17 21:18	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	1.0	1		01/25/17 21:18	79-00-5	
Trichloroethene	ND	ug/L	1.0	1		01/25/17 21:18	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0	1		01/25/17 21:18	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0	1		01/25/17 21:18	96-18-4	
Vinyl acetate	ND	ug/L	2.0	1		01/25/17 21:18	108-05-4	
Vinyl chloride	ND	ug/L	1.0	1		01/25/17 21:18	75-01-4	
Xylene (Total)	ND	ug/L	1.0	1		01/25/17 21:18	1330-20-7	
Surrogates								
4-Bromofluorobenzene (S)	98	%	70-130	1		01/25/17 21:18	460-00-4	
1,2-Dichloroethane-d4 (S)	99	%	70-130	1		01/25/17 21:18	17060-07-0	
Toluene-d8 (S)	106	%	70-130	1		01/25/17 21:18	2037-26-5	
2540C Total Dissolved Solids	Analytical Method: SM 2540C							
Total Dissolved Solids	ND	mg/L	25.0	1		01/25/17 18:58		

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ANALYTICAL RESULTS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327477

Sample: TRIP BLANK **Lab ID: 92327477006** Collected: 01/23/17 00:00 Received: 01/23/17 17:45 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
Acetone	ND	ug/L	25.0	1		01/25/17 21:35	67-64-1	
Acrylonitrile	ND	ug/L	10.0	1		01/25/17 21:35	107-13-1	
Benzene	ND	ug/L	1.0	1		01/25/17 21:35	71-43-2	
Bromochloromethane	ND	ug/L	1.0	1		01/25/17 21:35	74-97-5	
Bromodichloromethane	ND	ug/L	1.0	1		01/25/17 21:35	75-27-4	
Bromoform	ND	ug/L	1.0	1		01/25/17 21:35	75-25-2	
Bromomethane	ND	ug/L	2.0	1		01/25/17 21:35	74-83-9	
2-Butanone (MEK)	ND	ug/L	5.0	1		01/25/17 21:35	78-93-3	
Carbon disulfide	ND	ug/L	2.0	1		01/25/17 21:35	75-15-0	
Carbon tetrachloride	ND	ug/L	1.0	1		01/25/17 21:35	56-23-5	
Chlorobenzene	ND	ug/L	1.0	1		01/25/17 21:35	108-90-7	
Chloroethane	ND	ug/L	1.0	1		01/25/17 21:35	75-00-3	
Chloroform	ND	ug/L	1.0	1		01/25/17 21:35	67-66-3	
Chloromethane	ND	ug/L	1.0	1		01/25/17 21:35	74-87-3	
Dibromochloromethane	ND	ug/L	1.0	1		01/25/17 21:35	124-48-1	
Dibromomethane	ND	ug/L	1.0	1		01/25/17 21:35	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	1.0	1		01/25/17 21:35	95-50-1	
1,4-Dichlorobenzene	ND	ug/L	1.0	1		01/25/17 21:35	106-46-7	
trans-1,4-Dichloro-2-butene	ND	ug/L	1.0	1		01/25/17 21:35	110-57-6	
1,1-Dichloroethane	ND	ug/L	1.0	1		01/25/17 21:35	75-34-3	
1,2-Dichloroethane	ND	ug/L	1.0	1		01/25/17 21:35	107-06-2	
1,1-Dichloroethene	ND	ug/L	1.0	1		01/25/17 21:35	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	1.0	1		01/25/17 21:35	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	1.0	1		01/25/17 21:35	156-60-5	
1,2-Dichloropropane	ND	ug/L	1.0	1		01/25/17 21:35	78-87-5	
cis-1,3-Dichloropropene	ND	ug/L	1.0	1		01/25/17 21:35	10061-01-5	
trans-1,3-Dichloropropene	ND	ug/L	1.0	1		01/25/17 21:35	10061-02-6	
Ethylbenzene	ND	ug/L	1.0	1		01/25/17 21:35	100-41-4	
2-Hexanone	ND	ug/L	5.0	1		01/25/17 21:35	591-78-6	
Iodomethane	ND	ug/L	5.0	1		01/25/17 21:35	74-88-4	
Methylene Chloride	**1.7**	ug/L	1.0	1		01/25/17 21:35	75-09-2	C9
4-Methyl-2-pentanone (MIBK)	ND	ug/L	5.0	1		01/25/17 21:35	108-10-1	
Styrene	ND	ug/L	1.0	1		01/25/17 21:35	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0	1		01/25/17 21:35	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0	1		01/25/17 21:35	79-34-5	
Tetrachloroethene	ND	ug/L	1.0	1		01/25/17 21:35	127-18-4	
Toluene	ND	ug/L	1.0	1		01/25/17 21:35	108-88-3	
1,1,1-Trichloroethane	ND	ug/L	1.0	1		01/25/17 21:35	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	1.0	1		01/25/17 21:35	79-00-5	
Trichloroethene	ND	ug/L	1.0	1		01/25/17 21:35	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0	1		01/25/17 21:35	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0	1		01/25/17 21:35	96-18-4	
Vinyl acetate	ND	ug/L	2.0	1		01/25/17 21:35	108-05-4	
Vinyl chloride	ND	ug/L	1.0	1		01/25/17 21:35	75-01-4	
Xylene (Total)	ND	ug/L	1.0	1		01/25/17 21:35	1330-20-7	
Surrogates								
4-Bromofluorobenzene (S)	99	%	70-130	1		01/25/17 21:35	460-00-4	

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ANALYTICAL RESULTS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327477

Sample: TRIP BLANK **Lab ID: 92327477006** Collected: 01/23/17 00:00 Received: 01/23/17 17:45 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
Surrogates								
1,2-Dichloroethane-d4 (S)	95	%	70-130	1		01/25/17 21:35	17060-07-0	
Toluene-d8 (S)	109	%	70-130	1		01/25/17 21:35	2037-26-5	

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QUALITY CONTROL DATA

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327477

QC Batch: 345857 Analysis Method: EPA 300.0
QC Batch Method: EPA 300.0 Analysis Description: 3000 IC Anions, GWD
Associated Lab Samples: 92327477001, 92327477002, 92327477003, 92327477004, 92327477005

METHOD BLANK: 1918758 Matrix: Water
Associated Lab Samples: 92327477001, 92327477002, 92327477003, 92327477004, 92327477005

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Chloride	mg/L	ND	1.0	01/26/17 17:36	
Fluoride	mg/L	ND	0.10	01/26/17 17:36	
Sulfate	mg/L	ND	1.0	01/26/17 17:36	

LABORATORY CONTROL SAMPLE: 1918759

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Chloride	mg/L	50	51.5	103	90-110	
Fluoride	mg/L	2.5	2.6	103	90-110	
Sulfate	mg/L	50	51.4	103	90-110	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1918760 1918761

Parameter	Units	92327477001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Chloride	mg/L	303	50	50	348	349	90	92	90-110	0	20	
Fluoride	mg/L	0.14	2.5	2.5	2.3	2.4	87	89	90-110	2	20	M1
Sulfate	mg/L	20.0	50	50	71.6	73.9	103	108	90-110	3	20	

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QUALITY CONTROL DATA

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327477

QC Batch: 345675 Analysis Method: EPA 7470
QC Batch Method: EPA 7470 Analysis Description: 7470 Mercury
Associated Lab Samples: 92327477001, 92327477002, 92327477003, 92327477004, 92327477005

METHOD BLANK: 1917811 Matrix: Water
Associated Lab Samples: 92327477001, 92327477002, 92327477003, 92327477004, 92327477005

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Mercury	ug/L	ND	0.20	01/27/17 04:13	

LABORATORY CONTROL SAMPLE: 1917812

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Mercury	ug/L	2.5	2.3	93	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1917813 1917814

Parameter	Units	92327205019 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Mercury	ug/L	ND	2.5	2.5	2.3	2.4	91	95	75-125	4	25	

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QUALITY CONTROL DATA

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327477

QC Batch: 345711 Analysis Method: EPA 6010
QC Batch Method: EPA 3010A Analysis Description: 6010 MET
Associated Lab Samples: 92327477001, 92327477002, 92327477003, 92327477004, 92327477005

METHOD BLANK: 1918003 Matrix: Water
Associated Lab Samples: 92327477001, 92327477002, 92327477003, 92327477004, 92327477005

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Antimony	ug/L	ND	5.0	01/27/17 11:42	
Arsenic	ug/L	ND	10.0	01/27/17 11:42	
Barium	ug/L	ND	5.0	01/27/17 11:42	
Beryllium	ug/L	ND	1.0	01/27/17 11:42	
Cadmium	ug/L	ND	1.0	01/27/17 11:42	
Calcium	ug/L	ND	100	01/27/17 11:42	
Chromium	ug/L	ND	5.0	01/27/17 11:42	
Cobalt	ug/L	ND	5.0	01/27/17 11:42	
Copper	ug/L	ND	5.0	01/27/17 11:42	
Lead	ug/L	ND	5.0	01/27/17 11:42	
Molybdenum	ug/L	ND	5.0	01/27/17 11:42	
Nickel	ug/L	ND	5.0	01/27/17 11:42	
Selenium	ug/L	ND	10.0	01/27/17 11:42	
Silver	ug/L	ND	5.0	01/27/17 11:42	
Vanadium	ug/L	ND	5.0	01/27/17 11:42	
Zinc	ug/L	ND	10.0	01/27/17 11:42	

LABORATORY CONTROL SAMPLE: 1918004

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Antimony	ug/L	500	450	90	80-120	
Arsenic	ug/L	500	443	89	80-120	
Barium	ug/L	500	466	93	80-120	
Beryllium	ug/L	500	467	93	80-120	
Cadmium	ug/L	500	456	91	80-120	
Calcium	ug/L	5000	4700	94	80-120	
Chromium	ug/L	500	471	94	80-120	
Cobalt	ug/L	500	462	92	80-120	
Copper	ug/L	500	466	93	80-120	
Lead	ug/L	500	457	91	80-120	
Molybdenum	ug/L	500	476	95	80-120	
Nickel	ug/L	500	451	90	80-120	
Selenium	ug/L	500	452	90	80-120	
Silver	ug/L	250	235	94	80-120	
Vanadium	ug/L	500	464	93	80-120	
Zinc	ug/L	500	473	95	80-120	

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QUALITY CONTROL DATA

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327477

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1918005 1918006

Parameter	Units	92327477001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Antimony	ug/L	ND	500	500	471	470	94	94	75-125	0	20	
Arsenic	ug/L	ND	500	500	465	466	93	93	75-125	0	20	
Barium	ug/L	321	500	500	798	802	95	96	75-125	0	20	
Beryllium	ug/L	ND	500	500	475	478	95	96	75-125	0	20	
Cadmium	ug/L	ND	500	500	473	471	95	94	75-125	1	20	
Calcium	ug/L	28100	5000	5000	33600	33500	108	108	75-125	0	20	
Chromium	ug/L	ND	500	500	477	481	95	96	75-125	1	20	
Cobalt	ug/L	ND	500	500	464	461	93	92	75-125	1	20	
Copper	ug/L	ND	500	500	479	479	96	96	75-125	0	20	
Lead	ug/L	ND	500	500	451	448	90	89	75-125	1	20	
Molybdenum	ug/L	ND	500	500	493	492	98	98	75-125	0	20	
Nickel	ug/L	ND	500	500	450	449	90	90	75-125	0	20	
Selenium	ug/L	ND	500	500	472	468	94	94	75-125	1	20	
Silver	ug/L	ND	250	250	240	240	96	96	75-125	0	20	
Vanadium	ug/L	5.3	500	500	484	484	96	96	75-125	0	20	
Zinc	ug/L	ND	500	500	487	486	97	96	75-125	0	20	

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QUALITY CONTROL DATA

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327477

QC Batch: 345698 Analysis Method: EPA 6020B
QC Batch Method: EPA 3010A Analysis Description: 6020 MET
Associated Lab Samples: 92327477001, 92327477002, 92327477003, 92327477004, 92327477005

METHOD BLANK: 1917955 Matrix: Water
Associated Lab Samples: 92327477001, 92327477002, 92327477003, 92327477004, 92327477005

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Boron	ug/L	ND	25.0	01/27/17 13:47	
Lithium	ug/L	ND	2.5	01/27/17 13:47	
Thallium	ug/L	ND	0.10	01/27/17 13:47	

LABORATORY CONTROL SAMPLE: 1917956

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Boron	ug/L	100	103	103	80-120	
Lithium	ug/L	100	102	102	80-120	
Thallium	ug/L	100	94.5	94	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1917957 1917958

Parameter	Units	92327477001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Boron	ug/L	ND	100	100	106	109	98	102	75-125	3	20	
Lithium	ug/L	24.5	100	100	117	119	93	94	75-125	1	20	
Thallium	ug/L	ND	100	100	91.3	94.6	91	95	75-125	4	20	

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QUALITY CONTROL DATA

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327477

QC Batch: 345570 Analysis Method: EPA 8260
QC Batch Method: EPA 8260 Analysis Description: 8260 MSV Low Level Landfill
Associated Lab Samples: 92327477001, 92327477002, 92327477003, 92327477004, 92327477005, 92327477006

METHOD BLANK: 1917124 Matrix: Water
Associated Lab Samples: 92327477001, 92327477002, 92327477003, 92327477004, 92327477005, 92327477006

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
1,1,1,2-Tetrachloroethane	ug/L	ND	1.0	01/25/17 14:19	
1,1,1-Trichloroethane	ug/L	ND	1.0	01/25/17 14:19	
1,1,2,2-Tetrachloroethane	ug/L	ND	1.0	01/25/17 14:19	
1,1,2-Trichloroethane	ug/L	ND	1.0	01/25/17 14:19	
1,1-Dichloroethane	ug/L	ND	1.0	01/25/17 14:19	
1,1-Dichloroethene	ug/L	ND	1.0	01/25/17 14:19	
1,2,3-Trichloropropane	ug/L	ND	1.0	01/25/17 14:19	
1,2-Dichlorobenzene	ug/L	ND	1.0	01/25/17 14:19	
1,2-Dichloroethane	ug/L	ND	1.0	01/25/17 14:19	
1,2-Dichloropropane	ug/L	ND	1.0	01/25/17 14:19	
1,4-Dichlorobenzene	ug/L	ND	1.0	01/25/17 14:19	
2-Butanone (MEK)	ug/L	ND	5.0	01/25/17 14:19	
2-Hexanone	ug/L	ND	5.0	01/25/17 14:19	
4-Methyl-2-pentanone (MIBK)	ug/L	ND	5.0	01/25/17 14:19	
Acetone	ug/L	ND	25.0	01/25/17 14:19	
Acrylonitrile	ug/L	ND	10.0	01/25/17 14:19	
Benzene	ug/L	ND	1.0	01/25/17 14:19	
Bromochloromethane	ug/L	ND	1.0	01/25/17 14:19	
Bromodichloromethane	ug/L	ND	1.0	01/25/17 14:19	
Bromoform	ug/L	ND	1.0	01/25/17 14:19	
Bromomethane	ug/L	ND	2.0	01/25/17 14:19	
Carbon disulfide	ug/L	ND	2.0	01/25/17 14:19	
Carbon tetrachloride	ug/L	ND	1.0	01/25/17 14:19	
Chlorobenzene	ug/L	ND	1.0	01/25/17 14:19	
Chloroethane	ug/L	ND	1.0	01/25/17 14:19	
Chloroform	ug/L	ND	1.0	01/25/17 14:19	
Chloromethane	ug/L	ND	1.0	01/25/17 14:19	
cis-1,2-Dichloroethene	ug/L	ND	1.0	01/25/17 14:19	
cis-1,3-Dichloropropene	ug/L	ND	1.0	01/25/17 14:19	
Dibromochloromethane	ug/L	ND	1.0	01/25/17 14:19	
Dibromomethane	ug/L	ND	1.0	01/25/17 14:19	
Ethylbenzene	ug/L	ND	1.0	01/25/17 14:19	
Iodomethane	ug/L	ND	5.0	01/25/17 14:19	
Methylene Chloride	ug/L	ND	1.0	01/25/17 14:19	
Styrene	ug/L	ND	1.0	01/25/17 14:19	
Tetrachloroethene	ug/L	ND	1.0	01/25/17 14:19	
Toluene	ug/L	ND	1.0	01/25/17 14:19	
trans-1,2-Dichloroethene	ug/L	ND	1.0	01/25/17 14:19	
trans-1,3-Dichloropropene	ug/L	ND	1.0	01/25/17 14:19	
trans-1,4-Dichloro-2-butene	ug/L	ND	1.0	01/25/17 14:19	
Trichloroethene	ug/L	ND	1.0	01/25/17 14:19	

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QUALITY CONTROL DATA

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327477

METHOD BLANK: 1917124 Matrix: Water
Associated Lab Samples: 92327477001, 92327477002, 92327477003, 92327477004, 92327477005, 92327477006

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Trichlorofluoromethane	ug/L	ND	1.0	01/25/17 14:19	
Vinyl acetate	ug/L	ND	2.0	01/25/17 14:19	
Vinyl chloride	ug/L	ND	1.0	01/25/17 14:19	
Xylene (Total)	ug/L	ND	1.0	01/25/17 14:19	
1,2-Dichloroethane-d4 (S)	%	100	70-130	01/25/17 14:19	
4-Bromofluorobenzene (S)	%	100	70-130	01/25/17 14:19	
Toluene-d8 (S)	%	108	70-130	01/25/17 14:19	

LABORATORY CONTROL SAMPLE: 1917125

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
1,1,1,2-Tetrachloroethane	ug/L	50	48.5	97	80-125	
1,1,1-Trichloroethane	ug/L	50	51.9	104	71-129	
1,1,2,2-Tetrachloroethane	ug/L	50	44.3	89	79-124	
1,1,2-Trichloroethane	ug/L	50	50.9	102	85-125	
1,1-Dichloroethane	ug/L	50	52.2	104	73-126	
1,1-Dichloroethene	ug/L	50	57.0	114	66-135	
1,2,3-Trichloropropane	ug/L	50	45.0	90	75-130	
1,2-Dichlorobenzene	ug/L	50	47.1	94	80-133	
1,2-Dichloroethane	ug/L	50	53.0	106	67-128	
1,2-Dichloropropane	ug/L	50	51.4	103	75-132	
1,4-Dichlorobenzene	ug/L	50	46.9	94	78-130	
2-Butanone (MEK)	ug/L	100	97.8	98	61-144	
2-Hexanone	ug/L	100	83.5	83	68-143	
4-Methyl-2-pentanone (MIBK)	ug/L	100	88.2	88	72-135	
Acetone	ug/L	100	92.1	92	48-146	
Acrylonitrile	ug/L	250	248	99	40-160	
Benzene	ug/L	50	53.4	107	80-125	
Bromochloromethane	ug/L	50	53.8	108	71-125	
Bromodichloromethane	ug/L	50	51.1	102	78-124	
Bromoform	ug/L	50	42.7	85	71-128	
Bromomethane	ug/L	50	63.3	127	40-160	
Carbon disulfide	ug/L	50	60.2	120	50-160	
Carbon tetrachloride	ug/L	50	47.3	95	69-131	
Chlorobenzene	ug/L	50	47.7	95	81-122	
Chloroethane	ug/L	50	55.5	111	39-148	
Chloroform	ug/L	50	53.0	106	73-127	
Chloromethane	ug/L	50	53.5	107	44-146	
cis-1,2-Dichloroethene	ug/L	50	54.8	110	74-124	
cis-1,3-Dichloropropene	ug/L	50	50.7	101	72-132	
Dibromochloromethane	ug/L	50	48.1	96	78-125	
Dibromomethane	ug/L	50	49.7	99	82-120	
Ethylbenzene	ug/L	50	48.0	96	79-121	
Iodomethane	ug/L	100	126	126	39-154	

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QUALITY CONTROL DATA

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327477

LABORATORY CONTROL SAMPLE: 1917125

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Methylene Chloride	ug/L	50	52.4	105	64-133	
Styrene	ug/L	50	47.9	96	84-126	
Tetrachloroethene	ug/L	50	46.9	94	78-122	
Toluene	ug/L	50	49.6	99	80-121	
trans-1,2-Dichloroethene	ug/L	50	56.7	113	71-127	
trans-1,3-Dichloropropene	ug/L	50	50.0	100	69-141	
trans-1,4-Dichloro-2-butene	ug/L	50	42.3	85	40-160	
Trichloroethene	ug/L	50	50.5	101	78-122	
Trichlorofluoromethane	ug/L	50	56.8	114	53-137	
Vinyl acetate	ug/L	100	103	103	40-160	
Vinyl chloride	ug/L	50	46.5	93	58-137	
Xylene (Total)	ug/L	150	142	95	81-126	
1,2-Dichloroethane-d4 (S)	%			109	70-130	
4-Bromofluorobenzene (S)	%			99	70-130	
Toluene-d8 (S)	%			97	70-130	

MATRIX SPIKE SAMPLE: 1917126

Parameter	Units	92327477002 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
1,1,1,2-Tetrachloroethane	ug/L	ND	20	19.5	98	70-130	
1,1,1-Trichloroethane	ug/L	ND	20	22.9	114	70-130	
1,1,2,2-Tetrachloroethane	ug/L	ND	20	18.7	94	70-130	
1,1,2-Trichloroethane	ug/L	ND	20	22.9	115	70-130	
1,1-Dichloroethane	ug/L	ND	20	23.2	116	70-130	
1,1-Dichloroethene	ug/L	ND	20	25.3	127	70-166	
1,2,3-Trichloropropane	ug/L	ND	20	19.5	97	70-130	
1,2-Dichlorobenzene	ug/L	ND	20	20.5	103	70-130	
1,2-Dichloroethane	ug/L	ND	20	22.9	115	70-130	
1,2-Dichloropropane	ug/L	ND	20	23.4	117	70-130	
1,4-Dichlorobenzene	ug/L	ND	20	20.0	100	70-130	
2-Butanone (MEK)	ug/L	ND	40	43.0	108	70-130	
2-Hexanone	ug/L	ND	40	36.5	91	70-130	
4-Methyl-2-pentanone (MIBK)	ug/L	ND	40	40.1	100	70-130	
Acetone	ug/L	ND	40	42.6	106	70-130	
Acrylonitrile	ug/L	ND	100	108	108	70-130	
Benzene	ug/L	ND	20	24.4	122	70-148	
Bromochloromethane	ug/L	ND	20	23.9	120	70-130	
Bromodichloromethane	ug/L	ND	20	22.7	113	70-130	
Bromoform	ug/L	ND	20	16.0	80	70-130	
Bromomethane	ug/L	ND	20	27.4	137	70-130	M1
Carbon disulfide	ug/L	ND	20	26.5	133	70-130	M1
Carbon tetrachloride	ug/L	ND	20	22.0	110	70-130	
Chlorobenzene	ug/L	ND	20	21.3	107	70-146	
Chloroethane	ug/L	ND	20	26.5	132	70-130	M1
Chloroform	ug/L	ND	20	22.9	115	70-130	

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REPORT OF LABORATORY ANALYSIS

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Huntersville, NC 28078
(704)875-9092

QUALITY CONTROL DATA

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327477

MATRIX SPIKE SAMPLE: 1917126

Parameter	Units	92327477002 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Chloromethane	ug/L	ND	20	26.5	132	70-130	M1
cis-1,2-Dichloroethene	ug/L	ND	20	23.6	118	70-130	
cis-1,3-Dichloropropene	ug/L	ND	20	21.9	109	70-130	
Dibromochloromethane	ug/L	ND	20	19.2	96	70-130	
Dibromomethane	ug/L	ND	20	22.5	113	70-130	
Ethylbenzene	ug/L	ND	20	21.5	107	70-130	
Iodomethane	ug/L	ND	40	48.5	121	70-130	
Methylene Chloride	ug/L	ND	20	22.3	112	70-130	
Styrene	ug/L	ND	20	17.9	90	70-130	
Tetrachloroethene	ug/L	ND	20	20.2	101	70-130	
Toluene	ug/L	ND	20	23.0	115	70-155	
trans-1,2-Dichloroethene	ug/L	ND	20	23.4	117	70-130	
trans-1,3-Dichloropropene	ug/L	ND	20	21.5	108	70-130	
trans-1,4-Dichloro-2-butene	ug/L	ND	20	17.3	87	70-130	
Trichloroethene	ug/L	ND	20	23.3	116	69-151	
Trichlorofluoromethane	ug/L	ND	20	26.1	130	70-130	
Vinyl acetate	ug/L	ND	40	33.5	84	70-130	
Vinyl chloride	ug/L	ND	20	20.7	104	70-130	
1,2-Dichloroethane-d4 (S)	%				102	70-130	
4-Bromofluorobenzene (S)	%				99	70-130	
Toluene-d8 (S)	%				100	70-130	

SAMPLE DUPLICATE: 1917127

Parameter	Units	92327477003 Result	Dup Result	RPD	Max RPD	Qualifiers
1,1,1,2-Tetrachloroethane	ug/L	ND	ND		30	
1,1,1-Trichloroethane	ug/L	ND	ND		30	
1,1,2,2-Tetrachloroethane	ug/L	ND	ND		30	
1,1,2-Trichloroethane	ug/L	ND	ND		30	
1,1-Dichloroethane	ug/L	ND	ND		30	
1,1-Dichloroethene	ug/L	ND	ND		30	
1,2,3-Trichloropropane	ug/L	ND	ND		30	
1,2-Dichlorobenzene	ug/L	ND	ND		30	
1,2-Dichloroethane	ug/L	ND	ND		30	
1,2-Dichloropropane	ug/L	ND	ND		30	
1,4-Dichlorobenzene	ug/L	ND	ND		30	
2-Butanone (MEK)	ug/L	ND	ND		30	
2-Hexanone	ug/L	ND	ND		30	
4-Methyl-2-pentanone (MIBK)	ug/L	ND	ND		30	
Acetone	ug/L	ND	ND		30	
Acrylonitrile	ug/L	ND	ND		30	
Benzene	ug/L	ND	ND		30	
Bromochloromethane	ug/L	ND	ND		30	
Bromodichloromethane	ug/L	ND	ND		30	
Bromoform	ug/L	ND	ND		30	

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QUALITY CONTROL DATA

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327477

SAMPLE DUPLICATE: 1917127

Parameter	Units	92327477003 Result	Dup Result	RPD	Max RPD	Qualifiers
Bromomethane	ug/L	ND	ND		30	
Carbon disulfide	ug/L	ND	ND		30	
Carbon tetrachloride	ug/L	ND	ND		30	
Chlorobenzene	ug/L	ND	ND		30	
Chloroethane	ug/L	ND	ND		30	
Chloroform	ug/L	ND	ND		30	
Chloromethane	ug/L	ND	.29J		30	
cis-1,2-Dichloroethene	ug/L	ND	ND		30	
cis-1,3-Dichloropropene	ug/L	ND	ND		30	
Dibromochloromethane	ug/L	ND	ND		30	
Dibromomethane	ug/L	ND	ND		30	
Ethylbenzene	ug/L	ND	ND		30	
Iodomethane	ug/L	ND	ND		30	
Methylene Chloride	ug/L	ND	ND		30	
Styrene	ug/L	ND	ND		30	
Tetrachloroethene	ug/L	ND	ND		30	
Toluene	ug/L	ND	ND		30	
trans-1,2-Dichloroethene	ug/L	ND	ND		30	
trans-1,3-Dichloropropene	ug/L	ND	ND		30	
trans-1,4-Dichloro-2-butene	ug/L	ND	ND		30	
Trichloroethene	ug/L	ND	ND		30	
Trichlorofluoromethane	ug/L	ND	ND		30	
Vinyl acetate	ug/L	ND	ND		30	
Vinyl chloride	ug/L	ND	ND		30	
Xylene (Total)	ug/L	ND	ND		30	
1,2-Dichloroethane-d4 (S)	%	98	98	0		
4-Bromofluorobenzene (S)	%	98	101	3		
Toluene-d8 (S)	%	107	105	1		

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QUALITY CONTROL DATA

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327477

QC Batch: 345632 Analysis Method: SM 2540C
QC Batch Method: SM 2540C Analysis Description: 2540C Total Dissolved Solids
Associated Lab Samples: 92327477001, 92327477002, 92327477003, 92327477004, 92327477005

METHOD BLANK: 1917488 Matrix: Water
Associated Lab Samples: 92327477001, 92327477002, 92327477003, 92327477004, 92327477005

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Total Dissolved Solids	mg/L	ND	25.0	01/25/17 18:55	

LABORATORY CONTROL SAMPLE: 1917489

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Total Dissolved Solids	mg/L	250	226	90	90-110	

SAMPLE DUPLICATE: 1917490

Parameter	Units	92327032020 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	154	147	5	5	

SAMPLE DUPLICATE: 1917491

Parameter	Units	92327237019 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	925	912	1	5	

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327477

Sample: BG-1 **Lab ID: 92327477001** Collected: 01/23/17 11:30 Received: 01/23/17 17:45 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**0.532 ± 0.498 (0.705) C:NA T:89%**	pCi/L	02/15/17 11:43	13982-63-3	
Radium-228	EPA 904.0	**0.442 ± 0.459 (0.950) C:62% T:83%**	pCi/L	02/13/17 12:12	15262-20-1	

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327477

Sample: LEACHATE **Lab ID: 92327477002** Collected: 01/23/17 13:57 Received: 01/23/17 17:45 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**0.287 ± 0.446 (0.773) C:NA T:89%**	pCi/L	02/15/17 11:43	13982-63-3	
Radium-228	EPA 904.0	**0.306 ± 0.440 (0.946) C:62% T:84%**	pCi/L	02/13/17 12:12	15262-20-1	

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327477

Sample: MW-5 **Lab ID: 92327477003** Collected: 01/23/17 15:00 Received: 01/23/17 17:45 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**0.0732 ± 0.334 (0.539) C:NA T:89%**	pCi/L	02/15/17 11:55	13982-63-3	
Radium-228	EPA 904.0	**1.08 ± 0.730 (1.42) C:51% T:78%**	pCi/L	02/13/17 12:12	15262-20-1	

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327477

Sample: EQ BLANK **Lab ID: 92327477004** Collected: 01/23/17 17:00 Received: 01/23/17 17:45 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**0.000 ± 0.391 (0.631) C:NA T:81%**	pCi/L	02/15/17 11:43	13982-63-3	
Radium-228	EPA 904.0	**0.142 ± 0.491 (1.11) C:59% T:80%**	pCi/L	02/13/17 12:11	15262-20-1	

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327477

Sample: AMB-BLANK **Lab ID: 92327477005** Collected: 01/23/17 17:10 Received: 01/23/17 17:45 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**0.000 ± 0.663 (1.34) C:NA T:82%**	pCi/L	02/15/17 11:43	13982-63-3	
Radium-228	EPA 904.0	**-0.0930 ± 0.469 (1.11) C:57% T:79%**	pCi/L	02/13/17 12:12	15262-20-1	

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QUALITY CONTROL - RADIOCHEMISTRY

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327477

QC Batch: 248867 Analysis Method: EPA 903.1
QC Batch Method: EPA 903.1 Analysis Description: 903.1 Radium-226
Associated Lab Samples: 92327477001, 92327477002, 92327477003, 92327477004, 92327477005

METHOD BLANK: 1223912 Matrix: Water
Associated Lab Samples: 92327477001, 92327477002, 92327477003, 92327477004, 92327477005

Parameter	Act ± Unc (MDC) Carr Trac	Units	Analyzed	Qualifiers
Radium-226	0.0897 ± 0.409 (0.243) C:NA T:75%	pCi/L	02/15/17 11:11	

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QUALITY CONTROL - RADIOCHEMISTRY

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327477

QC Batch: 248868 Analysis Method: EPA 904.0
QC Batch Method: EPA 904.0 Analysis Description: 904.0 Radium 228
Associated Lab Samples: 92327477001, 92327477002, 92327477003, 92327477004, 92327477005

METHOD BLANK: 1223913 Matrix: Water
Associated Lab Samples: 92327477001, 92327477002, 92327477003, 92327477004, 92327477005

Parameter	Act ± Unc (MDC) Carr Trac	Units	Analyzed	Qualifiers
Radium-228	0.0913 ± 0.375 (0.826) C:65% T:85%	pCi/L	02/13/17 12:11	

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QUALIFIERS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327477

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above adjusted reporting limit.

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

Acid preservation may not be appropriate for 2 Chloroethylvinyl ether.

A separate vial preserved to a pH of 4-5 is recommended in SW846 Chapter 4 for the analysis of Acrolein and Acrylonitrile by EPA Method 8260.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Act - Activity

Unc - Uncertainty: SDWA = 1.96 sigma count uncertainty, all other matrices = Expanded Uncertainty (95% confidence interval). Gamma Spec = Expanded Uncertainty (95.4% Confidence Interval)

(MDC) - Minimum Detectable Concentration

Trac - Tracer Recovery (%)

Carr - Carrier Recovery (%)

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

LABORATORIES

PASI-A	Pace Analytical Services - Asheville
PASI-C	Pace Analytical Services - Charlotte
PASI-PA	Pace Analytical Services - Greensburg
PASI-W	Pace Analytical Services - Greenwood

ANALYTE QUALIFIERS

C9	Common Laboratory Contaminant.
M1	Matrix spike recovery exceeded QC limits. Batch accepted based on laboratory control sample (LCS) recovery.

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QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327477

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
92327477001	**BG-1**	EPA 300.0	345857		
92327477002	**LEACHATE**	EPA 300.0	345857		
92327477003	**MW-5**	EPA 300.0	345857		
92327477004	**EQ BLANK**	EPA 300.0	345857		
92327477005	**AMB-BLANK**	EPA 300.0	345857		
92327477001	**BG-1**	EPA 3010A	345711	EPA 6010	345927
92327477002	**LEACHATE**	EPA 3010A	345711	EPA 6010	345927
92327477003	**MW-5**	EPA 3010A	345711	EPA 6010	345927
92327477004	**EQ BLANK**	EPA 3010A	345711	EPA 6010	345927
92327477005	**AMB-BLANK**	EPA 3010A	345711	EPA 6010	345927
92327477001	**BG-1**	EPA 3010A	345698	EPA 6020B	345894
92327477002	**LEACHATE**	EPA 3010A	345698	EPA 6020B	345894
92327477003	**MW-5**	EPA 3010A	345698	EPA 6020B	345894
92327477004	**EQ BLANK**	EPA 3010A	345698	EPA 6020B	345894
92327477005	**AMB-BLANK**	EPA 3010A	345698	EPA 6020B	345894
92327477001	**BG-1**	EPA 7470	345675	EPA 7470	345874
92327477002	**LEACHATE**	EPA 7470	345675	EPA 7470	345874
92327477003	**MW-5**	EPA 7470	345675	EPA 7470	345874
92327477004	**EQ BLANK**	EPA 7470	345675	EPA 7470	345874
92327477005	**AMB-BLANK**	EPA 7470	345675	EPA 7470	345874
92327477001	**BG-1**	EPA 8260	345570		
92327477002	**LEACHATE**	EPA 8260	345570		
92327477003	**MW-5**	EPA 8260	345570		
92327477004	**EQ BLANK**	EPA 8260	345570		
92327477005	**AMB-BLANK**	EPA 8260	345570		
92327477006	**TRIP BLANK**	EPA 8260	345570		
92327477001	**BG-1**	EPA 903.1	248867		
92327477002	**LEACHATE**	EPA 903.1	248867		
92327477003	**MW-5**	EPA 903.1	248867		
92327477004	**EQ BLANK**	EPA 903.1	248867		
92327477005	**AMB-BLANK**	EPA 903.1	248867		
92327477001	**BG-1**	EPA 904.0	248868		
92327477002	**LEACHATE**	EPA 904.0	248868		
92327477003	**MW-5**	EPA 904.0	248868		
92327477004	**EQ BLANK**	EPA 904.0	248868		
92327477005	**AMB-BLANK**	EPA 904.0	248868		
92327477001	**BG-1**	SM 2540C	345632		
92327477002	**LEACHATE**	SM 2540C	345632		
92327477003	**MW-5**	SM 2540C	345632		
92327477004	**EQ BLANK**	SM 2540C	345632		
92327477005	**AMB-BLANK**	SM 2540C	345632		

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Pace Analytical®	Sample Condition Upon Receipt(SCUR)	Page 1 of 2
	Document No.: F-CAR-CS-033-Rev.01	Issuing Authority: Pace Quality Office

Laboratory receiving samples:

Asheville ☐ Eden ☐ Greenwood ☐ Huntersville ☑ Raleigh ☐ Mechanicsville ☐

Sample Condition Upon Receipt

Client Name: HDR

Project #: WO# : 92327477

92327477

Courier: ☐ Commercial ☑ Fed Ex ☐ UPS ☐ USPS ☐ Client ☑ Pace ☐ Other:____

Custody Seal Present? ☐ Yes ☑ No **Seals Intact?** ☐ Yes ☐ No

Date/Initials Person Examining Contents: JMS 1-24-17

Packing Material: ☐ Bubble Wrap ☑ Bubble Bags ☐ None ☐ Other:____

Thermometer: ☑ IR Gun ID: T1603 **Type of Ice:** ☑ Wet ☐ Blue ☐ None ☑ Samples on ice, cooling process has begun

Correction Factor: **Cooler Temp Corrected (°C):** 3.3 **Biological Tissue Frozen?** ☐ Yes ☑ No ☐ N/A

Temp should be above freezing to 6°C

USDA Regulated Soil (☑ N/A, water sample)

Did samples originate in a quarantine zone within the United States: CA, NY, or SC (check maps)? ☐ Yes ☑ No

Did samples originate from a foreign source (internationally, including Hawaii and Puerto Rico)? ☐ Yes ☑ No

				Comments/Discrepancy:
Chain of Custody Present?	☑ Yes	☐ No	☐ N/A	1.
Samples Arrived within Hold Time?	☑ Yes	☐ No	☐ N/A	2.
Short Hold Time Analysis (<72 hr.)?	☐ Yes	☑ No	☐ N/A	3.
Rush Turn Around Time Requested?	☐ Yes	☑ No	☐ N/A	4.
Sufficient Volume?	☑ Yes	☐ No	☐ N/A	5.
Correct Containers Used?	☑ Yes	☐ No	☐ N/A	6.
-Pace Containers Used?	☑ Yes	☐ No	☐ N/A	
Containers Intact?	☑ Yes	☐ No	☐ N/A	7.
Samples Field Filtered?	☐ Yes	☐ No	☑ N/A	8. Note if sediment is visible in the dissolved container
Sample Labels Match COC?	☑ Yes	☐ No	☐ N/A	9.
-Includes Date/Time/ID/Analysis Matrix: WT				
Headspace in VOA Vials (>5-6mm)?	☐ Yes	☑ No	☐ N/A	10.
Trip Blank Present?	☑ Yes	☐ No	☐ N/A	11.
Trip Blank Custody Seals Present?	☑ Yes	☐ No	☐ N/A	

CLIENT NOTIFICATION/RESOLUTION

Field Data Required? ☐ Yes ☐ No

Person Contacted: _____ Date/Time: _____

Comments/Sample Discrepancy: _____

Project Manager SCURF Review: JY **Date:** 1/25/17

Project Manager SRF Review: JY **Date:** 1/25/17

Note: Whenever there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office (i.e. out of hold, incorrect preservative, out of temp, incorrect containers)

*Check mark top half of box if pH and/or dechlorination is verified and within the acceptance range for preservation samples.

**Bottom half of box is to list number of bottles

Project #

WO#: 92327477

PM: KRG Due Date: 01/30/17

CLIENT: 92-HDR

1543

Item#	BP4U-125 mL Plastic Unpreserved (N/A) (Cl-)	BP3U-250 mL Plastic Unpreserved (N/A)	BP2U-500 mL Plastic Unpreserved (N/A)	BP1U-1 liter Plastic Unpreserved (N/A)	BP3S-250 mL Plastic H2SO4 (pH < 2) (Cl-)	BP3N-250 mL plastic HNO3 (pH < 2)	BP3Z-250 mL Plastic ZN Acetate & NaOH (>9)	BP3C-250 mL Plastic NaOH (pH > 12) (Cl-)	WGFU-Wide-mouthed Glass jar Unpreserved	AG1U-1 liter Amber Unpreserved (N/A) (Cl-)	AG1H-1 liter Amber HCl (pH < 2)	AG3U-250 mL Amber Unpreserved (N/A) (Cl-)	AG1S-1 liter Amber H2SO4 (pH < 2)	AG3S-250 mL Amber H2SO4 (pH < 2)	AG3A(DG3A)-250 mL Amber NH4Cl (N/A)(Cl-)	DG9H-40 mL VOA HCl (N/A)	VG9T-40 mL VOA Na2S2O3 (N/A)	VG9U-40 mL VOA Unp (N/A)	DG9P-40 mL VOA H3PO4 (N/A)	VOAK (6 vials per kit)-5035 kit (N/A)	V/GK (3 vials per kit)-VPH/Gas kit (N/A)	SP5T-125 mL Sterile Plastic (N/A – lab)	SP2T-250 mL Sterile Plastic (N/A – lab)	BPIN	BP3A-250 mL Plastic (NH2)2SO4 (9.3-9.7)	Cubitainer	VSGU-20 mL Scintillation vials (N/A)	GN
1		1	1			2										5/3	JM 1-25-17								3				
2		1	1			2										3									3				
3		1	1			2										3									3				
4		1	1			2										3									3				
5		1	1			2										3									3				
6																2													
7																													
8																													
9																													
10																													
11																													
12																													

pH Adjustment Log for Preserved Samples

Sample ID	Type of Preservative	pH upon receipt	Date preservation adjusted	Time preservation adjusted	Amount of Preservative added	Lot #

Pace Analytical

CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

Page : 1 Of 1

Section A Required Client Information:		Section B Required Project Information:		Section C Invoice Information:	
Company:	HDR Engineering	Report To:	Sean Quarry	Attention:	
Address:	440 South Church Street	Copy To:		Company Name:	
	Charlotte, NC 28202			Address:	
Email:	sean.quarry@hdrinc.com	Purchase Order #:		Pace Quote:	
Phone:	(704)248-3632 Fax	Project Name:	Charrah-Brickhaven	Pace Project Manager:	kevin.godwin@pacelabs.com,
Requested Due Date:		Project #:		Pace Profile #:	7672-1

Regulatory Agency: | State / Location: NC

MATRIX CODE: Drinking Water DW; Water WT; Waste Water WW; Product P; Soil/Solid SL; Oil OL; Wipe WP; Air AR; Other OT; Tissue TS

ITEM #	SAMPLE ID (One Character per box. (A-Z, 0-9 / , -) Sample Ids must be unique)	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED START DATE	COLLECTED START TIME	COLLECTED END DATE	COLLECTED END TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Preservatives: Unpreserved	H2SO4	HNO3	HCl	NaOH	Na2S2O3	Methanol	Other	Analyses Test Y/N	Trip BLANK	8260	300.0-Cl,F,Sulfate	TDS	Radium 226/228	6010/7470	6020 (B, Li)	Residual Chlorine (Y/N)	92327477
1	BG-1	WT	G			1-23-17	1130		12										2	3	1	1	3	1	1		001
2	LST-E-SD-MW-5	WT	G			1-23-17	1357		10											3	1	1	3	1	1		002
3		WT	G			1-23-17	1500		10											3	1	1	3	1	1		003
4	EQ BLANK	WT				1-23-17	1700		10											3	1	1	3	1	1		004
5	AMB-BLANK	WT				1-23-17	1710		10											3	1	1	3	1	1		005
6																												006-TB
7																											
8																											
9																											
10																											
11																											
12																											

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	SAMPLE CONDITIONS: TEMP in C	Received on Ice (Y/N)	Custody Sealed Cooler (Y/N)	Samples Intact (Y/N)
	William Thomas / Pace	1-23-17	1745	Kevin Godwin / Pace	1/23/17	1745				
				PACE	1/24/17	0813				
		1-24-17	1430	PACE HVL	1-24-17	1430	3.3	Y	N	Y

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER: William Thomas

SIGNATURE of SAMPLER: William Thomas DATE Signed: 1/23/17

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

February 16, 2017

Sean Quarry
HDR Engineering
440 South Church Street
Suite 1000
Charlotte, NC 28202

RE: Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327590

Dear Sean Quarry:
Enclosed are the analytical results for sample(s) received by the laboratory on January 24, 2017. The results relate only to the samples included in this report. Results reported herein conform to the most current, applicable TNI/NELAC standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Kevin Godwin
kevin.godwin@pacelabs.com
Project Manager

Enclosures

cc: Mike Plummer, HDR

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(704)875-9092

CERTIFICATIONS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327590

Pennsylvania Certification IDs

1638 Roseytown Rd Suites 2,3&4, Greensburg, PA 15601
L-A-B DOD-ELAP Accreditation #: L2417
Alabama Certification #: 41590
Arizona Certification #: AZ0734
Arkansas Certification
California Certification #: 04222CA
Colorado Certification
Connecticut Certification #: PH-0694
Delaware Certification
Florida/TNI Certification #: E87683
Georgia Certification #: C040
Guam Certification
Hawaii Certification
Idaho Certification
Illinois Certification
Indiana Certification
Iowa Certification #: 391
Kansas/TNI Certification #: E-10358
Kentucky Certification #: 90133
Louisiana DHH/TNI Certification #: LA140008
Louisiana DEQ/TNI Certification #: 4086
Maine Certification #: PA00091
Maryland Certification #: 308
Massachusetts Certification #: M-PA1457
Michigan/PADEP Certification
Missouri Certification #: 235
Montana Certification #: Cert 0082
Nebraska Certification #: NE-05-29-14
Nevada Certification #: PA014572015-1
New Hampshire/TNI Certification #: 2976
New Jersey/TNI Certification #: PA 051
New Mexico Certification #: PA01457
New York/TNI Certification #: 10888
North Carolina Certification #: 42706
North Dakota Certification #: R-190
Oregon/TNI Certification #: PA200002
Pennsylvania/TNI Certification #: 65-00282
Puerto Rico Certification #: PA01457
Rhode Island Certification #: 65-00282
South Dakota Certification
Tennessee Certification #: TN2867
Texas/TNI Certification #: T104704188-14-8
Utah/TNI Certification #: PA014572015-5
USDA Soil Permit #: P330-14-00213
Vermont Dept. of Health: ID# VT-0282
Virgin Island/PADEP Certification
Virginia/VELAP Certification #: 460198
Washington Certification #: C868
West Virginia DEP Certification #: 143
West Virginia DHHR Certification #: 9964C
Wisconsin Certification
Wyoming Certification #: 8TMS-L

Charlotte Certification IDs

9800 Kincey Ave. Ste 100, Huntersville, NC 28078
North Carolina Drinking Water Certification #: 37706
North Carolina Field Services Certification #: 5342
North Carolina Wastewater Certification #: 12
South Carolina Certification #: 99006001
Florida/NELAP Certification #: E87627
Kentucky UST Certification #: 84
Virginia/VELAP Certification #: 460221

Asheville Certification IDs

2225 Riverside Drive, Asheville, NC 28804
Florida/NELAP Certification #: E87648
Massachusetts Certification #: M-NC030
North Carolina Drinking Water Certification #: 37712
North Carolina Wastewater Certification #: 40
South Carolina Certification #: 99030001
Virginia/VELAP Certification #: 460222

Greenwood Certification IDs

816 Durst Avenue East, Greenwood, SC 29649
South Carolina Laboratory ID #: 24562
North Carolina Divison of Water Resources Certification number 25
Florida Certification number E87633
Virginia VELAP ID: 460250
Asbestos NVLAP accreditation: 101410-0

REPORT OF LABORATORY ANALYSIS

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Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

SAMPLE SUMMARY

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327590

Lab ID	Sample ID	Matrix	Date Collected	Date Received
92327590001	**MW-6**	Water	01/24/17 09:10	01/24/17 18:45
92327590002	**MW-8**	Water	01/24/17 13:30	01/24/17 18:45
92327590003	**MW-3**	Water	01/24/17 15:35	01/24/17 18:45
92327590004	**AMB**	Water	01/24/17 16:00	01/24/17 18:45
92327590005	**EQ BLANK**	Water	01/24/17 17:00	01/24/17 18:45
92327590006	**TRIP BLANK**	Water	01/24/17 00:00	01/24/17 18:45

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SAMPLE ANALYTE COUNT

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327590

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
92327590001	**MW-6**	EPA 300.0	EIC	3	PASI-W
		EPA 6010	SH1	16	PASI-A
		EPA 6020B	CDF	3	PASI-A
		EPA 7470	WAB	1	PASI-A
		EPA 8260	ZDO	48	PASI-C
		EPA 903.1	WRR	1	PASI-PA
		EPA 904.0	JLW	1	PASI-PA
		SM 2540C	MJS1	1	PASI-A
92327590002	**MW-8**	EPA 300.0	EIC	3	PASI-W
		EPA 6010	SH1	16	PASI-A
		EPA 6020B	CDF	3	PASI-A
		EPA 7470	WAB	1	PASI-A
		EPA 8260	ZDO	48	PASI-C
		EPA 903.1	WRR	1	PASI-PA
		EPA 904.0	JLW	1	PASI-PA
		SM 2540C	MJS1	1	PASI-A
92327590003	**MW-3**	EPA 300.0	EIC	3	PASI-W
		EPA 6010	SH1	16	PASI-A
		EPA 6020B	CDF	3	PASI-A
		EPA 7470	WAB	1	PASI-A
		EPA 8260	ZDO	48	PASI-C
		EPA 903.1	WRR	1	PASI-PA
		EPA 904.0	JLW	1	PASI-PA
		SM 2540C	MJS1	1	PASI-A
92327590004	**AMB**	EPA 300.0	EIC	3	PASI-W
		EPA 6010	SH1	16	PASI-A
		EPA 6020B	CDF	3	PASI-A
		EPA 7470	WAB	1	PASI-A
		EPA 8260	ZDO	48	PASI-C
		EPA 903.1	WRR	1	PASI-PA
		EPA 904.0	JLW	1	PASI-PA
		SM 2540C	MJS1	1	PASI-A
92327590005	**EQ BLANK**	EPA 300.0	EIC	3	PASI-W
		EPA 6010	SH1	16	PASI-A
		EPA 6020B	CDF	3	PASI-A
		EPA 7470	WAB	1	PASI-A
		EPA 8260	ZDO	48	PASI-C

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SAMPLE ANALYTE COUNT

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327590

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
		EPA 903.1	WRR	1	PASI-PA
		EPA 904.0	JLW	1	PASI-PA
		SM 2540C	MJS1	1	PASI-A
92327590006	**TRIP BLANK**	EPA 8260	ZDO	48	PASI-C

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SUMMARY OF DETECTION

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327590

Lab Sample ID / Method	Client Sample ID / Parameters	Result	Units	Report Limit	Analyzed	Qualifiers
92327590001	**MW-6**					
EPA 300.0	Chloride	263	mg/L	5.0	01/27/17 00:46	
EPA 300.0	Fluoride	0.38	mg/L	0.10	01/26/17 20:17	
EPA 300.0	Sulfate	145	mg/L	5.0	01/27/17 00:46	
EPA 6010	Barium	122	ug/L	5.0	01/28/17 01:31	
EPA 6010	Calcium	34500	ug/L	100	01/28/17 01:31	
EPA 6020B	Lithium	48.5	ug/L	2.5	01/27/17 14:05	
EPA 903.1	Radium-226	0.126 ± 0.302 (0.584) C:NA T:91%	pCi/L		02/16/17 10:47	
EPA 904.0	Radium-228	0.416 ± 0.406 (0.830) C:61% T:86%	pCi/L		02/15/17 11:55	
SM 2540C	Total Dissolved Solids	776	mg/L	25.0	01/26/17 20:01	D6
92327590002	**MW-8**					
EPA 300.0	Chloride	660	mg/L	13.0	01/27/17 01:11	
EPA 300.0	Sulfate	6.0	mg/L	1.0	01/26/17 20:35	
EPA 6010	Barium	1360	ug/L	5.0	01/28/17 01:40	
EPA 6010	Calcium	169000	ug/L	500	01/28/17 15:43	
EPA 6010	Chromium	82.0	ug/L	5.0	01/28/17 01:40	
EPA 6010	Nickel	42.1	ug/L	5.0	01/28/17 01:40	
EPA 6010	Zinc	29.2	ug/L	10.0	01/28/17 01:40	
EPA 6020B	Lithium	38.3	ug/L	2.5	01/27/17 14:18	
EPA 903.1	Radium-226	0.0618 ± 0.282 (0.574) C:NA T:97%	pCi/L		02/16/17 11:10	
EPA 904.0	Radium-228	0.392 ± 0.281 (0.541) C:91% T:87%	pCi/L		02/15/17 11:56	
SM 2540C	Total Dissolved Solids	1270	mg/L	25.0	01/26/17 20:03	
92327590003	**MW-3**					
EPA 300.0	Chloride	1060	mg/L	20.0	01/26/17 22:47	
EPA 300.0	Sulfate	174	mg/L	3.0	01/26/17 22:22	
EPA 6010	Barium	531	ug/L	5.0	01/28/17 01:43	
EPA 6010	Calcium	160000	ug/L	500	01/28/17 15:46	
EPA 6010	Molybdenum	7.2	ug/L	5.0	01/28/17 01:43	
EPA 6020B	Lithium	103	ug/L	2.5	01/27/17 14:20	
EPA 903.1	Radium-226	1.25 ± 0.636 (0.612) C:NA T:94%	pCi/L		02/16/17 11:10	

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(704)875-9092

SUMMARY OF DETECTION

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327590

Lab Sample ID / Method	Client Sample ID / Parameters	Result	Units	Report Limit	Analyzed	Qualifiers
92327590003	**MW-3**					
EPA 904.0	Radium-228	0.387 ± 0.353 (0.715) C:76% T:83%	pCi/L		02/15/17 11:55	
SM 2540C	Total Dissolved Solids	303	mg/L	25.0	01/26/17 20:03	
92327590004	**AMB**					
EPA 903.1	Radium-226	0.189 ± 0.411 (0.759) C:NA T:94%	pCi/L		02/16/17 11:10	
EPA 904.0	Radium-228	0.432 ± 0.367 (0.733) C:66% T:90%	pCi/L		02/15/17 11:56	
92327590005	**EQ BLANK**					
EPA 903.1	Radium-226	0.0651 ± 0.297 (0.479) C:NA T:93%	pCi/L		02/16/17 11:10	
EPA 904.0	Radium-228	0.286 ± 0.376 (0.801) C:67% T:90%	pCi/L		02/15/17 11:56	

REPORT OF LABORATORY ANALYSIS

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Huntersville, NC 28078
(704)875-9092

ANALYTICAL RESULTS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327590

Sample: MW-6 **Lab ID: 92327590001** Collected: 01/24/17 09:10 Received: 01/24/17 18:45 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
3000 IC Anions 28 Days, GWD	Analytical Method: EPA 300.0							
Chloride	**263**	mg/L	5.0	5		01/27/17 00:46	16887-00-6	
Fluoride	**0.38**	mg/L	0.10	1		01/26/17 20:17	16984-48-8	
Sulfate	**145**	mg/L	5.0	5		01/27/17 00:46	14808-79-8	
6010 MET ICP	Analytical Method: EPA 6010 Preparation Method: EPA 3010A							
Antimony	ND	ug/L	5.0	1	01/26/17 22:15	01/28/17 01:31	7440-36-0	
Arsenic	ND	ug/L	10.0	1	01/26/17 22:15	01/28/17 01:31	7440-38-2	
Barium	**122**	ug/L	5.0	1	01/26/17 22:15	01/28/17 01:31	7440-39-3	
Beryllium	ND	ug/L	1.0	1	01/26/17 22:15	01/28/17 01:31	7440-41-7	
Cadmium	ND	ug/L	1.0	1	01/26/17 22:15	01/28/17 01:31	7440-43-9	
Calcium	**34500**	ug/L	100	1	01/26/17 22:15	01/28/17 01:31	7440-70-2	
Chromium	ND	ug/L	5.0	1	01/26/17 22:15	01/28/17 01:31	7440-47-3	
Cobalt	ND	ug/L	5.0	1	01/26/17 22:15	01/28/17 01:31	7440-48-4	
Copper	ND	ug/L	5.0	1	01/26/17 22:15	01/28/17 01:31	7440-50-8	
Lead	ND	ug/L	5.0	1	01/26/17 22:15	01/28/17 01:31	7439-92-1	
Molybdenum	ND	ug/L	5.0	1	01/26/17 22:15	01/28/17 01:31	7439-98-7	
Nickel	ND	ug/L	5.0	1	01/26/17 22:15	01/28/17 01:31	7440-02-0	
Selenium	ND	ug/L	10.0	1	01/26/17 22:15	01/28/17 15:21	7782-49-2	
Silver	ND	ug/L	5.0	1	01/26/17 22:15	01/28/17 01:31	7440-22-4	
Vanadium	ND	ug/L	5.0	1	01/26/17 22:15	01/28/17 01:31	7440-62-2	
Zinc	ND	ug/L	10.0	1	01/26/17 22:15	01/28/17 01:31	7440-66-6	
6020 MET ICPMS	Analytical Method: EPA 6020B Preparation Method: EPA 3010A							
Boron	ND	ug/L	25.0	1	01/26/17 17:55	01/27/17 14:05	7440-42-8	
Lithium	**48.5**	ug/L	2.5	1	01/26/17 17:55	01/27/17 14:05	7439-93-2	
Thallium	ND	ug/L	0.10	1	01/26/17 17:55	01/27/17 14:05	7440-28-0	
7470 Mercury	Analytical Method: EPA 7470 Preparation Method: EPA 7470							
Mercury	ND	ug/L	0.20	1	01/26/17 22:55	01/30/17 17:12	7439-97-6	
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
Acetone	ND	ug/L	25.0	1		01/26/17 13:08	67-64-1	
Acrylonitrile	ND	ug/L	10.0	1		01/26/17 13:08	107-13-1	
Benzene	ND	ug/L	1.0	1		01/26/17 13:08	71-43-2	
Bromochloromethane	ND	ug/L	1.0	1		01/26/17 13:08	74-97-5	
Bromodichloromethane	ND	ug/L	1.0	1		01/26/17 13:08	75-27-4	
Bromoform	ND	ug/L	1.0	1		01/26/17 13:08	75-25-2	
Bromomethane	ND	ug/L	2.0	1		01/26/17 13:08	74-83-9	
2-Butanone (MEK)	ND	ug/L	5.0	1		01/26/17 13:08	78-93-3	
Carbon disulfide	ND	ug/L	2.0	1		01/26/17 13:08	75-15-0	
Carbon tetrachloride	ND	ug/L	1.0	1		01/26/17 13:08	56-23-5	
Chlorobenzene	ND	ug/L	1.0	1		01/26/17 13:08	108-90-7	
Chloroethane	ND	ug/L	1.0	1		01/26/17 13:08	75-00-3	
Chloroform	ND	ug/L	1.0	1		01/26/17 13:08	67-66-3	
Chloromethane	ND	ug/L	1.0	1		01/26/17 13:08	74-87-3	
Dibromochloromethane	ND	ug/L	1.0	1		01/26/17 13:08	124-48-1	

REPORT OF LABORATORY ANALYSIS

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Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

ANALYTICAL RESULTS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327590

Sample: MW-6 **Lab ID: 92327590001** Collected: 01/24/17 09:10 Received: 01/24/17 18:45 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
Dibromomethane	ND	ug/L	1.0	1		01/26/17 13:08	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	1.0	1		01/26/17 13:08	95-50-1	
1,4-Dichlorobenzene	ND	ug/L	1.0	1		01/26/17 13:08	106-46-7	
trans-1,4-Dichloro-2-butene	ND	ug/L	1.0	1		01/26/17 13:08	110-57-6	
1,1-Dichloroethane	ND	ug/L	1.0	1		01/26/17 13:08	75-34-3	
1,2-Dichloroethane	ND	ug/L	1.0	1		01/26/17 13:08	107-06-2	
1,1-Dichloroethene	ND	ug/L	1.0	1		01/26/17 13:08	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	1.0	1		01/26/17 13:08	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	1.0	1		01/26/17 13:08	156-60-5	
1,2-Dichloropropane	ND	ug/L	1.0	1		01/26/17 13:08	78-87-5	
cis-1,3-Dichloropropene	ND	ug/L	1.0	1		01/26/17 13:08	10061-01-5	
trans-1,3-Dichloropropene	ND	ug/L	1.0	1		01/26/17 13:08	10061-02-6	
Ethylbenzene	ND	ug/L	1.0	1		01/26/17 13:08	100-41-4	
2-Hexanone	ND	ug/L	5.0	1		01/26/17 13:08	591-78-6	
Iodomethane	ND	ug/L	5.0	1		01/26/17 13:08	74-88-4	
Methylene Chloride	ND	ug/L	1.0	1		01/26/17 13:08	75-09-2	
4-Methyl-2-pentanone (MIBK)	ND	ug/L	5.0	1		01/26/17 13:08	108-10-1	
Styrene	ND	ug/L	1.0	1		01/26/17 13:08	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0	1		01/26/17 13:08	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0	1		01/26/17 13:08	79-34-5	
Tetrachloroethene	ND	ug/L	1.0	1		01/26/17 13:08	127-18-4	
Toluene	ND	ug/L	1.0	1		01/26/17 13:08	108-88-3	
1,1,1-Trichloroethane	ND	ug/L	1.0	1		01/26/17 13:08	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	1.0	1		01/26/17 13:08	79-00-5	
Trichloroethene	ND	ug/L	1.0	1		01/26/17 13:08	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0	1		01/26/17 13:08	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0	1		01/26/17 13:08	96-18-4	
Vinyl acetate	ND	ug/L	2.0	1		01/26/17 13:08	108-05-4	
Vinyl chloride	ND	ug/L	1.0	1		01/26/17 13:08	75-01-4	
Xylene (Total)	ND	ug/L	1.0	1		01/26/17 13:08	1330-20-7	
Surrogates								
4-Bromofluorobenzene (S)	99	%	70-130	1		01/26/17 13:08	460-00-4	
1,2-Dichloroethane-d4 (S)	90	%	70-130	1		01/26/17 13:08	17060-07-0	
Toluene-d8 (S)	104	%	70-130	1		01/26/17 13:08	2037-26-5	
2540C Total Dissolved Solids	Analytical Method: SM 2540C							
Total Dissolved Solids	**776**	mg/L	25.0	1		01/26/17 20:01		D6

REPORT OF LABORATORY ANALYSIS

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9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

ANALYTICAL RESULTS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327590

Sample: MW-8 **Lab ID: 92327590002** Collected: 01/24/17 13:30 Received: 01/24/17 18:45 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
3000 IC Anions 28 Days, GWD	Analytical Method: EPA 300.0							
Chloride	**660**	mg/L	13.0	13		01/27/17 01:11	16887-00-6	
Fluoride	ND	mg/L	0.10	1		01/26/17 20:35	16984-48-8	
Sulfate	**6.0**	mg/L	1.0	1		01/26/17 20:35	14808-79-8	
6010 MET ICP	Analytical Method: EPA 6010 Preparation Method: EPA 3010A							
Antimony	ND	ug/L	5.0	1	01/26/17 22:15	01/28/17 01:40	7440-36-0	
Arsenic	ND	ug/L	10.0	1	01/26/17 22:15	01/28/17 01:40	7440-38-2	
Barium	**1360**	ug/L	5.0	1	01/26/17 22:15	01/28/17 01:40	7440-39-3	
Beryllium	ND	ug/L	1.0	1	01/26/17 22:15	01/28/17 01:40	7440-41-7	
Cadmium	ND	ug/L	1.0	1	01/26/17 22:15	01/28/17 01:40	7440-43-9	
Calcium	**169000**	ug/L	500	5	01/26/17 22:15	01/28/17 15:43	7440-70-2	
Chromium	**82.0**	ug/L	5.0	1	01/26/17 22:15	01/28/17 01:40	7440-47-3	
Cobalt	ND	ug/L	5.0	1	01/26/17 22:15	01/28/17 01:40	7440-48-4	
Copper	ND	ug/L	5.0	1	01/26/17 22:15	01/28/17 01:40	7440-50-8	
Lead	ND	ug/L	5.0	1	01/26/17 22:15	01/28/17 01:40	7439-92-1	
Molybdenum	ND	ug/L	5.0	1	01/26/17 22:15	01/28/17 01:40	7439-98-7	
Nickel	**42.1**	ug/L	5.0	1	01/26/17 22:15	01/28/17 01:40	7440-02-0	
Selenium	ND	ug/L	10.0	1	01/26/17 22:15	01/28/17 15:30	7782-49-2	
Silver	ND	ug/L	5.0	1	01/26/17 22:15	01/28/17 01:40	7440-22-4	
Vanadium	ND	ug/L	5.0	1	01/26/17 22:15	01/28/17 01:40	7440-62-2	
Zinc	**29.2**	ug/L	10.0	1	01/26/17 22:15	01/28/17 01:40	7440-66-6	
6020 MET ICPMS	Analytical Method: EPA 6020B Preparation Method: EPA 3010A							
Boron	ND	ug/L	25.0	1	01/26/17 17:55	01/27/17 14:18	7440-42-8	
Lithium	**38.3**	ug/L	2.5	1	01/26/17 17:55	01/27/17 14:18	7439-93-2	
Thallium	ND	ug/L	0.10	1	01/26/17 17:55	01/27/17 14:18	7440-28-0	
7470 Mercury	Analytical Method: EPA 7470 Preparation Method: EPA 7470							
Mercury	ND	ug/L	0.20	1	01/26/17 22:55	01/30/17 17:15	7439-97-6	
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
Acetone	ND	ug/L	25.0	1		01/26/17 13:25	67-64-1	
Acrylonitrile	ND	ug/L	10.0	1		01/26/17 13:25	107-13-1	
Benzene	ND	ug/L	1.0	1		01/26/17 13:25	71-43-2	
Bromochloromethane	ND	ug/L	1.0	1		01/26/17 13:25	74-97-5	
Bromodichloromethane	ND	ug/L	1.0	1		01/26/17 13:25	75-27-4	
Bromoform	ND	ug/L	1.0	1		01/26/17 13:25	75-25-2	
Bromomethane	ND	ug/L	2.0	1		01/26/17 13:25	74-83-9	
2-Butanone (MEK)	ND	ug/L	5.0	1		01/26/17 13:25	78-93-3	
Carbon disulfide	ND	ug/L	2.0	1		01/26/17 13:25	75-15-0	
Carbon tetrachloride	ND	ug/L	1.0	1		01/26/17 13:25	56-23-5	
Chlorobenzene	ND	ug/L	1.0	1		01/26/17 13:25	108-90-7	
Chloroethane	ND	ug/L	1.0	1		01/26/17 13:25	75-00-3	
Chloroform	ND	ug/L	1.0	1		01/26/17 13:25	67-66-3	
Chloromethane	ND	ug/L	1.0	1		01/26/17 13:25	74-87-3	
Dibromochloromethane	ND	ug/L	1.0	1		01/26/17 13:25	124-48-1	

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(704)875-9092

ANALYTICAL RESULTS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327590

Sample: MW-8 **Lab ID: 92327590002** Collected: 01/24/17 13:30 Received: 01/24/17 18:45 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
Dibromomethane	ND	ug/L	1.0	1		01/26/17 13:25	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	1.0	1		01/26/17 13:25	95-50-1	
1,4-Dichlorobenzene	ND	ug/L	1.0	1		01/26/17 13:25	106-46-7	
trans-1,4-Dichloro-2-butene	ND	ug/L	1.0	1		01/26/17 13:25	110-57-6	
1,1-Dichloroethane	ND	ug/L	1.0	1		01/26/17 13:25	75-34-3	
1,2-Dichloroethane	ND	ug/L	1.0	1		01/26/17 13:25	107-06-2	
1,1-Dichloroethene	ND	ug/L	1.0	1		01/26/17 13:25	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	1.0	1		01/26/17 13:25	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	1.0	1		01/26/17 13:25	156-60-5	
1,2-Dichloropropane	ND	ug/L	1.0	1		01/26/17 13:25	78-87-5	
cis-1,3-Dichloropropene	ND	ug/L	1.0	1		01/26/17 13:25	10061-01-5	
trans-1,3-Dichloropropene	ND	ug/L	1.0	1		01/26/17 13:25	10061-02-6	
Ethylbenzene	ND	ug/L	1.0	1		01/26/17 13:25	100-41-4	
2-Hexanone	ND	ug/L	5.0	1		01/26/17 13:25	591-78-6	
Iodomethane	ND	ug/L	5.0	1		01/26/17 13:25	74-88-4	
Methylene Chloride	ND	ug/L	1.0	1		01/26/17 13:25	75-09-2	
4-Methyl-2-pentanone (MIBK)	ND	ug/L	5.0	1		01/26/17 13:25	108-10-1	
Styrene	ND	ug/L	1.0	1		01/26/17 13:25	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0	1		01/26/17 13:25	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0	1		01/26/17 13:25	79-34-5	
Tetrachloroethene	ND	ug/L	1.0	1		01/26/17 13:25	127-18-4	
Toluene	ND	ug/L	1.0	1		01/26/17 13:25	108-88-3	
1,1,1-Trichloroethane	ND	ug/L	1.0	1		01/26/17 13:25	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	1.0	1		01/26/17 13:25	79-00-5	
Trichloroethene	ND	ug/L	1.0	1		01/26/17 13:25	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0	1		01/26/17 13:25	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0	1		01/26/17 13:25	96-18-4	
Vinyl acetate	ND	ug/L	2.0	1		01/26/17 13:25	108-05-4	
Vinyl chloride	ND	ug/L	1.0	1		01/26/17 13:25	75-01-4	
Xylene (Total)	ND	ug/L	1.0	1		01/26/17 13:25	1330-20-7	
Surrogates								
4-Bromofluorobenzene (S)	97	%	70-130	1		01/26/17 13:25	460-00-4	
1,2-Dichloroethane-d4 (S)	93	%	70-130	1		01/26/17 13:25	17060-07-0	
Toluene-d8 (S)	104	%	70-130	1		01/26/17 13:25	2037-26-5	
2540C Total Dissolved Solids	Analytical Method: SM 2540C							
Total Dissolved Solids	**1270**	mg/L	25.0	1		01/26/17 20:03		

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(704)875-9092

ANALYTICAL RESULTS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327590

Sample: MW-3 **Lab ID: 92327590003** Collected: 01/24/17 15:35 Received: 01/24/17 18:45 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
3000 IC Anions 28 Days, GWD	Analytical Method: EPA 300.0							
Chloride	**1060**	mg/L	20.0	20		01/26/17 22:47	16887-00-6	
Fluoride	ND	mg/L	0.10	1		01/26/17 20:53	16984-48-8	
Sulfate	**174**	mg/L	3.0	3		01/26/17 22:22	14808-79-8	
6010 MET ICP	Analytical Method: EPA 6010 Preparation Method: EPA 3010A							
Antimony	ND	ug/L	5.0	1	01/26/17 22:15	01/28/17 01:43	7440-36-0	
Arsenic	ND	ug/L	10.0	1	01/26/17 22:15	01/28/17 01:43	7440-38-2	
Barium	**531**	ug/L	5.0	1	01/26/17 22:15	01/28/17 01:43	7440-39-3	
Beryllium	ND	ug/L	1.0	1	01/26/17 22:15	01/28/17 01:43	7440-41-7	
Cadmium	ND	ug/L	1.0	1	01/26/17 22:15	01/28/17 01:43	7440-43-9	
Calcium	**160000**	ug/L	500	5	01/26/17 22:15	01/28/17 15:46	7440-70-2	
Chromium	ND	ug/L	5.0	1	01/26/17 22:15	01/28/17 01:43	7440-47-3	
Cobalt	ND	ug/L	5.0	1	01/26/17 22:15	01/28/17 01:43	7440-48-4	
Copper	ND	ug/L	5.0	1	01/26/17 22:15	01/28/17 01:43	7440-50-8	
Lead	ND	ug/L	5.0	1	01/26/17 22:15	01/28/17 01:43	7439-92-1	
Molybdenum	**7.2**	ug/L	5.0	1	01/26/17 22:15	01/28/17 01:43	7439-98-7	
Nickel	ND	ug/L	5.0	1	01/26/17 22:15	01/28/17 01:43	7440-02-0	
Selenium	ND	ug/L	10.0	1	01/26/17 22:15	01/28/17 15:33	7782-49-2	
Silver	ND	ug/L	5.0	1	01/26/17 22:15	01/28/17 01:43	7440-22-4	
Vanadium	ND	ug/L	5.0	1	01/26/17 22:15	01/28/17 01:43	7440-62-2	
Zinc	ND	ug/L	10.0	1	01/26/17 22:15	01/28/17 01:43	7440-66-6	
6020 MET ICPMS	Analytical Method: EPA 6020B Preparation Method: EPA 3010A							
Boron	ND	ug/L	25.0	1	01/26/17 17:55	01/27/17 14:20	7440-42-8	
Lithium	**103**	ug/L	2.5	1	01/26/17 17:55	01/27/17 14:20	7439-93-2	
Thallium	ND	ug/L	0.10	1	01/26/17 17:55	01/27/17 14:20	7440-28-0	
7470 Mercury	Analytical Method: EPA 7470 Preparation Method: EPA 7470							
Mercury	ND	ug/L	0.20	1	01/26/17 22:55	01/30/17 17:17	7439-97-6	
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
Acetone	ND	ug/L	25.0	1		01/26/17 14:00	67-64-1	
Acrylonitrile	ND	ug/L	10.0	1		01/26/17 14:00	107-13-1	
Benzene	ND	ug/L	1.0	1		01/26/17 14:00	71-43-2	
Bromochloromethane	ND	ug/L	1.0	1		01/26/17 14:00	74-97-5	
Bromodichloromethane	ND	ug/L	1.0	1		01/26/17 14:00	75-27-4	
Bromoform	ND	ug/L	1.0	1		01/26/17 14:00	75-25-2	
Bromomethane	ND	ug/L	2.0	1		01/26/17 14:00	74-83-9	
2-Butanone (MEK)	ND	ug/L	5.0	1		01/26/17 14:00	78-93-3	
Carbon disulfide	ND	ug/L	2.0	1		01/26/17 14:00	75-15-0	
Carbon tetrachloride	ND	ug/L	1.0	1		01/26/17 14:00	56-23-5	
Chlorobenzene	ND	ug/L	1.0	1		01/26/17 14:00	108-90-7	
Chloroethane	ND	ug/L	1.0	1		01/26/17 14:00	75-00-3	
Chloroform	ND	ug/L	1.0	1		01/26/17 14:00	67-66-3	
Chloromethane	ND	ug/L	1.0	1		01/26/17 14:00	74-87-3	
Dibromochloromethane	ND	ug/L	1.0	1		01/26/17 14:00	124-48-1	

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ANALYTICAL RESULTS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327590

Sample: MW-3 **Lab ID: 92327590003** Collected: 01/24/17 15:35 Received: 01/24/17 18:45 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
Dibromomethane	ND	ug/L	1.0	1		01/26/17 14:00	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	1.0	1		01/26/17 14:00	95-50-1	
1,4-Dichlorobenzene	ND	ug/L	1.0	1		01/26/17 14:00	106-46-7	
trans-1,4-Dichloro-2-butene	ND	ug/L	1.0	1		01/26/17 14:00	110-57-6	
1,1-Dichloroethane	ND	ug/L	1.0	1		01/26/17 14:00	75-34-3	
1,2-Dichloroethane	ND	ug/L	1.0	1		01/26/17 14:00	107-06-2	
1,1-Dichloroethene	ND	ug/L	1.0	1		01/26/17 14:00	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	1.0	1		01/26/17 14:00	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	1.0	1		01/26/17 14:00	156-60-5	
1,2-Dichloropropane	ND	ug/L	1.0	1		01/26/17 14:00	78-87-5	
cis-1,3-Dichloropropene	ND	ug/L	1.0	1		01/26/17 14:00	10061-01-5	
trans-1,3-Dichloropropene	ND	ug/L	1.0	1		01/26/17 14:00	10061-02-6	
Ethylbenzene	ND	ug/L	1.0	1		01/26/17 14:00	100-41-4	
2-Hexanone	ND	ug/L	5.0	1		01/26/17 14:00	591-78-6	
Iodomethane	ND	ug/L	5.0	1		01/26/17 14:00	74-88-4	
Methylene Chloride	ND	ug/L	1.0	1		01/26/17 14:00	75-09-2	
4-Methyl-2-pentanone (MIBK)	ND	ug/L	5.0	1		01/26/17 14:00	108-10-1	
Styrene	ND	ug/L	1.0	1		01/26/17 14:00	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0	1		01/26/17 14:00	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0	1		01/26/17 14:00	79-34-5	
Tetrachloroethene	ND	ug/L	1.0	1		01/26/17 14:00	127-18-4	
Toluene	ND	ug/L	1.0	1		01/26/17 14:00	108-88-3	
1,1,1-Trichloroethane	ND	ug/L	1.0	1		01/26/17 14:00	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	1.0	1		01/26/17 14:00	79-00-5	
Trichloroethene	ND	ug/L	1.0	1		01/26/17 14:00	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0	1		01/26/17 14:00	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0	1		01/26/17 14:00	96-18-4	
Vinyl acetate	ND	ug/L	2.0	1		01/26/17 14:00	108-05-4	
Vinyl chloride	ND	ug/L	1.0	1		01/26/17 14:00	75-01-4	
Xylene (Total)	ND	ug/L	1.0	1		01/26/17 14:00	1330-20-7	
Surrogates								
4-Bromofluorobenzene (S)	99	%	70-130	1		01/26/17 14:00	460-00-4	
1,2-Dichloroethane-d4 (S)	90	%	70-130	1		01/26/17 14:00	17060-07-0	
Toluene-d8 (S)	104	%	70-130	1		01/26/17 14:00	2037-26-5	
2540C Total Dissolved Solids	Analytical Method: SM 2540C							
Total Dissolved Solids	**303**	mg/L	25.0	1		01/26/17 20:03		

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ANALYTICAL RESULTS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327590

Sample: AMB **Lab ID: 92327590004** Collected: 01/24/17 16:00 Received: 01/24/17 18:45 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
3000 IC Anions 28 Days, GWD	Analytical Method: EPA 300.0							
Chloride	ND	mg/L	1.0	1		01/26/17 21:47	16887-00-6	
Fluoride	ND	mg/L	0.10	1		01/26/17 21:47	16984-48-8	
Sulfate	ND	mg/L	1.0	1		01/26/17 21:47	14808-79-8	
6010 MET ICP	Analytical Method: EPA 6010 Preparation Method: EPA 3010A							
Antimony	ND	ug/L	5.0	1	01/26/17 22:15	01/28/17 01:46	7440-36-0	
Arsenic	ND	ug/L	10.0	1	01/26/17 22:15	01/28/17 01:46	7440-38-2	
Barium	ND	ug/L	5.0	1	01/26/17 22:15	01/28/17 01:46	7440-39-3	
Beryllium	ND	ug/L	1.0	1	01/26/17 22:15	01/28/17 01:46	7440-41-7	
Cadmium	ND	ug/L	1.0	1	01/26/17 22:15	01/28/17 01:46	7440-43-9	
Calcium	ND	ug/L	100	1	01/26/17 22:15	01/28/17 01:46	7440-70-2	
Chromium	ND	ug/L	5.0	1	01/26/17 22:15	01/28/17 01:46	7440-47-3	
Cobalt	ND	ug/L	5.0	1	01/26/17 22:15	01/28/17 01:46	7440-48-4	
Copper	ND	ug/L	5.0	1	01/26/17 22:15	01/28/17 01:46	7440-50-8	
Lead	ND	ug/L	5.0	1	01/26/17 22:15	01/28/17 01:46	7439-92-1	
Molybdenum	ND	ug/L	5.0	1	01/26/17 22:15	01/28/17 01:46	7439-98-7	
Nickel	ND	ug/L	5.0	1	01/26/17 22:15	01/28/17 01:46	7440-02-0	
Selenium	ND	ug/L	10.0	1	01/26/17 22:15	01/28/17 15:37	7782-49-2	
Silver	ND	ug/L	5.0	1	01/26/17 22:15	01/28/17 01:46	7440-22-4	
Vanadium	ND	ug/L	5.0	1	01/26/17 22:15	01/28/17 01:46	7440-62-2	
Zinc	ND	ug/L	10.0	1	01/26/17 22:15	01/28/17 01:46	7440-66-6	
6020 MET ICPMS	Analytical Method: EPA 6020B Preparation Method: EPA 3010A							
Boron	ND	ug/L	25.0	1	01/26/17 17:55	01/27/17 14:21	7440-42-8	
Lithium	ND	ug/L	2.5	1	01/26/17 17:55	01/27/17 14:21	7439-93-2	
Thallium	ND	ug/L	0.10	1	01/26/17 17:55	01/27/17 14:21	7440-28-0	
7470 Mercury	Analytical Method: EPA 7470 Preparation Method: EPA 7470							
Mercury	ND	ug/L	0.20	1	01/26/17 22:55	01/30/17 17:27	7439-97-6	
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
Acetone	ND	ug/L	25.0	1		01/26/17 14:17	67-64-1	
Acrylonitrile	ND	ug/L	10.0	1		01/26/17 14:17	107-13-1	
Benzene	ND	ug/L	1.0	1		01/26/17 14:17	71-43-2	
Bromochloromethane	ND	ug/L	1.0	1		01/26/17 14:17	74-97-5	
Bromodichloromethane	ND	ug/L	1.0	1		01/26/17 14:17	75-27-4	
Bromoform	ND	ug/L	1.0	1		01/26/17 14:17	75-25-2	
Bromomethane	ND	ug/L	2.0	1		01/26/17 14:17	74-83-9	
2-Butanone (MEK)	ND	ug/L	5.0	1		01/26/17 14:17	78-93-3	
Carbon disulfide	ND	ug/L	2.0	1		01/26/17 14:17	75-15-0	
Carbon tetrachloride	ND	ug/L	1.0	1		01/26/17 14:17	56-23-5	
Chlorobenzene	ND	ug/L	1.0	1		01/26/17 14:17	108-90-7	
Chloroethane	ND	ug/L	1.0	1		01/26/17 14:17	75-00-3	
Chloroform	ND	ug/L	1.0	1		01/26/17 14:17	67-66-3	
Chloromethane	ND	ug/L	1.0	1		01/26/17 14:17	74-87-3	
Dibromochloromethane	ND	ug/L	1.0	1		01/26/17 14:17	124-48-1	

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9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

ANALYTICAL RESULTS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327590

Sample: AMB **Lab ID: 92327590004** Collected: 01/24/17 16:00 Received: 01/24/17 18:45 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
Dibromomethane	ND	ug/L	1.0	1		01/26/17 14:17	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	1.0	1		01/26/17 14:17	95-50-1	
1,4-Dichlorobenzene	ND	ug/L	1.0	1		01/26/17 14:17	106-46-7	
trans-1,4-Dichloro-2-butene	ND	ug/L	1.0	1		01/26/17 14:17	110-57-6	
1,1-Dichloroethane	ND	ug/L	1.0	1		01/26/17 14:17	75-34-3	
1,2-Dichloroethane	ND	ug/L	1.0	1		01/26/17 14:17	107-06-2	
1,1-Dichloroethene	ND	ug/L	1.0	1		01/26/17 14:17	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	1.0	1		01/26/17 14:17	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	1.0	1		01/26/17 14:17	156-60-5	
1,2-Dichloropropane	ND	ug/L	1.0	1		01/26/17 14:17	78-87-5	
cis-1,3-Dichloropropene	ND	ug/L	1.0	1		01/26/17 14:17	10061-01-5	
trans-1,3-Dichloropropene	ND	ug/L	1.0	1		01/26/17 14:17	10061-02-6	
Ethylbenzene	ND	ug/L	1.0	1		01/26/17 14:17	100-41-4	
2-Hexanone	ND	ug/L	5.0	1		01/26/17 14:17	591-78-6	
Iodomethane	ND	ug/L	5.0	1		01/26/17 14:17	74-88-4	
Methylene Chloride	ND	ug/L	1.0	1		01/26/17 14:17	75-09-2	
4-Methyl-2-pentanone (MIBK)	ND	ug/L	5.0	1		01/26/17 14:17	108-10-1	
Styrene	ND	ug/L	1.0	1		01/26/17 14:17	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0	1		01/26/17 14:17	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0	1		01/26/17 14:17	79-34-5	
Tetrachloroethene	ND	ug/L	1.0	1		01/26/17 14:17	127-18-4	
Toluene	ND	ug/L	1.0	1		01/26/17 14:17	108-88-3	
1,1,1-Trichloroethane	ND	ug/L	1.0	1		01/26/17 14:17	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	1.0	1		01/26/17 14:17	79-00-5	
Trichloroethene	ND	ug/L	1.0	1		01/26/17 14:17	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0	1		01/26/17 14:17	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0	1		01/26/17 14:17	96-18-4	
Vinyl acetate	ND	ug/L	2.0	1		01/26/17 14:17	108-05-4	
Vinyl chloride	ND	ug/L	1.0	1		01/26/17 14:17	75-01-4	
Xylene (Total)	ND	ug/L	1.0	1		01/26/17 14:17	1330-20-7	
Surrogates								
4-Bromofluorobenzene (S)	98	%	70-130	1		01/26/17 14:17	460-00-4	
1,2-Dichloroethane-d4 (S)	92	%	70-130	1		01/26/17 14:17	17060-07-0	
Toluene-d8 (S)	103	%	70-130	1		01/26/17 14:17	2037-26-5	
2540C Total Dissolved Solids	Analytical Method: SM 2540C							
Total Dissolved Solids	ND	mg/L	25.0	1		01/26/17 20:03		

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(704)875-9092

ANALYTICAL RESULTS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327590

Sample: EQ BLANK **Lab ID: 92327590005** Collected: 01/24/17 17:00 Received: 01/24/17 18:45 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
3000 IC Anions 28 Days, GWD	Analytical Method: EPA 300.0							
Chloride	ND	mg/L	1.0	1		01/26/17 22:05	16887-00-6	
Fluoride	ND	mg/L	0.10	1		01/26/17 22:05	16984-48-8	
Sulfate	ND	mg/L	1.0	1		01/26/17 22:05	14808-79-8	
6010 MET ICP	Analytical Method: EPA 6010 Preparation Method: EPA 3010A							
Antimony	ND	ug/L	5.0	1	01/26/17 22:15	01/28/17 01:50	7440-36-0	
Arsenic	ND	ug/L	10.0	1	01/26/17 22:15	01/28/17 01:50	7440-38-2	
Barium	ND	ug/L	5.0	1	01/26/17 22:15	01/28/17 01:50	7440-39-3	
Beryllium	ND	ug/L	1.0	1	01/26/17 22:15	01/28/17 01:50	7440-41-7	
Cadmium	ND	ug/L	1.0	1	01/26/17 22:15	01/28/17 01:50	7440-43-9	
Calcium	ND	ug/L	100	1	01/26/17 22:15	01/28/17 01:50	7440-70-2	
Chromium	ND	ug/L	5.0	1	01/26/17 22:15	01/28/17 01:50	7440-47-3	
Cobalt	ND	ug/L	5.0	1	01/26/17 22:15	01/28/17 01:50	7440-48-4	
Copper	ND	ug/L	5.0	1	01/26/17 22:15	01/28/17 01:50	7440-50-8	
Lead	ND	ug/L	5.0	1	01/26/17 22:15	01/28/17 01:50	7439-92-1	
Molybdenum	ND	ug/L	5.0	1	01/26/17 22:15	01/28/17 01:50	7439-98-7	
Nickel	ND	ug/L	5.0	1	01/26/17 22:15	01/28/17 01:50	7440-02-0	
Selenium	ND	ug/L	10.0	1	01/26/17 22:15	01/28/17 15:40	7782-49-2	
Silver	ND	ug/L	5.0	1	01/26/17 22:15	01/28/17 01:50	7440-22-4	
Vanadium	ND	ug/L	5.0	1	01/26/17 22:15	01/28/17 01:50	7440-62-2	
Zinc	ND	ug/L	10.0	1	01/26/17 22:15	01/28/17 01:50	7440-66-6	
6020 MET ICPMS	Analytical Method: EPA 6020B Preparation Method: EPA 3010A							
Boron	ND	ug/L	25.0	1	01/26/17 17:55	01/27/17 14:23	7440-42-8	
Lithium	ND	ug/L	2.5	1	01/26/17 17:55	01/27/17 14:23	7439-93-2	
Thallium	ND	ug/L	0.10	1	01/26/17 17:55	01/27/17 14:23	7440-28-0	
7470 Mercury	Analytical Method: EPA 7470 Preparation Method: EPA 7470							
Mercury	ND	ug/L	0.20	1	01/26/17 22:55	01/30/17 17:29	7439-97-6	
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
Acetone	ND	ug/L	25.0	1		01/26/17 14:35	67-64-1	
Acrylonitrile	ND	ug/L	10.0	1		01/26/17 14:35	107-13-1	
Benzene	ND	ug/L	1.0	1		01/26/17 14:35	71-43-2	
Bromochloromethane	ND	ug/L	1.0	1		01/26/17 14:35	74-97-5	
Bromodichloromethane	ND	ug/L	1.0	1		01/26/17 14:35	75-27-4	
Bromoform	ND	ug/L	1.0	1		01/26/17 14:35	75-25-2	
Bromomethane	ND	ug/L	2.0	1		01/26/17 14:35	74-83-9	
2-Butanone (MEK)	ND	ug/L	5.0	1		01/26/17 14:35	78-93-3	
Carbon disulfide	ND	ug/L	2.0	1		01/26/17 14:35	75-15-0	
Carbon tetrachloride	ND	ug/L	1.0	1		01/26/17 14:35	56-23-5	
Chlorobenzene	ND	ug/L	1.0	1		01/26/17 14:35	108-90-7	
Chloroethane	ND	ug/L	1.0	1		01/26/17 14:35	75-00-3	
Chloroform	ND	ug/L	1.0	1		01/26/17 14:35	67-66-3	
Chloromethane	ND	ug/L	1.0	1		01/26/17 14:35	74-87-3	
Dibromochloromethane	ND	ug/L	1.0	1		01/26/17 14:35	124-48-1	

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ANALYTICAL RESULTS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327590

Sample: EQ BLANK **Lab ID: 92327590005** Collected: 01/24/17 17:00 Received: 01/24/17 18:45 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
Dibromomethane	ND	ug/L	1.0	1		01/26/17 14:35	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	1.0	1		01/26/17 14:35	95-50-1	
1,4-Dichlorobenzene	ND	ug/L	1.0	1		01/26/17 14:35	106-46-7	
trans-1,4-Dichloro-2-butene	ND	ug/L	1.0	1		01/26/17 14:35	110-57-6	
1,1-Dichloroethane	ND	ug/L	1.0	1		01/26/17 14:35	75-34-3	
1,2-Dichloroethane	ND	ug/L	1.0	1		01/26/17 14:35	107-06-2	
1,1-Dichloroethene	ND	ug/L	1.0	1		01/26/17 14:35	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	1.0	1		01/26/17 14:35	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	1.0	1		01/26/17 14:35	156-60-5	
1,2-Dichloropropane	ND	ug/L	1.0	1		01/26/17 14:35	78-87-5	
cis-1,3-Dichloropropene	ND	ug/L	1.0	1		01/26/17 14:35	10061-01-5	
trans-1,3-Dichloropropene	ND	ug/L	1.0	1		01/26/17 14:35	10061-02-6	
Ethylbenzene	ND	ug/L	1.0	1		01/26/17 14:35	100-41-4	
2-Hexanone	ND	ug/L	5.0	1		01/26/17 14:35	591-78-6	
Iodomethane	ND	ug/L	5.0	1		01/26/17 14:35	74-88-4	
Methylene Chloride	ND	ug/L	1.0	1		01/26/17 14:35	75-09-2	
4-Methyl-2-pentanone (MIBK)	ND	ug/L	5.0	1		01/26/17 14:35	108-10-1	
Styrene	ND	ug/L	1.0	1		01/26/17 14:35	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0	1		01/26/17 14:35	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0	1		01/26/17 14:35	79-34-5	
Tetrachloroethene	ND	ug/L	1.0	1		01/26/17 14:35	127-18-4	
Toluene	ND	ug/L	1.0	1		01/26/17 14:35	108-88-3	
1,1,1-Trichloroethane	ND	ug/L	1.0	1		01/26/17 14:35	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	1.0	1		01/26/17 14:35	79-00-5	
Trichloroethene	ND	ug/L	1.0	1		01/26/17 14:35	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0	1		01/26/17 14:35	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0	1		01/26/17 14:35	96-18-4	
Vinyl acetate	ND	ug/L	2.0	1		01/26/17 14:35	108-05-4	
Vinyl chloride	ND	ug/L	1.0	1		01/26/17 14:35	75-01-4	
Xylene (Total)	ND	ug/L	1.0	1		01/26/17 14:35	1330-20-7	
Surrogates								
4-Bromofluorobenzene (S)	96	%	70-130	1		01/26/17 14:35	460-00-4	
1,2-Dichloroethane-d4 (S)	96	%	70-130	1		01/26/17 14:35	17060-07-0	
Toluene-d8 (S)	108	%	70-130	1		01/26/17 14:35	2037-26-5	
2540C Total Dissolved Solids	Analytical Method: SM 2540C							
Total Dissolved Solids	ND	mg/L	25.0	1		01/26/17 20:04		

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ANALYTICAL RESULTS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327590

Sample: TRIP BLANK **Lab ID: 92327590006** Collected: 01/24/17 00:00 Received: 01/24/17 18:45 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
Acetone	ND	ug/L	25.0	1		01/26/17 14:52	67-64-1	
Acrylonitrile	ND	ug/L	10.0	1		01/26/17 14:52	107-13-1	
Benzene	ND	ug/L	1.0	1		01/26/17 14:52	71-43-2	
Bromochloromethane	ND	ug/L	1.0	1		01/26/17 14:52	74-97-5	
Bromodichloromethane	ND	ug/L	1.0	1		01/26/17 14:52	75-27-4	
Bromoform	ND	ug/L	1.0	1		01/26/17 14:52	75-25-2	
Bromomethane	ND	ug/L	2.0	1		01/26/17 14:52	74-83-9	
2-Butanone (MEK)	ND	ug/L	5.0	1		01/26/17 14:52	78-93-3	
Carbon disulfide	ND	ug/L	2.0	1		01/26/17 14:52	75-15-0	
Carbon tetrachloride	ND	ug/L	1.0	1		01/26/17 14:52	56-23-5	
Chlorobenzene	ND	ug/L	1.0	1		01/26/17 14:52	108-90-7	
Chloroethane	ND	ug/L	1.0	1		01/26/17 14:52	75-00-3	
Chloroform	ND	ug/L	1.0	1		01/26/17 14:52	67-66-3	
Chloromethane	ND	ug/L	1.0	1		01/26/17 14:52	74-87-3	
Dibromochloromethane	ND	ug/L	1.0	1		01/26/17 14:52	124-48-1	
Dibromomethane	ND	ug/L	1.0	1		01/26/17 14:52	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	1.0	1		01/26/17 14:52	95-50-1	
1,4-Dichlorobenzene	ND	ug/L	1.0	1		01/26/17 14:52	106-46-7	
trans-1,4-Dichloro-2-butene	ND	ug/L	1.0	1		01/26/17 14:52	110-57-6	
1,1-Dichloroethane	ND	ug/L	1.0	1		01/26/17 14:52	75-34-3	
1,2-Dichloroethane	ND	ug/L	1.0	1		01/26/17 14:52	107-06-2	
1,1-Dichloroethene	ND	ug/L	1.0	1		01/26/17 14:52	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	1.0	1		01/26/17 14:52	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	1.0	1		01/26/17 14:52	156-60-5	
1,2-Dichloropropane	ND	ug/L	1.0	1		01/26/17 14:52	78-87-5	
cis-1,3-Dichloropropene	ND	ug/L	1.0	1		01/26/17 14:52	10061-01-5	
trans-1,3-Dichloropropene	ND	ug/L	1.0	1		01/26/17 14:52	10061-02-6	
Ethylbenzene	ND	ug/L	1.0	1		01/26/17 14:52	100-41-4	
2-Hexanone	ND	ug/L	5.0	1		01/26/17 14:52	591-78-6	
Iodomethane	ND	ug/L	5.0	1		01/26/17 14:52	74-88-4	
Methylene Chloride	ND	ug/L	1.0	1		01/26/17 14:52	75-09-2	
4-Methyl-2-pentanone (MIBK)	ND	ug/L	5.0	1		01/26/17 14:52	108-10-1	
Styrene	ND	ug/L	1.0	1		01/26/17 14:52	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0	1		01/26/17 14:52	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0	1		01/26/17 14:52	79-34-5	
Tetrachloroethene	ND	ug/L	1.0	1		01/26/17 14:52	127-18-4	
Toluene	ND	ug/L	1.0	1		01/26/17 14:52	108-88-3	
1,1,1-Trichloroethane	ND	ug/L	1.0	1		01/26/17 14:52	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	1.0	1		01/26/17 14:52	79-00-5	
Trichloroethene	ND	ug/L	1.0	1		01/26/17 14:52	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0	1		01/26/17 14:52	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0	1		01/26/17 14:52	96-18-4	
Vinyl acetate	ND	ug/L	2.0	1		01/26/17 14:52	108-05-4	
Vinyl chloride	ND	ug/L	1.0	1		01/26/17 14:52	75-01-4	
Xylene (Total)	ND	ug/L	1.0	1		01/26/17 14:52	1330-20-7	
Surrogates								
4-Bromofluorobenzene (S)	97	%	70-130	1		01/26/17 14:52	460-00-4	

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ANALYTICAL RESULTS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327590

Sample: TRIP BLANK **Lab ID: 92327590006** Collected: 01/24/17 00:00 Received: 01/24/17 18:45 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
Surrogates								
1,2-Dichloroethane-d4 (S)	94	%	70-130	1		01/26/17 14:52	17060-07-0	
Toluene-d8 (S)	102	%	70-130	1		01/26/17 14:52	2037-26-5	

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QUALITY CONTROL DATA

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327590

QC Batch: 345857 Analysis Method: EPA 300.0
QC Batch Method: EPA 300.0 Analysis Description: 3000 IC Anions, GWD
Associated Lab Samples: 92327590001, 92327590002, 92327590003, 92327590004, 92327590005

METHOD BLANK: 1918758 Matrix: Water
Associated Lab Samples: 92327590001, 92327590002, 92327590003, 92327590004, 92327590005

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Chloride	mg/L	ND	1.0	01/26/17 17:36	
Fluoride	mg/L	ND	0.10	01/26/17 17:36	
Sulfate	mg/L	ND	1.0	01/26/17 17:36	

LABORATORY CONTROL SAMPLE: 1918759

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Chloride	mg/L	50	51.5	103	90-110	
Fluoride	mg/L	2.5	2.6	103	90-110	
Sulfate	mg/L	50	51.4	103	90-110	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1918760 1918761

Parameter	Units	92327477001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Chloride	mg/L	303	50	50	348	349	90	92	90-110	0	20	
Fluoride	mg/L	0.14	2.5	2.5	2.3	2.4	87	89	90-110	2	20	M1
Sulfate	mg/L	20.0	50	50	71.6	73.9	103	108	90-110	3	20	

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QUALITY CONTROL DATA

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327590

QC Batch: 345701 Analysis Method: EPA 7470
QC Batch Method: EPA 7470 Analysis Description: 7470 Mercury
Associated Lab Samples: 92327590001, 92327590002, 92327590003, 92327590004, 92327590005

METHOD BLANK: 1917967 Matrix: Water
Associated Lab Samples: 92327590001, 92327590002, 92327590003, 92327590004, 92327590005

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Mercury	ug/L	ND	0.20	01/30/17 17:01	

LABORATORY CONTROL SAMPLE: 1917968

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Mercury	ug/L	2.5	2.3	92	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1917969 1917970

Parameter	Units	92327429001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Mercury	ug/L	ND	2.5	2.5	2.4	2.4	95	95	75-125	1	25	

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QUALITY CONTROL DATA

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327590

QC Batch: 345712 Analysis Method: EPA 6010
QC Batch Method: EPA 3010A Analysis Description: 6010 MET
Associated Lab Samples: 92327590001, 92327590002, 92327590003, 92327590004, 92327590005

METHOD BLANK: 1918007 Matrix: Water
Associated Lab Samples: 92327590001, 92327590002, 92327590003, 92327590004, 92327590005

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Antimony	ug/L	ND	5.0	01/28/17 01:25	
Arsenic	ug/L	ND	10.0	01/28/17 01:25	
Barium	ug/L	ND	5.0	01/28/17 01:25	
Beryllium	ug/L	ND	1.0	01/28/17 01:25	
Cadmium	ug/L	ND	1.0	01/28/17 01:25	
Calcium	ug/L	ND	100	01/28/17 01:25	
Chromium	ug/L	ND	5.0	01/28/17 01:25	
Cobalt	ug/L	ND	5.0	01/28/17 01:25	
Copper	ug/L	ND	5.0	01/28/17 01:25	
Lead	ug/L	ND	5.0	01/28/17 01:25	
Molybdenum	ug/L	ND	5.0	01/28/17 01:25	
Nickel	ug/L	ND	5.0	01/28/17 01:25	
Selenium	ug/L	ND	10.0	01/28/17 15:05	
Silver	ug/L	ND	5.0	01/28/17 01:25	
Vanadium	ug/L	ND	5.0	01/28/17 01:25	
Zinc	ug/L	ND	10.0	01/28/17 01:25	

LABORATORY CONTROL SAMPLE: 1918008

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Antimony	ug/L	500	450	90	80-120	
Arsenic	ug/L	500	444	89	80-120	
Barium	ug/L	500	495	99	80-120	
Beryllium	ug/L	500	484	97	80-120	
Cadmium	ug/L	500	462	92	80-120	
Calcium	ug/L	5000	4820	96	80-120	
Chromium	ug/L	500	489	98	80-120	
Cobalt	ug/L	500	466	93	80-120	
Copper	ug/L	500	480	96	80-120	
Lead	ug/L	500	461	92	80-120	
Molybdenum	ug/L	500	480	96	80-120	
Nickel	ug/L	500	462	92	80-120	
Selenium	ug/L	500	556	111	80-120	
Silver	ug/L	250	237	95	80-120	
Vanadium	ug/L	500	472	94	80-120	
Zinc	ug/L	500	474	95	80-120	

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QUALITY CONTROL DATA

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327590

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1918009 1918010

Parameter	Units	92327590001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Antimony	ug/L	ND	500	500	447	450	89	90	75-125	1	20	
Arsenic	ug/L	ND	500	500	452	450	90	90	75-125	0	20	
Barium	ug/L	122	500	500	613	616	98	99	75-125	0	20	
Beryllium	ug/L	ND	500	500	482	486	96	97	75-125	1	20	
Cadmium	ug/L	ND	500	500	456	456	91	91	75-125	0	20	
Calcium	ug/L	34500	5000	5000	40000	40700	110	125	75-125	2	20	
Chromium	ug/L	ND	500	500	482	483	96	97	75-125	0	20	
Cobalt	ug/L	ND	500	500	445	446	89	89	75-125	0	20	
Copper	ug/L	ND	500	500	476	475	95	95	75-125	0	20	
Lead	ug/L	ND	500	500	434	432	87	86	75-125	0	20	
Molybdenum	ug/L	ND	500	500	479	479	95	95	75-125	0	20	
Nickel	ug/L	ND	500	500	441	440	88	88	75-125	0	20	
Selenium	ug/L	ND	500	500	493	547	98	109	75-125	10	20	
Silver	ug/L	ND	250	250	232	233	93	93	75-125	1	20	
Vanadium	ug/L	ND	500	500	472	472	94	94	75-125	0	20	
Zinc	ug/L	ND	500	500	465	465	92	92	75-125	0	20	

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QUALITY CONTROL DATA

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327590

QC Batch: 345698 Analysis Method: EPA 6020B
QC Batch Method: EPA 3010A Analysis Description: 6020 MET
Associated Lab Samples: 92327590001, 92327590002, 92327590003, 92327590004, 92327590005

METHOD BLANK: 1917955 Matrix: Water
Associated Lab Samples: 92327590001, 92327590002, 92327590003, 92327590004, 92327590005

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Boron	ug/L	ND	25.0	01/27/17 13:47	
Lithium	ug/L	ND	2.5	01/27/17 13:47	
Thallium	ug/L	ND	0.10	01/27/17 13:47	

LABORATORY CONTROL SAMPLE: 1917956

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Boron	ug/L	100	103	103	80-120	
Lithium	ug/L	100	102	102	80-120	
Thallium	ug/L	100	94.5	94	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1917957 1917958

Parameter	Units	92327477001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Boron	ug/L	ND	100	100	106	109	98	102	75-125	3	20	
Lithium	ug/L	24.5	100	100	117	119	93	94	75-125	1	20	
Thallium	ug/L	ND	100	100	91.3	94.6	91	95	75-125	4	20	

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QUALITY CONTROL DATA

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327590

QC Batch: 345758 Analysis Method: EPA 8260
QC Batch Method: EPA 8260 Analysis Description: 8260 MSV Low Level Landfill
Associated Lab Samples: 92327590001, 92327590002, 92327590003, 92327590004, 92327590005, 92327590006

METHOD BLANK: 1918168 Matrix: Water
Associated Lab Samples: 92327590001, 92327590002, 92327590003, 92327590004, 92327590005, 92327590006

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
1,1,1,2-Tetrachloroethane	ug/L	ND	1.0	01/26/17 12:33	
1,1,1-Trichloroethane	ug/L	ND	1.0	01/26/17 12:33	
1,1,2,2-Tetrachloroethane	ug/L	ND	1.0	01/26/17 12:33	
1,1,2-Trichloroethane	ug/L	ND	1.0	01/26/17 12:33	
1,1-Dichloroethane	ug/L	ND	1.0	01/26/17 12:33	
1,1-Dichloroethene	ug/L	ND	1.0	01/26/17 12:33	
1,2,3-Trichloropropane	ug/L	ND	1.0	01/26/17 12:33	
1,2-Dichlorobenzene	ug/L	ND	1.0	01/26/17 12:33	
1,2-Dichloroethane	ug/L	ND	1.0	01/26/17 12:33	
1,2-Dichloropropane	ug/L	ND	1.0	01/26/17 12:33	
1,4-Dichlorobenzene	ug/L	ND	1.0	01/26/17 12:33	
2-Butanone (MEK)	ug/L	ND	5.0	01/26/17 12:33	
2-Hexanone	ug/L	ND	5.0	01/26/17 12:33	
4-Methyl-2-pentanone (MIBK)	ug/L	ND	5.0	01/26/17 12:33	
Acetone	ug/L	ND	25.0	01/26/17 12:33	
Acrylonitrile	ug/L	ND	10.0	01/26/17 12:33	
Benzene	ug/L	ND	1.0	01/26/17 12:33	
Bromochloromethane	ug/L	ND	1.0	01/26/17 12:33	
Bromodichloromethane	ug/L	ND	1.0	01/26/17 12:33	
Bromoform	ug/L	ND	1.0	01/26/17 12:33	
Bromomethane	ug/L	ND	2.0	01/26/17 12:33	
Carbon disulfide	ug/L	ND	2.0	01/26/17 12:33	
Carbon tetrachloride	ug/L	ND	1.0	01/26/17 12:33	
Chlorobenzene	ug/L	ND	1.0	01/26/17 12:33	
Chloroethane	ug/L	ND	1.0	01/26/17 12:33	
Chloroform	ug/L	ND	1.0	01/26/17 12:33	
Chloromethane	ug/L	ND	1.0	01/26/17 12:33	
cis-1,2-Dichloroethene	ug/L	ND	1.0	01/26/17 12:33	
cis-1,3-Dichloropropene	ug/L	ND	1.0	01/26/17 12:33	
Dibromochloromethane	ug/L	ND	1.0	01/26/17 12:33	
Dibromomethane	ug/L	ND	1.0	01/26/17 12:33	
Ethylbenzene	ug/L	ND	1.0	01/26/17 12:33	
Iodomethane	ug/L	ND	5.0	01/26/17 12:33	
Methylene Chloride	ug/L	ND	1.0	01/26/17 12:33	
Styrene	ug/L	ND	1.0	01/26/17 12:33	
Tetrachloroethene	ug/L	ND	1.0	01/26/17 12:33	
Toluene	ug/L	ND	1.0	01/26/17 12:33	
trans-1,2-Dichloroethene	ug/L	ND	1.0	01/26/17 12:33	
trans-1,3-Dichloropropene	ug/L	ND	1.0	01/26/17 12:33	
trans-1,4-Dichloro-2-butene	ug/L	ND	1.0	01/26/17 12:33	
Trichloroethene	ug/L	ND	1.0	01/26/17 12:33	

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QUALITY CONTROL DATA

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327590

METHOD BLANK: 1918168 Matrix: Water
Associated Lab Samples: 92327590001, 92327590002, 92327590003, 92327590004, 92327590005, 92327590006

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Trichlorofluoromethane	ug/L	ND	1.0	01/26/17 12:33	
Vinyl acetate	ug/L	ND	2.0	01/26/17 12:33	
Vinyl chloride	ug/L	ND	1.0	01/26/17 12:33	
Xylene (Total)	ug/L	ND	1.0	01/26/17 12:33	
1,2-Dichloroethane-d4 (S)	%	94	70-130	01/26/17 12:33	
4-Bromofluorobenzene (S)	%	98	70-130	01/26/17 12:33	
Toluene-d8 (S)	%	105	70-130	01/26/17 12:33	

LABORATORY CONTROL SAMPLE: 1918169

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
1,1,1,2-Tetrachloroethane	ug/L	50	51.3	103	80-125	
1,1,1-Trichloroethane	ug/L	50	46.1	92	71-129	
1,1,2,2-Tetrachloroethane	ug/L	50	43.8	88	79-124	
1,1,2-Trichloroethane	ug/L	50	49.3	99	85-125	
1,1-Dichloroethane	ug/L	50	46.8	94	73-126	
1,1-Dichloroethene	ug/L	50	49.0	98	66-135	
1,2,3-Trichloropropane	ug/L	50	45.6	91	75-130	
1,2-Dichlorobenzene	ug/L	50	49.7	99	80-133	
1,2-Dichloroethane	ug/L	50	47.2	94	67-128	
1,2-Dichloropropane	ug/L	50	49.5	99	75-132	
1,4-Dichlorobenzene	ug/L	50	48.2	96	78-130	
2-Butanone (MEK)	ug/L	100	83.6	84	61-144	
2-Hexanone	ug/L	100	80.5	80	68-143	
4-Methyl-2-pentanone (MIBK)	ug/L	100	82.4	82	72-135	
Acetone	ug/L	100	76.9	77	48-146	
Acrylonitrile	ug/L	250	213	85	40-160	
Benzene	ug/L	50	51.0	102	80-125	
Bromochloromethane	ug/L	50	48.2	96	71-125	
Bromodichloromethane	ug/L	50	49.4	99	78-124	
Bromoform	ug/L	50	44.7	89	71-128	
Bromomethane	ug/L	50	57.3	115	40-160	
Carbon disulfide	ug/L	50	53.0	106	50-160	
Carbon tetrachloride	ug/L	50	46.1	92	69-131	
Chlorobenzene	ug/L	50	50.3	101	81-122	
Chloroethane	ug/L	50	48.9	98	39-148	
Chloroform	ug/L	50	47.3	95	73-127	
Chloromethane	ug/L	50	47.5	95	44-146	
cis-1,2-Dichloroethene	ug/L	50	48.4	97	74-124	
cis-1,3-Dichloropropene	ug/L	50	49.9	100	72-132	
Dibromochloromethane	ug/L	50	49.9	100	78-125	
Dibromomethane	ug/L	50	48.1	96	82-120	
Ethylbenzene	ug/L	50	49.5	99	79-121	
Iodomethane	ug/L	100	109	109	39-154	

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QUALITY CONTROL DATA

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327590

LABORATORY CONTROL SAMPLE: 1918169

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Methylene Chloride	ug/L	50	46.1	92	64-133	
Styrene	ug/L	50	50.8	102	84-126	
Tetrachloroethene	ug/L	50	48.4	97	78-122	
Toluene	ug/L	50	48.2	96	80-121	
trans-1,2-Dichloroethene	ug/L	50	49.1	98	71-127	
trans-1,3-Dichloropropene	ug/L	50	48.8	98	69-141	
trans-1,4-Dichloro-2-butene	ug/L	50	44.4	89	40-160	
Trichloroethene	ug/L	50	49.0	98	78-122	
Trichlorofluoromethane	ug/L	50	50.3	101	53-137	
Vinyl acetate	ug/L	100	92.1	92	40-160	
Vinyl chloride	ug/L	50	40.2	80	58-137	
Xylene (Total)	ug/L	150	149	100	81-126	
1,2-Dichloroethane-d4 (S)	%			100	70-130	
4-Bromofluorobenzene (S)	%			100	70-130	
Toluene-d8 (S)	%			97	70-130	

MATRIX SPIKE SAMPLE: 1918170

Parameter	Units	92327590001 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
1,1,1,2-Tetrachloroethane	ug/L	ND	20	21.1	106	70-130	
1,1,1-Trichloroethane	ug/L	ND	20	20.0	100	70-130	
1,1,2,2-Tetrachloroethane	ug/L	ND	20	19.1	95	70-130	
1,1,2-Trichloroethane	ug/L	ND	20	19.9	100	70-130	
1,1-Dichloroethane	ug/L	ND	20	19.9	100	70-130	
1,1-Dichloroethene	ug/L	ND	20	22.0	110	70-166	
1,2,3-Trichloropropane	ug/L	ND	20	19.3	97	70-130	
1,2-Dichlorobenzene	ug/L	ND	20	22.5	112	70-130	
1,2-Dichloroethane	ug/L	ND	20	19.3	96	70-130	
1,2-Dichloropropane	ug/L	ND	20	20.7	103	70-130	
1,4-Dichlorobenzene	ug/L	ND	20	21.5	108	70-130	
2-Butanone (MEK)	ug/L	ND	40	34.4	86	70-130	
2-Hexanone	ug/L	ND	40	35.7	89	70-130	
4-Methyl-2-pentanone (MIBK)	ug/L	ND	40	33.3	83	70-130	
Acetone	ug/L	ND	40	31.2	78	70-130	
Acrylonitrile	ug/L	ND	100	86.8	87	70-130	
Benzene	ug/L	ND	20	22.4	112	70-148	
Bromochloromethane	ug/L	ND	20	20.4	102	70-130	
Bromodichloromethane	ug/L	ND	20	20.6	103	70-130	
Bromoform	ug/L	ND	20	16.7	84	70-130	
Bromomethane	ug/L	ND	20	24.5	123	70-130	
Carbon disulfide	ug/L	ND	20	22.9	115	70-130	
Carbon tetrachloride	ug/L	ND	20	20.9	105	70-130	
Chlorobenzene	ug/L	ND	20	22.4	112	70-146	
Chloroethane	ug/L	ND	20	22.5	113	70-130	
Chloroform	ug/L	ND	20	20.2	101	70-130	

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REPORT OF LABORATORY ANALYSIS

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Huntersville, NC 28078
(704)875-9092

QUALITY CONTROL DATA

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327590

MATRIX SPIKE SAMPLE: 1918170

Parameter	Units	92327590001 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Chloromethane	ug/L	ND	20	22.9	114	70-130	
cis-1,2-Dichloroethene	ug/L	ND	20	20.5	103	70-130	
cis-1,3-Dichloropropene	ug/L	ND	20	19.5	98	70-130	
Dibromochloromethane	ug/L	ND	20	20.7	103	70-130	
Dibromomethane	ug/L	ND	20	20.7	104	70-130	
Ethylbenzene	ug/L	ND	20	22.7	114	70-130	
Iodomethane	ug/L	ND	40	46.7	117	70-130	
Methylene Chloride	ug/L	ND	20	18.0	90	70-130	
Styrene	ug/L	ND	20	21.5	108	70-130	
Tetrachloroethene	ug/L	ND	20	21.6	108	70-130	
Toluene	ug/L	ND	20	20.9	104	70-155	
trans-1,2-Dichloroethene	ug/L	ND	20	21.8	109	70-130	
trans-1,3-Dichloropropene	ug/L	ND	20	18.7	93	70-130	
trans-1,4-Dichloro-2-butene	ug/L	ND	20	17.2	86	70-130	
Trichloroethene	ug/L	ND	20	21.4	107	69-151	
Trichlorofluoromethane	ug/L	ND	20	22.9	115	70-130	
Vinyl acetate	ug/L	ND	40	30.7	77	70-130	
Vinyl chloride	ug/L	ND	20	18.5	92	70-130	
1,2-Dichloroethane-d4 (S)	%				100	70-130	
4-Bromofluorobenzene (S)	%				96	70-130	
Toluene-d8 (S)	%				97	70-130	

SAMPLE DUPLICATE: 1918171

Parameter	Units	92327590002 Result	Dup Result	RPD	Max RPD	Qualifiers
1,1,1,2-Tetrachloroethane	ug/L	ND	ND		30	
1,1,1-Trichloroethane	ug/L	ND	ND		30	
1,1,2,2-Tetrachloroethane	ug/L	ND	ND		30	
1,1,2-Trichloroethane	ug/L	ND	ND		30	
1,1-Dichloroethane	ug/L	ND	ND		30	
1,1-Dichloroethene	ug/L	ND	ND		30	
1,2,3-Trichloropropane	ug/L	ND	ND		30	
1,2-Dichlorobenzene	ug/L	ND	ND		30	
1,2-Dichloroethane	ug/L	ND	ND		30	
1,2-Dichloropropane	ug/L	ND	ND		30	
1,4-Dichlorobenzene	ug/L	ND	ND		30	
2-Butanone (MEK)	ug/L	ND	ND		30	
2-Hexanone	ug/L	ND	ND		30	
4-Methyl-2-pentanone (MIBK)	ug/L	ND	ND		30	
Acetone	ug/L	ND	ND		30	
Acrylonitrile	ug/L	ND	ND		30	
Benzene	ug/L	ND	ND		30	
Bromochloromethane	ug/L	ND	ND		30	
Bromodichloromethane	ug/L	ND	ND		30	
Bromoform	ug/L	ND	ND		30	

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QUALITY CONTROL DATA

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327590

SAMPLE DUPLICATE: 1918171

Parameter	Units	92327590002 Result	Dup Result	RPD	Max RPD	Qualifiers
Bromomethane	ug/L	ND	ND		30	
Carbon disulfide	ug/L	ND	ND		30	
Carbon tetrachloride	ug/L	ND	ND		30	
Chlorobenzene	ug/L	ND	ND		30	
Chloroethane	ug/L	ND	ND		30	
Chloroform	ug/L	ND	ND		30	
Chloromethane	ug/L	ND	ND		30	
cis-1,2-Dichloroethene	ug/L	ND	ND		30	
cis-1,3-Dichloropropene	ug/L	ND	ND		30	
Dibromochloromethane	ug/L	ND	ND		30	
Dibromomethane	ug/L	ND	ND		30	
Ethylbenzene	ug/L	ND	ND		30	
Iodomethane	ug/L	ND	ND		30	
Methylene Chloride	ug/L	ND	ND		30	
Styrene	ug/L	ND	ND		30	
Tetrachloroethene	ug/L	ND	ND		30	
Toluene	ug/L	ND	ND		30	
trans-1,2-Dichloroethene	ug/L	ND	ND		30	
trans-1,3-Dichloropropene	ug/L	ND	ND		30	
trans-1,4-Dichloro-2-butene	ug/L	ND	ND		30	
Trichloroethene	ug/L	ND	ND		30	
Trichlorofluoromethane	ug/L	ND	ND		30	
Vinyl acetate	ug/L	ND	ND		30	
Vinyl chloride	ug/L	ND	ND		30	
Xylene (Total)	ug/L	ND	ND		30	
1,2-Dichloroethane-d4 (S)	%	93	95	2		
4-Bromofluorobenzene (S)	%	97	98	0		
Toluene-d8 (S)	%	104	102	3		

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QUALITY CONTROL DATA

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327590

QC Batch: 345870 Analysis Method: SM 2540C
QC Batch Method: SM 2540C Analysis Description: 2540C Total Dissolved Solids
Associated Lab Samples: 92327590001, 92327590002, 92327590003, 92327590004, 92327590005

METHOD BLANK: 1918836 Matrix: Water
Associated Lab Samples: 92327590001, 92327590002, 92327590003, 92327590004, 92327590005

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Total Dissolved Solids	mg/L	ND	25.0	01/26/17 20:00	

LABORATORY CONTROL SAMPLE: 1918837

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Total Dissolved Solids	mg/L	250	254	102	90-110	

SAMPLE DUPLICATE: 1918838

Parameter	Units	92327590001 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	776	822	6	5	D6

SAMPLE DUPLICATE: 1918839

Parameter	Units	92327032024 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	196	222	12	5	D6

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327590

Sample: MW-6 **Lab ID: 92327590001** Collected: 01/24/17 09:10 Received: 01/24/17 18:45 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**0.126 ± 0.302 (0.584) C:NA T:91%**	pCi/L	02/16/17 10:47	13982-63-3	
Radium-228	EPA 904.0	**0.416 ± 0.406 (0.830) C:61% T:86%**	pCi/L	02/15/17 11:55	15262-20-1	

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327590

Sample: MW-8 **Lab ID: 92327590002** Collected: 01/24/17 13:30 Received: 01/24/17 18:45 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**0.0618 ± 0.282 (0.574) C:NA T:97%**	pCi/L	02/16/17 11:10	13982-63-3	
Radium-228	EPA 904.0	**0.392 ± 0.281 (0.541) C:91% T:87%**	pCi/L	02/15/17 11:56	15262-20-1	

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327590

Sample: MW-3 **Lab ID: 92327590003** Collected: 01/24/17 15:35 Received: 01/24/17 18:45 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**1.25 ± 0.636 (0.612) C:NA T:94%**	pCi/L	02/16/17 11:10	13982-63-3	
Radium-228	EPA 904.0	**0.387 ± 0.353 (0.715) C:76% T:83%**	pCi/L	02/15/17 11:55	15262-20-1	

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327590

Sample: AMB **Lab ID: 92327590004** Collected: 01/24/17 16:00 Received: 01/24/17 18:45 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**0.189 ± 0.411 (0.759) C:NA T:94%**	pCi/L	02/16/17 11:10	13982-63-3	
Radium-228	EPA 904.0	**0.432 ± 0.367 (0.733) C:66% T:90%**	pCi/L	02/15/17 11:56	15262-20-1	

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327590

Sample: EQ BLANK **Lab ID: 92327590005** Collected: 01/24/17 17:00 Received: 01/24/17 18:45 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**0.0651 ± 0.297 (0.479) C:NA T:93%**	pCi/L	02/16/17 11:10	13982-63-3	
Radium-228	EPA 904.0	**0.286 ± 0.376 (0.801) C:67% T:90%**	pCi/L	02/15/17 11:56	15262-20-1	

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QUALITY CONTROL - RADIOCHEMISTRY

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327590

QC Batch: 248466 Analysis Method: EPA 904.0
QC Batch Method: EPA 904.0 Analysis Description: 904.0 Radium 228
Associated Lab Samples: 92327590001, 92327590002, 92327590003, 92327590004, 92327590005

METHOD BLANK: 1222207 Matrix: Water
Associated Lab Samples: 92327590001, 92327590002, 92327590003, 92327590004, 92327590005

Parameter	Act ± Unc (MDC) Carr Trac	Units	Analyzed	Qualifiers
Radium-228	-0.179 ± 0.369 (0.903) C:61% T:84%	pCi/L	02/15/17 11:54	

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QUALITY CONTROL - RADIOCHEMISTRY

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327590

QC Batch: 248465 Analysis Method: EPA 903.1
QC Batch Method: EPA 903.1 Analysis Description: 903.1 Radium-226
Associated Lab Samples: 92327590001, 92327590002, 92327590003, 92327590004, 92327590005

METHOD BLANK: 1222204 Matrix: Water
Associated Lab Samples: 92327590001, 92327590002, 92327590003, 92327590004, 92327590005

Parameter	Act ± Unc (MDC) Carr Trac	Units	Analyzed	Qualifiers
Radium-226	0.184 ± 0.434 (0.803) C:NA T:96%	pCi/L	02/16/17 10:30	

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QUALIFIERS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327590

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above adjusted reporting limit.

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

Acid preservation may not be appropriate for 2 Chloroethylvinyl ether.

A separate vial preserved to a pH of 4-5 is recommended in SW846 Chapter 4 for the analysis of Acrolein and Acrylonitrile by EPA Method 8260.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Act - Activity

Unc - Uncertainty: SDWA = 1.96 sigma count uncertainty, all other matrices = Expanded Uncertainty (95% confidence interval). Gamma Spec = Expanded Uncertainty (95.4% Confidence Interval)

(MDC) - Minimum Detectable Concentration

Trac - Tracer Recovery (%)

Carr - Carrier Recovery (%)

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

LABORATORIES

PASI-A	Pace Analytical Services - Asheville
PASI-C	Pace Analytical Services - Charlotte
PASI-PA	Pace Analytical Services - Greensburg
PASI-W	Pace Analytical Services - Greenwood

ANALYTE QUALIFIERS

D6	The precision between the sample and sample duplicate exceeded laboratory control limits.
M1	Matrix spike recovery exceeded QC limits. Batch accepted based on laboratory control sample (LCS) recovery.

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QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327590

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
92327590001	**MW-6**	EPA 300.0	345857		
92327590002	**MW-8**	EPA 300.0	345857		
92327590003	**MW-3**	EPA 300.0	345857		
92327590004	**AMB**	EPA 300.0	345857		
92327590005	**EQ BLANK**	EPA 300.0	345857		
92327590001	**MW-6**	EPA 3010A	345712	EPA 6010	345996
92327590002	**MW-8**	EPA 3010A	345712	EPA 6010	345996
92327590003	**MW-3**	EPA 3010A	345712	EPA 6010	345996
92327590004	**AMB**	EPA 3010A	345712	EPA 6010	345996
92327590005	**EQ BLANK**	EPA 3010A	345712	EPA 6010	345996
92327590001	**MW-6**	EPA 3010A	345698	EPA 6020B	345894
92327590002	**MW-8**	EPA 3010A	345698	EPA 6020B	345894
92327590003	**MW-3**	EPA 3010A	345698	EPA 6020B	345894
92327590004	**AMB**	EPA 3010A	345698	EPA 6020B	345894
92327590005	**EQ BLANK**	EPA 3010A	345698	EPA 6020B	345894
92327590001	**MW-6**	EPA 7470	345701	EPA 7470	345888
92327590002	**MW-8**	EPA 7470	345701	EPA 7470	345888
92327590003	**MW-3**	EPA 7470	345701	EPA 7470	345888
92327590004	**AMB**	EPA 7470	345701	EPA 7470	345888
92327590005	**EQ BLANK**	EPA 7470	345701	EPA 7470	345888
92327590001	**MW-6**	EPA 8260	345758		
92327590002	**MW-8**	EPA 8260	345758		
92327590003	**MW-3**	EPA 8260	345758		
92327590004	**AMB**	EPA 8260	345758		
92327590005	**EQ BLANK**	EPA 8260	345758		
92327590006	**TRIP BLANK**	EPA 8260	345758		
92327590001	**MW-6**	EPA 903.1	248465		
92327590002	**MW-8**	EPA 903.1	248465		
92327590003	**MW-3**	EPA 903.1	248465		
92327590004	**AMB**	EPA 903.1	248465		
92327590005	**EQ BLANK**	EPA 903.1	248465		
92327590001	**MW-6**	EPA 904.0	248466		
92327590002	**MW-8**	EPA 904.0	248466		
92327590003	**MW-3**	EPA 904.0	248466		
92327590004	**AMB**	EPA 904.0	248466		
92327590005	**EQ BLANK**	EPA 904.0	248466		
92327590001	**MW-6**	SM 2540C	345870		
92327590002	**MW-8**	SM 2540C	345870		
92327590003	**MW-3**	SM 2540C	345870		
92327590004	**AMB**	SM 2540C	345870		
92327590005	**EQ BLANK**	SM 2540C	345870		

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Laboratory receiving samples:

Asheville ☐ Eden ☐ Greenwood ☐ Huntersville ☑ Raleigh ☐ Mechanicsville ☐

Sample Condition Upon Receipt

Client Name: HDR

Project #:

WO# : 92327590

92327590

Courier: ☐ Fed Ex ☐ UPS ☐ USPS ☐ Client ☐ Commercial ☑ Pace ☐ Other:____

Custody Seal Present? ☐ Yes ☑ No **Seals Intact?** ☐ Yes ☐ No

Date/Initials Person Examining Contents: JM 1-25-17

Packing Material: ☐ Bubble Wrap ☑ Bubble Bags ☐ None ☐ Other:____

Thermometer: ☑ IR Gun ID: T1603 **Type of Ice:** ☑ Wet ☐ Blue ☐ None ☑ Samples on ice, cooling process has begun

Correction Factor: **Cooler Temp Corrected (°C):** 2.3 **Biological Tissue Frozen?** ☐ Yes ☑ No ☐ N/A

Temp should be above freezing to 6°C

USDA Regulated Soil (☑ N/A, water sample)

Did samples originate in a quarantine zone within the United States: CA, NY, or SC (check maps)? ☐ Yes ☑ No

Did samples originate from a foreign source (internationally, including Hawaii and Puerto Rico)? ☐ Yes ☑ No

				Comments/Discrepancy:
Chain of Custody Present?	☑ Yes	☐ No	☐ N/A	1.
Samples Arrived within Hold Time?	☑ Yes	☐ No	☐ N/A	2.
Short Hold Time Analysis (<72 hr.)?	☐ Yes	☑ No	☐ N/A	3.
Rush Turn Around Time Requested?	☐ Yes	☑ No	☐ N/A	4.
Sufficient Volume?	☑ Yes	☐ No	☐ N/A	5.
Correct Containers Used?	☑ Yes	☐ No	☐ N/A	6.
-Pace Containers Used?	☑ Yes	☐ No	☐ N/A	
Containers Intact?	☑ Yes	☐ No	☐ N/A	7.
Samples Field Filtered?	☐ Yes	☐ No	☑ N/A	8. Note if sediment is visible in the dissolved container
Sample Labels Match COC? -Includes Date/Time/ID/Analysis Matrix: wt	☑ Yes	☐ No	☐ N/A	9.
Headspace in VOA Vials (>5-6mm)?	☐ Yes	☑ No	☐ N/A	10.
Trip Blank Present?	☑ Yes	☐ No	☐ N/A	11.
Trip Blank Custody Seals Present?	☑ Yes	☐ No	☐ N/A	

CLIENT NOTIFICATION/RESOLUTION

Field Data Required? ☐ Yes ☐ No

Person Contacted: _____ Date/Time: _____

Comments/Sample Discrepancy: _____

Project Manager SCURF Review: JY **Date:** 1/25/17

Project Manager SRF Review: JY **Date:** 1/25/17

ote: Whenever there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office (i.e. ut of hold, incorrect preservative, out of temp, incorrect containers)

*Check mark top half of box if pH and/or dechlorination is verified and within the acceptance range for preservation samples.

**Bottom half of box is to list number of bottles

Project #

WO#: 92327590

PM: KRG Due Date: 01/31/17

CLIENT: 92-HDR

1351

Item#	BP4U-125 mL Plastic Unpreserved (N/A) (Cl-)	BP3U-250 mL Plastic Unpreserved (N/A)	BP2U-500 mL Plastic Unpreserved (N/A)	BP1U-1 liter Plastic Unpreserved (N/A)	BP3S-250 mL Plastic H2SO4 (pH < 2) (Cl-)	BP3N-250 mL plastic HNO3 (pH < 2)	BP3Z-250 mL Plastic ZN Acetate & NaOH (>9)	BP3C-250 mL Plastic NaOH (pH > 12) (Cl-)	WGFU-Wide-mouthed Glass jar Unpreserved	AG1U-1 liter Amber Unpreserved (N/A) (Cl-)	AG1H-1 liter Amber HCl (pH < 2)	AG3U-250 mL Amber Unpreserved (N/A) (Cl-)	AG1S-1 liter Amber H2SO4 (pH < 2)	AG3S-250 mL Amber H2SO4 (pH < 2)	AG3A(DG3A)-250 mL Amber NH4Cl (N/A)(Cl-)	DG9H-40 mL VOA HCl (N/A)	VG9T-40 mL VOA Na2S2O3 (N/A)	VG9U-40 mL VOA Unp (N/A)	DG9P-40 mL VOA H3PO4 (N/A)	VOAK (6 vials per kit)-5035 kit (N/A)	V/GK (3 vials per kit)-VPH/Gas kit (N/A)	SP5T-125 mL Sterile Plastic (N/A – lab)	SP2T-250 mL Sterile Plastic (N/A – lab)	BP1N	BP3A-250 mL Plastic (NH2)2SO4 (9.3-9.7)	Cubitainer	VSGU-20 mL Scintillation vials (N/A)	GN
1		1	1			2										3									3				
2		1	1			2										3									3				
3		1	1			2										3									3				
4		1	1			2										3									3				
5		1	1			2										3									3				
6																2													
7																													
8																													
9																													
10																													
11																													
12																													

pH Adjustment Log for Preserved Samples

Sample ID	Type of Preservative	pH upon receipt	Date preservation adjusted	Time preservation adjusted	Amount of Preservative added	Lot #

Pace Analytical

CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

Page : 1 Of 1

Section A Required Client Information:	Section B Required Project Information:	Section C Invoice Information:
Company: HDR Engineering	Report To: Sean Quarry	Attention:
Address: 440 South Church Street	Copy To:	Company Name:
Charlotte, NC 28202		Address:
Email: sean.quarry@hdrinc.com	Purchase Order #:	Pace Quote:
Phone: (704)248-3632 Fax	Project Name: Charrah-Brickhaven	Pace Project Manager: kevin.godwin@pacelabs.com,
Requested Due Date:	Project #:	Pace Profile #: 7672-1

Regulatory Agency
State / Location
NC

MATRIX CODE: Drinking Water DW; Water WT; Waste Water WW; Product P; Soil/Solid SL; Oil OL; Wipe WP; Air AR; Other OT; Tissue TS

ITEM #	SAMPLE ID (One Character per box. (A-Z, 0-9 / , -) Sample Ids must be unique)	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED START DATE	COLLECTED START TIME	COLLECTED END DATE	COLLECTED END TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Unpreserved	H2SO4	HNO3	HCl	NaOH	Na2S2O3	Methanol	Other	Analyses Test Y/N	Trip BLANK	8260	300.0-Cl,F,Sulfate	TDS	Radium 226/228	6010/7470	6020 (B, Li)	Residual Chlorine (Y/N)	92327590
1	MW-6	WT	G	/	/	1-24-17	0910		12										2	3	1	1	3	1	1		001
2	MW-8	WT	G	/	/	1-24-17	1330		10											3	1	1	3	1	1		002
3	MW-3	WT	G	/	/	1-24-17	1535		10											3	1	1	3	1	1		003
4	AMB	WT	G	/	/	1-24-17	1600		10											3	1	1	3	1	1		004
5	EQ BLANK	WT	G	/	/	1-24-17	1700		10											3	1	1	3	1	1		005
6																											006-TB
7																											
8																											
9																											
10																											
11																											
12																											

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	SAMPLE CONDITIONS: TEMP in C	Received on Ice (Y/N)	Custody Sealed Cooler (Y/N)	Samples Intact (Y/N)
	[signature] Pace	1-24-17	1845	[signature] Pace	1/24/16	1845				
	[signature] Pace	1/25/17	1500	[signature] PACE HVL	1-25-17	1205	2.3	Y	N	Y

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER: William Thomas

SIGNATURE of SAMPLER: [signature] DATE Signed: 1/24/17

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

February 21, 2017

Sean Quarry
HDR Engineering
440 South Church Street
Suite 1000
Charlotte, NC 28202

RE: Project: Charrah-Brickhaven
Pace Project No.: 92327809

Dear Sean Quarry:
Enclosed are the analytical results for sample(s) received by the laboratory on January 25, 2017. The results relate only to the samples included in this report. Results reported herein conform to the most current, applicable TNI/NELAC standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Kevin Godwin
kevin.godwin@pacelabs.com
Project Manager

Enclosures

cc: Mike Plummer, HDR

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(704)875-9092

CERTIFICATIONS

Project: Charrah-Brickhaven
Pace Project No.: 92327809

Pennsylvania Certification IDs

1638 Roseytown Rd Suites 2,3&4, Greensburg, PA 15601
L-A-B DOD-ELAP Accreditation #: L2417
Alabama Certification #: 41590
Arizona Certification #: AZ0734
Arkansas Certification
California Certification #: 04222CA
Colorado Certification
Connecticut Certification #: PH-0694
Delaware Certification
Florida/TNI Certification #: E87683
Georgia Certification #: C040
Guam Certification
Hawaii Certification
Idaho Certification
Illinois Certification
Indiana Certification
Iowa Certification #: 391
Kansas/TNI Certification #: E-10358
Kentucky Certification #: 90133
Louisiana DHH/TNI Certification #: LA140008
Louisiana DEQ/TNI Certification #: 4086
Maine Certification #: PA00091
Maryland Certification #: 308
Massachusetts Certification #: M-PA1457
Michigan/PADEP Certification
Missouri Certification #: 235
Montana Certification #: Cert 0082
Nebraska Certification #: NE-05-29-14
Nevada Certification #: PA014572015-1
New Hampshire/TNI Certification #: 2976
New Jersey/TNI Certification #: PA 051
New Mexico Certification #: PA01457
New York/TNI Certification #: 10888
North Carolina Certification #: 42706
North Dakota Certification #: R-190
Oregon/TNI Certification #: PA200002
Pennsylvania/TNI Certification #: 65-00282
Puerto Rico Certification #: PA01457
Rhode Island Certification #: 65-00282
South Dakota Certification
Tennessee Certification #: TN2867
Texas/TNI Certification #: T104704188-14-8
Utah/TNI Certification #: PA014572015-5
USDA Soil Permit #: P330-14-00213
Vermont Dept. of Health: ID# VT-0282
Virgin Island/PADEP Certification
Virginia/VELAP Certification #: 460198
Washington Certification #: C868
West Virginia DEP Certification #: 143
West Virginia DHHR Certification #: 9964C
Wisconsin Certification
Wyoming Certification #: 8TMS-L

Charlotte Certification IDs

9800 Kincey Ave. Ste 100, Huntersville, NC 28078
North Carolina Drinking Water Certification #: 37706
North Carolina Field Services Certification #: 5342
North Carolina Wastewater Certification #: 12
South Carolina Certification #: 99006001
Florida/NELAP Certification #: E87627
Kentucky UST Certification #: 84
Virginia/VELAP Certification #: 460221

Asheville Certification IDs

2225 Riverside Drive, Asheville, NC 28804
Florida/NELAP Certification #: E87648
Massachusetts Certification #: M-NC030
North Carolina Drinking Water Certification #: 37712
North Carolina Wastewater Certification #: 40
South Carolina Certification #: 99030001
Virginia/VELAP Certification #: 460222

Greenwood Certification IDs

816 Durst Avenue East, Greenwood, SC 29649
South Carolina Laboratory ID #: 24562
North Carolina Divison of Water Resources Certification number 25
Florida Certification number E87633
Virginia VELAP ID: 460250
Asbestos NVLAP accreditation: 101410-0

REPORT OF LABORATORY ANALYSIS

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9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

SAMPLE SUMMARY

Project: Charrah-Brickhaven
Pace Project No.: 92327809

Lab ID	Sample ID	Matrix	Date Collected	Date Received
92327809001	**MW-4**	Water	01/25/17 09:45	01/25/17 19:30
92327809002	**MW-4 DUP**	Water	01/25/17 09:45	01/25/17 19:30
92327809003	**SW-1**	Water	01/25/17 12:05	01/25/17 19:30
92327809004	**SW-2**	Water	01/25/17 13:15	01/25/17 19:30
92327809005	**MW-1**	Water	01/25/17 17:35	01/25/17 19:30
92327809006	**AMB**	Water	01/25/17 17:30	01/25/17 19:30
92327809007	**EQ BLANK**	Water	01/25/17 19:05	01/25/17 19:30
92327809008	**TRIP BLANK**	Water	01/25/17 00:00	01/25/17 19:30

REPORT OF LABORATORY ANALYSIS

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(704)875-9092

SAMPLE ANALYTE COUNT

Project: Charrah-Brickhaven
Pace Project No.: 92327809

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
92327809001	**MW-4**	EPA 300.0	EIC	3	PASI-W
		EPA 6010	SH1	16	PASI-A
		EPA 6020B	CDF	3	PASI-A
		EPA 7470	WAB	1	PASI-A
		EPA 8260	ZDO	48	PASI-C
		EPA 903.1	KAC	1	PASI-PA
		EPA 904.0	JJY	1	PASI-PA
		SM 2540C	MJS1	1	PASI-A
92327809002	**MW-4 DUP**	EPA 300.0	CDC	3	PASI-W
		EPA 6010	SH1	16	PASI-A
		EPA 6020B	CDF	3	PASI-A
		EPA 7470	WAB	1	PASI-A
		EPA 8260	ZDO	48	PASI-C
		EPA 903.1	KAC	1	PASI-PA
		EPA 904.0	JJY	1	PASI-PA
		SM 2540C	MJS1	1	PASI-A
92327809003	**SW-1**	EPA 300.0	CDC	3	PASI-W
		EPA 6010	SH1	16	PASI-A
		EPA 6020B	CDF	3	PASI-A
		EPA 7470	WAB	1	PASI-A
		EPA 8260	ZDO	48	PASI-C
		EPA 903.1	KAC	1	PASI-PA
		EPA 904.0	JJY	1	PASI-PA
		SM 2540C	MJS1	1	PASI-A
92327809004	**SW-2**	EPA 300.0	CDC	3	PASI-W
		EPA 6010	SH1	16	PASI-A
		EPA 6020B	CDF	3	PASI-A
		EPA 7470	WAB	1	PASI-A
		EPA 8260	ZDO	48	PASI-C
		EPA 903.1	KAC	1	PASI-PA
		EPA 904.0	JJY	1	PASI-PA
		SM 2540C	MLS	1	PASI-A
92327809005	**MW-1**	EPA 300.0	EIC	3	PASI-W
		EPA 6010	SH1	16	PASI-A
		EPA 6020B	CDF	3	PASI-A
		EPA 7470	WAB	1	PASI-A
		EPA 8260	ZDO	48	PASI-C

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(704)875-9092

SAMPLE ANALYTE COUNT

Project: Charrah-Brickhaven
Pace Project No.: 92327809

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
		EPA 903.1	KAC	1	PASI-PA
		EPA 904.0	JJY	1	PASI-PA
		SM 2540C	MLS	1	PASI-A
92327809006	**AMB**	EPA 300.0	CDC	3	PASI-W
		EPA 6010	SH1	16	PASI-A
		EPA 6020B	CDF	3	PASI-A
		EPA 7470	WAB	1	PASI-A
		EPA 8260	ZDO	48	PASI-C
		EPA 903.1	KAC	1	PASI-PA
		EPA 904.0	JJY	1	PASI-PA
		SM 2540C	MLS	1	PASI-A
92327809007	**EQ BLANK**	EPA 300.0	CDC	3	PASI-W
		EPA 6010	SH1	16	PASI-A
		EPA 6020B	CDF	3	PASI-A
		EPA 7470	WAB	1	PASI-A
		EPA 8260	ZDO	48	PASI-C
		EPA 903.1	KAC	1	PASI-PA
		EPA 904.0	JJY	1	PASI-PA
		SM 2540C	MLS	1	PASI-A
92327809008	**TRIP BLANK**	EPA 8260	ZDO	48	PASI-C

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9800 Kincey Ave. Suite 100
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(704)875-9092

SUMMARY OF DETECTION

Project: Charrah-Brickhaven
Pace Project No.: 92327809

Lab Sample ID / Method	Client Sample ID / Parameters	Result	Units	Report Limit	Analyzed	Qualifiers
92327809001	**MW-4**					
EPA 300.0	Chloride	513	mg/L	10.0	02/02/17 16:21	M6
EPA 300.0	Fluoride	0.21	mg/L	0.10	02/02/17 15:14	M1
EPA 300.0	Sulfate	10.0	mg/L	1.0	02/02/17 15:14	
EPA 6010	Barium	330	ug/L	5.0	01/31/17 08:26	
EPA 6010	Calcium	68200	ug/L	100	01/31/17 08:26	
EPA 6010	Molybdenum	8.9	ug/L	5.0	01/31/17 08:26	
EPA 6020B	Lithium	28.3	ug/L	2.5	01/28/17 15:14	
EPA 903.1	Radium-226	0.224 ± 0.441 (0.791) C:NA T:102%	pCi/L		02/20/17 12:53	
EPA 904.0	Radium-228	0.243 ± 0.447 (0.980) C:58% T:84%	pCi/L		02/20/17 20:07	
SM 2540C	Total Dissolved Solids	1150	mg/L	25.0	01/31/17 00:08	
92327809002	**MW-4 DUP**					
EPA 300.0	Chloride	519	mg/L	10.0	02/02/17 02:21	
EPA 300.0	Fluoride	0.22	mg/L	0.10	02/01/17 12:56	M1
EPA 300.0	Sulfate	10.1	mg/L	1.0	02/01/17 12:56	
EPA 6010	Barium	322	ug/L	5.0	01/31/17 08:29	
EPA 6010	Calcium	67900	ug/L	100	01/31/17 08:29	
EPA 6010	Nickel	5.6	ug/L	5.0	01/31/17 08:29	
EPA 6020B	Lithium	29.4	ug/L	2.5	01/28/17 15:19	
EPA 903.1	Radium-226	0.137 ± 0.330 (0.637) C:NA T:88%	pCi/L		02/20/17 12:53	
EPA 904.0	Radium-228	-0.231 ± 0.401 (0.998) C:52% T:91%	pCi/L		02/20/17 20:07	
SM 2540C	Total Dissolved Solids	1180	mg/L	25.0	01/31/17 00:08	
92327809003	**SW-1**					
EPA 300.0	Chloride	8.9	mg/L	1.0	02/01/17 13:46	
EPA 300.0	Fluoride	0.11	mg/L	0.10	02/01/17 13:46	
EPA 300.0	Sulfate	6.5	mg/L	1.0	02/01/17 13:46	
EPA 6010	Barium	101	ug/L	5.0	01/31/17 08:33	
EPA 6010	Calcium	3850	ug/L	100	01/31/17 08:33	
EPA 6010	Lead	6.8	ug/L	5.0	01/31/17 08:33	
EPA 6010	Vanadium	11.2	ug/L	5.0	01/31/17 08:33	
EPA 6010	Zinc	17.5	ug/L	10.0	01/31/17 08:33	
EPA 903.1	Radium-226	0.316 ± 0.746 (1.38) C:NA T:56%	pCi/L		02/20/17 12:53	

REPORT OF LABORATORY ANALYSIS

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9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

SUMMARY OF DETECTION

Project: Charrah-Brickhaven
Pace Project No.: 92327809

Lab Sample ID / Method	Client Sample ID / Parameters	Result	Units	Report Limit	Analyzed	Qualifiers
92327809003	**SW-1**					
EPA 904.0	Radium-228	-0.216 ± 0.472 (1.15) C:53% T:84%	pCi/L		02/20/17 20:07	
SM 2540C	Total Dissolved Solids	230	mg/L	25.0	01/31/17 00:08	
92327809004	**SW-2**					
EPA 300.0	Chloride	11.0	mg/L	1.0	02/01/17 14:03	
EPA 300.0	Sulfate	10.5	mg/L	1.0	02/01/17 14:03	
EPA 6010	Barium	68.2	ug/L	5.0	01/31/17 08:36	
EPA 6010	Calcium	7650	ug/L	100	01/31/17 08:36	
EPA 6010	Copper	7.5	ug/L	5.0	01/31/17 08:36	
EPA 6020B	Boron	27.4	ug/L	25.0	01/30/17 14:57	
EPA 903.1	Radium-226	0.147 ± 0.353 (0.681) C:NA T:79%	pCi/L		02/20/17 13:06	
EPA 904.0	Radium-228	0.298 ± 0.529 (1.16) C:53% T:73%	pCi/L		02/20/17 20:07	
SM 2540C	Total Dissolved Solids	148	mg/L	25.0	01/31/17 12:07	
92327809005	**MW-1**					
EPA 300.0	Chloride	401	mg/L	8.0	02/02/17 17:29	
EPA 300.0	Fluoride	0.12	mg/L	0.10	02/02/17 16:04	
EPA 300.0	Sulfate	7.0	mg/L	1.0	02/02/17 16:04	
EPA 6010	Barium	131	ug/L	5.0	01/31/17 08:39	
EPA 6010	Calcium	112000	ug/L	1000	01/31/17 15:06	
EPA 6010	Chromium	6.6	ug/L	5.0	01/31/17 08:39	
EPA 6020B	Lithium	31.2	ug/L	2.5	01/28/17 15:31	
EPA 903.1	Radium-226	-0.188 ± 0.369 (0.883) C:NA T:97%	pCi/L		02/20/17 13:06	
EPA 904.0	Radium-228	0.237 ± 0.494 (1.09) C:53% T:87%	pCi/L		02/20/17 20:07	
SM 2540C	Total Dissolved Solids	931	mg/L	25.0	01/31/17 12:08	
92327809006	**AMB**					
EPA 8260	Methylene Chloride	4.7	ug/L	1.0	01/30/17 15:59	C9
EPA 903.1	Radium-226	-0.125 ± 0.346 (0.818) C:NA T:88%	pCi/L		02/20/17 13:24	

REPORT OF LABORATORY ANALYSIS

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9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

SUMMARY OF DETECTION

Project: Charrah-Brickhaven
Pace Project No.: 92327809

Lab Sample ID / Method	Client Sample ID / Parameters	Result	Units	Report Limit	Analyzed	Qualifiers
92327809006	**AMB**					
EPA 904.0	Radium-228	0.0595 ± 0.519 (1.20) C:50% T:84%	pCi/L		02/20/17 20:07	
92327809007	**EQ BLANK**					
EPA 6010	Chromium	7.7	ug/L	5.0	01/31/17 08:54	
EPA 6010	Nickel	6.3	ug/L	5.0	01/31/17 08:54	
EPA 903.1	Radium-226	0.000 ± 0.304 (0.619) C:NA T:85%	pCi/L		02/20/17 13:24	
EPA 904.0	Radium-228	0.144 ± 0.506 (1.14) C:58% T:81%	pCi/L		02/20/17 20:07	

REPORT OF LABORATORY ANALYSIS

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Huntersville, NC 28078
(704)875-9092

ANALYTICAL RESULTS

Project: Charrah-Brickhaven
Pace Project No.: 92327809

Sample: MW-4 **Lab ID: 92327809001** Collected: 01/25/17 09:45 Received: 01/25/17 19:30 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
3000 IC Anions 28 Days, GWD	Analytical Method: EPA 300.0							
Chloride	**513**	mg/L	10.0	10		02/02/17 16:21	16887-00-6	M6
Fluoride	**0.21**	mg/L	0.10	1		02/02/17 15:14	16984-48-8	M1
Sulfate	**10.0**	mg/L	1.0	1		02/02/17 15:14	14808-79-8	
6010 MET ICP	Analytical Method: EPA 6010 Preparation Method: EPA 3010A							
Antimony	ND	ug/L	5.0	1	01/27/17 22:00	01/31/17 08:26	7440-36-0	
Arsenic	ND	ug/L	10.0	1	01/27/17 22:00	01/31/17 08:26	7440-38-2	
Barium	**330**	ug/L	5.0	1	01/27/17 22:00	01/31/17 08:26	7440-39-3	
Beryllium	ND	ug/L	1.0	1	01/27/17 22:00	01/31/17 08:26	7440-41-7	
Cadmium	ND	ug/L	1.0	1	01/27/17 22:00	01/31/17 08:26	7440-43-9	
Calcium	**68200**	ug/L	100	1	01/27/17 22:00	01/31/17 08:26	7440-70-2	
Chromium	ND	ug/L	5.0	1	01/27/17 22:00	01/31/17 08:26	7440-47-3	
Cobalt	ND	ug/L	5.0	1	01/27/17 22:00	01/31/17 08:26	7440-48-4	
Copper	ND	ug/L	5.0	1	01/27/17 22:00	01/31/17 08:26	7440-50-8	
Lead	ND	ug/L	5.0	1	01/27/17 22:00	01/31/17 08:26	7439-92-1	
Molybdenum	**8.9**	ug/L	5.0	1	01/27/17 22:00	01/31/17 08:26	7439-98-7	
Nickel	ND	ug/L	5.0	1	01/27/17 22:00	01/31/17 08:26	7440-02-0	
Selenium	ND	ug/L	10.0	1	01/27/17 22:00	01/31/17 08:26	7782-49-2	
Silver	ND	ug/L	5.0	1	01/27/17 22:00	01/31/17 08:26	7440-22-4	
Vanadium	ND	ug/L	5.0	1	01/27/17 22:00	01/31/17 08:26	7440-62-2	
Zinc	ND	ug/L	10.0	1	01/27/17 22:00	01/31/17 08:26	7440-66-6	
6020 MET ICPMS	Analytical Method: EPA 6020B Preparation Method: EPA 3010A							
Boron	ND	ug/L	25.0	1	01/27/17 18:55	01/30/17 14:47	7440-42-8	
Lithium	**28.3**	ug/L	2.5	1	01/27/17 18:55	01/28/17 15:14	7439-93-2	
Thallium	ND	ug/L	0.10	1	01/27/17 18:55	01/28/17 15:14	7440-28-0	
7470 Mercury	Analytical Method: EPA 7470 Preparation Method: EPA 7470							
Mercury	ND	ug/L	0.20	1	01/27/17 23:59	01/31/17 17:01	7439-97-6	M1
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
Acetone	ND	ug/L	25.0	1		01/30/17 14:14	67-64-1	
Acrylonitrile	ND	ug/L	10.0	1		01/30/17 14:14	107-13-1	
Benzene	ND	ug/L	1.0	1		01/30/17 14:14	71-43-2	
Bromochloromethane	ND	ug/L	1.0	1		01/30/17 14:14	74-97-5	
Bromodichloromethane	ND	ug/L	1.0	1		01/30/17 14:14	75-27-4	
Bromoform	ND	ug/L	1.0	1		01/30/17 14:14	75-25-2	
Bromomethane	ND	ug/L	2.0	1		01/30/17 14:14	74-83-9	M1
2-Butanone (MEK)	ND	ug/L	5.0	1		01/30/17 14:14	78-93-3	
Carbon disulfide	ND	ug/L	2.0	1		01/30/17 14:14	75-15-0	
Carbon tetrachloride	ND	ug/L	1.0	1		01/30/17 14:14	56-23-5	
Chlorobenzene	ND	ug/L	1.0	1		01/30/17 14:14	108-90-7	
Chloroethane	ND	ug/L	1.0	1		01/30/17 14:14	75-00-3	
Chloroform	ND	ug/L	1.0	1		01/30/17 14:14	67-66-3	
Chloromethane	ND	ug/L	1.0	1		01/30/17 14:14	74-87-3	
Dibromochloromethane	ND	ug/L	1.0	1		01/30/17 14:14	124-48-1	

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9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

ANALYTICAL RESULTS

Project: Charrah-Brickhaven
Pace Project No.: 92327809

Sample: MW-4 **Lab ID: 92327809001** Collected: 01/25/17 09:45 Received: 01/25/17 19:30 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
Dibromomethane	ND	ug/L	1.0	1		01/30/17 14:14	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	1.0	1		01/30/17 14:14	95-50-1	
1,4-Dichlorobenzene	ND	ug/L	1.0	1		01/30/17 14:14	106-46-7	
trans-1,4-Dichloro-2-butene	ND	ug/L	1.0	1		01/30/17 14:14	110-57-6	
1,1-Dichloroethane	ND	ug/L	1.0	1		01/30/17 14:14	75-34-3	
1,2-Dichloroethane	ND	ug/L	1.0	1		01/30/17 14:14	107-06-2	
1,1-Dichloroethene	ND	ug/L	1.0	1		01/30/17 14:14	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	1.0	1		01/30/17 14:14	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	1.0	1		01/30/17 14:14	156-60-5	
1,2-Dichloropropane	ND	ug/L	1.0	1		01/30/17 14:14	78-87-5	
cis-1,3-Dichloropropene	ND	ug/L	1.0	1		01/30/17 14:14	10061-01-5	
trans-1,3-Dichloropropene	ND	ug/L	1.0	1		01/30/17 14:14	10061-02-6	
Ethylbenzene	ND	ug/L	1.0	1		01/30/17 14:14	100-41-4	
2-Hexanone	ND	ug/L	5.0	1		01/30/17 14:14	591-78-6	
Iodomethane	ND	ug/L	5.0	1		01/30/17 14:14	74-88-4	
Methylene Chloride	ND	ug/L	1.0	1		01/30/17 14:14	75-09-2	
4-Methyl-2-pentanone (MIBK)	ND	ug/L	5.0	1		01/30/17 14:14	108-10-1	
Styrene	ND	ug/L	1.0	1		01/30/17 14:14	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0	1		01/30/17 14:14	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0	1		01/30/17 14:14	79-34-5	
Tetrachloroethene	ND	ug/L	1.0	1		01/30/17 14:14	127-18-4	
Toluene	ND	ug/L	1.0	1		01/30/17 14:14	108-88-3	
1,1,1-Trichloroethane	ND	ug/L	1.0	1		01/30/17 14:14	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	1.0	1		01/30/17 14:14	79-00-5	
Trichloroethene	ND	ug/L	1.0	1		01/30/17 14:14	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0	1		01/30/17 14:14	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0	1		01/30/17 14:14	96-18-4	
Vinyl acetate	ND	ug/L	2.0	1		01/30/17 14:14	108-05-4	
Vinyl chloride	ND	ug/L	1.0	1		01/30/17 14:14	75-01-4	
Xylene (Total)	ND	ug/L	1.0	1		01/30/17 14:14	1330-20-7	
Surrogates								
4-Bromofluorobenzene (S)	94	%	70-130	1		01/30/17 14:14	460-00-4	
1,2-Dichloroethane-d4 (S)	93	%	70-130	1		01/30/17 14:14	17060-07-0	
Toluene-d8 (S)	106	%	70-130	1		01/30/17 14:14	2037-26-5	
2540C Total Dissolved Solids	Analytical Method: SM 2540C							
Total Dissolved Solids	**1150**	mg/L	25.0	1		01/31/17 00:08		

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Huntersville, NC 28078
(704)875-9092

ANALYTICAL RESULTS

Project: Charrah-Brickhaven
Pace Project No.: 92327809

Sample: MW-4 DUP **Lab ID: 92327809002** Collected: 01/25/17 09:45 Received: 01/25/17 19:30 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
3000 IC Anions 28 Days, GWD	Analytical Method: EPA 300.0							
Chloride	**519**	mg/L	10.0	10		02/02/17 02:21	16887-00-6	
Fluoride	**0.22**	mg/L	0.10	1		02/01/17 12:56	16984-48-8	M1
Sulfate	**10.1**	mg/L	1.0	1		02/01/17 12:56	14808-79-8	
6010 MET ICP	Analytical Method: EPA 6010 Preparation Method: EPA 3010A							
Antimony	ND	ug/L	5.0	1	01/27/17 22:00	01/31/17 08:29	7440-36-0	
Arsenic	ND	ug/L	10.0	1	01/27/17 22:00	01/31/17 08:29	7440-38-2	
Barium	**322**	ug/L	5.0	1	01/27/17 22:00	01/31/17 08:29	7440-39-3	
Beryllium	ND	ug/L	1.0	1	01/27/17 22:00	01/31/17 08:29	7440-41-7	
Cadmium	ND	ug/L	1.0	1	01/27/17 22:00	01/31/17 08:29	7440-43-9	
Calcium	**67900**	ug/L	100	1	01/27/17 22:00	01/31/17 08:29	7440-70-2	
Chromium	ND	ug/L	5.0	1	01/27/17 22:00	01/31/17 08:29	7440-47-3	
Cobalt	ND	ug/L	5.0	1	01/27/17 22:00	01/31/17 08:29	7440-48-4	
Copper	ND	ug/L	5.0	1	01/27/17 22:00	01/31/17 08:29	7440-50-8	
Lead	ND	ug/L	5.0	1	01/27/17 22:00	01/31/17 08:29	7439-92-1	
Molybdenum	ND	ug/L	5.0	1	01/27/17 22:00	01/31/17 08:29	7439-98-7	
Nickel	**5.6**	ug/L	5.0	1	01/27/17 22:00	01/31/17 08:29	7440-02-0	
Selenium	ND	ug/L	10.0	1	01/27/17 22:00	01/31/17 08:29	7782-49-2	
Silver	ND	ug/L	5.0	1	01/27/17 22:00	01/31/17 08:29	7440-22-4	
Vanadium	ND	ug/L	5.0	1	01/27/17 22:00	01/31/17 08:29	7440-62-2	
Zinc	ND	ug/L	10.0	1	01/27/17 22:00	01/31/17 08:29	7440-66-6	
6020 MET ICPMS	Analytical Method: EPA 6020B Preparation Method: EPA 3010A							
Boron	ND	ug/L	25.0	1	01/27/17 18:55	01/30/17 14:53	7440-42-8	
Lithium	**29.4**	ug/L	2.5	1	01/27/17 18:55	01/28/17 15:19	7439-93-2	
Thallium	ND	ug/L	0.10	1	01/27/17 18:55	01/28/17 15:19	7440-28-0	
7470 Mercury	Analytical Method: EPA 7470 Preparation Method: EPA 7470							
Mercury	ND	ug/L	0.20	1	01/27/17 23:59	01/31/17 17:08	7439-97-6	
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
Acetone	ND	ug/L	25.0	1		01/30/17 14:32	67-64-1	
Acrylonitrile	ND	ug/L	10.0	1		01/30/17 14:32	107-13-1	
Benzene	ND	ug/L	1.0	1		01/30/17 14:32	71-43-2	
Bromochloromethane	ND	ug/L	1.0	1		01/30/17 14:32	74-97-5	
Bromodichloromethane	ND	ug/L	1.0	1		01/30/17 14:32	75-27-4	
Bromoform	ND	ug/L	1.0	1		01/30/17 14:32	75-25-2	
Bromomethane	ND	ug/L	2.0	1		01/30/17 14:32	74-83-9	
2-Butanone (MEK)	ND	ug/L	5.0	1		01/30/17 14:32	78-93-3	
Carbon disulfide	ND	ug/L	2.0	1		01/30/17 14:32	75-15-0	
Carbon tetrachloride	ND	ug/L	1.0	1		01/30/17 14:32	56-23-5	
Chlorobenzene	ND	ug/L	1.0	1		01/30/17 14:32	108-90-7	
Chloroethane	ND	ug/L	1.0	1		01/30/17 14:32	75-00-3	
Chloroform	ND	ug/L	1.0	1		01/30/17 14:32	67-66-3	
Chloromethane	ND	ug/L	1.0	1		01/30/17 14:32	74-87-3	
Dibromochloromethane	ND	ug/L	1.0	1		01/30/17 14:32	124-48-1	

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Huntersville, NC 28078
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ANALYTICAL RESULTS

Project: Charrah-Brickhaven
Pace Project No.: 92327809

Sample: MW-4 DUP **Lab ID: 92327809002** Collected: 01/25/17 09:45 Received: 01/25/17 19:30 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
Dibromomethane	ND	ug/L	1.0	1		01/30/17 14:32	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	1.0	1		01/30/17 14:32	95-50-1	
1,4-Dichlorobenzene	ND	ug/L	1.0	1		01/30/17 14:32	106-46-7	
trans-1,4-Dichloro-2-butene	ND	ug/L	1.0	1		01/30/17 14:32	110-57-6	
1,1-Dichloroethane	ND	ug/L	1.0	1		01/30/17 14:32	75-34-3	
1,2-Dichloroethane	ND	ug/L	1.0	1		01/30/17 14:32	107-06-2	
1,1-Dichloroethene	ND	ug/L	1.0	1		01/30/17 14:32	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	1.0	1		01/30/17 14:32	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	1.0	1		01/30/17 14:32	156-60-5	
1,2-Dichloropropane	ND	ug/L	1.0	1		01/30/17 14:32	78-87-5	
cis-1,3-Dichloropropene	ND	ug/L	1.0	1		01/30/17 14:32	10061-01-5	
trans-1,3-Dichloropropene	ND	ug/L	1.0	1		01/30/17 14:32	10061-02-6	
Ethylbenzene	ND	ug/L	1.0	1		01/30/17 14:32	100-41-4	
2-Hexanone	ND	ug/L	5.0	1		01/30/17 14:32	591-78-6	
Iodomethane	ND	ug/L	5.0	1		01/30/17 14:32	74-88-4	
Methylene Chloride	ND	ug/L	1.0	1		01/30/17 14:32	75-09-2	
4-Methyl-2-pentanone (MIBK)	ND	ug/L	5.0	1		01/30/17 14:32	108-10-1	
Styrene	ND	ug/L	1.0	1		01/30/17 14:32	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0	1		01/30/17 14:32	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0	1		01/30/17 14:32	79-34-5	
Tetrachloroethene	ND	ug/L	1.0	1		01/30/17 14:32	127-18-4	
Toluene	ND	ug/L	1.0	1		01/30/17 14:32	108-88-3	
1,1,1-Trichloroethane	ND	ug/L	1.0	1		01/30/17 14:32	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	1.0	1		01/30/17 14:32	79-00-5	
Trichloroethene	ND	ug/L	1.0	1		01/30/17 14:32	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0	1		01/30/17 14:32	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0	1		01/30/17 14:32	96-18-4	
Vinyl acetate	ND	ug/L	2.0	1		01/30/17 14:32	108-05-4	
Vinyl chloride	ND	ug/L	1.0	1		01/30/17 14:32	75-01-4	
Xylene (Total)	ND	ug/L	1.0	1		01/30/17 14:32	1330-20-7	
Surrogates								
4-Bromofluorobenzene (S)	94	%	70-130	1		01/30/17 14:32	460-00-4	
1,2-Dichloroethane-d4 (S)	93	%	70-130	1		01/30/17 14:32	17060-07-0	
Toluene-d8 (S)	106	%	70-130	1		01/30/17 14:32	2037-26-5	
2540C Total Dissolved Solids	Analytical Method: SM 2540C							
Total Dissolved Solids	**1180**	mg/L	25.0	1		01/31/17 00:08		

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ANALYTICAL RESULTS

Project: Charrah-Brickhaven
Pace Project No.: 92327809

Sample: SW-1 **Lab ID: 92327809003** Collected: 01/25/17 12:05 Received: 01/25/17 19:30 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
3000 IC Anions 28 Days, GWD	Analytical Method: EPA 300.0							
Chloride	**8.9**	mg/L	1.0	1		02/01/17 13:46	16887-00-6	
Fluoride	**0.11**	mg/L	0.10	1		02/01/17 13:46	16984-48-8	
Sulfate	**6.5**	mg/L	1.0	1		02/01/17 13:46	14808-79-8	
6010 MET ICP	Analytical Method: EPA 6010 Preparation Method: EPA 3010A							
Antimony	ND	ug/L	5.0	1	01/27/17 22:00	01/31/17 08:33	7440-36-0	
Arsenic	ND	ug/L	10.0	1	01/27/17 22:00	01/31/17 08:33	7440-38-2	
Barium	**101**	ug/L	5.0	1	01/27/17 22:00	01/31/17 08:33	7440-39-3	
Beryllium	ND	ug/L	1.0	1	01/27/17 22:00	01/31/17 08:33	7440-41-7	
Cadmium	ND	ug/L	1.0	1	01/27/17 22:00	01/31/17 08:33	7440-43-9	
Calcium	**3850**	ug/L	100	1	01/27/17 22:00	01/31/17 08:33	7440-70-2	
Chromium	ND	ug/L	5.0	1	01/27/17 22:00	01/31/17 08:33	7440-47-3	
Cobalt	ND	ug/L	5.0	1	01/27/17 22:00	01/31/17 08:33	7440-48-4	
Copper	ND	ug/L	5.0	1	01/27/17 22:00	01/31/17 08:33	7440-50-8	
Lead	**6.8**	ug/L	5.0	1	01/27/17 22:00	01/31/17 08:33	7439-92-1	
Molybdenum	ND	ug/L	5.0	1	01/27/17 22:00	01/31/17 08:33	7439-98-7	
Nickel	ND	ug/L	5.0	1	01/27/17 22:00	01/31/17 08:33	7440-02-0	
Selenium	ND	ug/L	10.0	1	01/27/17 22:00	01/31/17 08:33	7782-49-2	
Silver	ND	ug/L	5.0	1	01/27/17 22:00	01/31/17 08:33	7440-22-4	
Vanadium	**11.2**	ug/L	5.0	1	01/27/17 22:00	01/31/17 08:33	7440-62-2	
Zinc	**17.5**	ug/L	10.0	1	01/27/17 22:00	01/31/17 08:33	7440-66-6	
6020 MET ICPMS	Analytical Method: EPA 6020B Preparation Method: EPA 3010A							
Boron	ND	ug/L	25.0	1	01/27/17 18:55	01/30/17 14:55	7440-42-8	
Lithium	ND	ug/L	2.5	1	01/27/17 18:55	01/28/17 15:21	7439-93-2	
Thallium	ND	ug/L	0.10	1	01/27/17 18:55	01/28/17 15:21	7440-28-0	
7470 Mercury	Analytical Method: EPA 7470 Preparation Method: EPA 7470							
Mercury	ND	ug/L	0.20	1	01/27/17 23:59	01/31/17 17:15	7439-97-6	
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
Acetone	ND	ug/L	25.0	1		01/30/17 15:06	67-64-1	
Acrylonitrile	ND	ug/L	10.0	1		01/30/17 15:06	107-13-1	
Benzene	ND	ug/L	1.0	1		01/30/17 15:06	71-43-2	
Bromochloromethane	ND	ug/L	1.0	1		01/30/17 15:06	74-97-5	
Bromodichloromethane	ND	ug/L	1.0	1		01/30/17 15:06	75-27-4	
Bromoform	ND	ug/L	1.0	1		01/30/17 15:06	75-25-2	
Bromomethane	ND	ug/L	2.0	1		01/30/17 15:06	74-83-9	
2-Butanone (MEK)	ND	ug/L	5.0	1		01/30/17 15:06	78-93-3	
Carbon disulfide	ND	ug/L	2.0	1		01/30/17 15:06	75-15-0	
Carbon tetrachloride	ND	ug/L	1.0	1		01/30/17 15:06	56-23-5	
Chlorobenzene	ND	ug/L	1.0	1		01/30/17 15:06	108-90-7	
Chloroethane	ND	ug/L	1.0	1		01/30/17 15:06	75-00-3	
Chloroform	ND	ug/L	1.0	1		01/30/17 15:06	67-66-3	
Chloromethane	ND	ug/L	1.0	1		01/30/17 15:06	74-87-3	
Dibromochloromethane	ND	ug/L	1.0	1		01/30/17 15:06	124-48-1	

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ANALYTICAL RESULTS

Project: Charrah-Brickhaven
Pace Project No.: 92327809

Sample: SW-1 **Lab ID: 92327809003** Collected: 01/25/17 12:05 Received: 01/25/17 19:30 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
Dibromomethane	ND	ug/L	1.0	1		01/30/17 15:06	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	1.0	1		01/30/17 15:06	95-50-1	
1,4-Dichlorobenzene	ND	ug/L	1.0	1		01/30/17 15:06	106-46-7	
trans-1,4-Dichloro-2-butene	ND	ug/L	1.0	1		01/30/17 15:06	110-57-6	
1,1-Dichloroethane	ND	ug/L	1.0	1		01/30/17 15:06	75-34-3	
1,2-Dichloroethane	ND	ug/L	1.0	1		01/30/17 15:06	107-06-2	
1,1-Dichloroethene	ND	ug/L	1.0	1		01/30/17 15:06	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	1.0	1		01/30/17 15:06	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	1.0	1		01/30/17 15:06	156-60-5	
1,2-Dichloropropane	ND	ug/L	1.0	1		01/30/17 15:06	78-87-5	
cis-1,3-Dichloropropene	ND	ug/L	1.0	1		01/30/17 15:06	10061-01-5	
trans-1,3-Dichloropropene	ND	ug/L	1.0	1		01/30/17 15:06	10061-02-6	
Ethylbenzene	ND	ug/L	1.0	1		01/30/17 15:06	100-41-4	
2-Hexanone	ND	ug/L	5.0	1		01/30/17 15:06	591-78-6	
Iodomethane	ND	ug/L	5.0	1		01/30/17 15:06	74-88-4	
Methylene Chloride	ND	ug/L	1.0	1		01/30/17 15:06	75-09-2	
4-Methyl-2-pentanone (MIBK)	ND	ug/L	5.0	1		01/30/17 15:06	108-10-1	
Styrene	ND	ug/L	1.0	1		01/30/17 15:06	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0	1		01/30/17 15:06	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0	1		01/30/17 15:06	79-34-5	
Tetrachloroethene	ND	ug/L	1.0	1		01/30/17 15:06	127-18-4	
Toluene	ND	ug/L	1.0	1		01/30/17 15:06	108-88-3	
1,1,1-Trichloroethane	ND	ug/L	1.0	1		01/30/17 15:06	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	1.0	1		01/30/17 15:06	79-00-5	
Trichloroethene	ND	ug/L	1.0	1		01/30/17 15:06	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0	1		01/30/17 15:06	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0	1		01/30/17 15:06	96-18-4	
Vinyl acetate	ND	ug/L	2.0	1		01/30/17 15:06	108-05-4	
Vinyl chloride	ND	ug/L	1.0	1		01/30/17 15:06	75-01-4	
Xylene (Total)	ND	ug/L	1.0	1		01/30/17 15:06	1330-20-7	
Surrogates								
4-Bromofluorobenzene (S)	95	%	70-130	1		01/30/17 15:06	460-00-4	
1,2-Dichloroethane-d4 (S)	95	%	70-130	1		01/30/17 15:06	17060-07-0	
Toluene-d8 (S)	103	%	70-130	1		01/30/17 15:06	2037-26-5	
2540C Total Dissolved Solids	Analytical Method: SM 2540C							
Total Dissolved Solids	**230**	mg/L	25.0	1		01/31/17 00:08		

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Huntersville, NC 28078
(704)875-9092

ANALYTICAL RESULTS

Project: Charrah-Brickhaven
Pace Project No.: 92327809

Sample: SW-2 **Lab ID: 92327809004** Collected: 01/25/17 13:15 Received: 01/25/17 19:30 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
3000 IC Anions 28 Days, GWD	Analytical Method: EPA 300.0							
Chloride	**11.0**	mg/L	1.0	1		02/01/17 14:03	16887-00-6	
Fluoride	ND	mg/L	0.10	1		02/01/17 14:03	16984-48-8	
Sulfate	**10.5**	mg/L	1.0	1		02/01/17 14:03	14808-79-8	
6010 MET ICP	Analytical Method: EPA 6010 Preparation Method: EPA 3010A							
Antimony	ND	ug/L	5.0	1	01/27/17 22:00	01/31/17 08:36	7440-36-0	
Arsenic	ND	ug/L	10.0	1	01/27/17 22:00	01/31/17 08:36	7440-38-2	
Barium	**68.2**	ug/L	5.0	1	01/27/17 22:00	01/31/17 08:36	7440-39-3	
Beryllium	ND	ug/L	1.0	1	01/27/17 22:00	01/31/17 08:36	7440-41-7	
Cadmium	ND	ug/L	1.0	1	01/27/17 22:00	01/31/17 08:36	7440-43-9	
Calcium	**7650**	ug/L	100	1	01/27/17 22:00	01/31/17 08:36	7440-70-2	
Chromium	ND	ug/L	5.0	1	01/27/17 22:00	01/31/17 08:36	7440-47-3	
Cobalt	ND	ug/L	5.0	1	01/27/17 22:00	01/31/17 08:36	7440-48-4	
Copper	**7.5**	ug/L	5.0	1	01/27/17 22:00	01/31/17 08:36	7440-50-8	
Lead	ND	ug/L	5.0	1	01/27/17 22:00	01/31/17 08:36	7439-92-1	
Molybdenum	ND	ug/L	5.0	1	01/27/17 22:00	01/31/17 08:36	7439-98-7	
Nickel	ND	ug/L	5.0	1	01/27/17 22:00	01/31/17 08:36	7440-02-0	
Selenium	ND	ug/L	10.0	1	01/27/17 22:00	01/31/17 08:36	7782-49-2	
Silver	ND	ug/L	5.0	1	01/27/17 22:00	01/31/17 08:36	7440-22-4	
Vanadium	ND	ug/L	5.0	1	01/27/17 22:00	01/31/17 08:36	7440-62-2	
Zinc	ND	ug/L	10.0	1	01/27/17 22:00	01/31/17 08:36	7440-66-6	
6020 MET ICPMS	Analytical Method: EPA 6020B Preparation Method: EPA 3010A							
Boron	**27.4**	ug/L	25.0	1	01/27/17 18:55	01/30/17 14:57	7440-42-8	
Lithium	ND	ug/L	2.5	1	01/27/17 18:55	01/28/17 15:23	7439-93-2	
Thallium	ND	ug/L	0.10	1	01/27/17 18:55	01/28/17 15:23	7440-28-0	
7470 Mercury	Analytical Method: EPA 7470 Preparation Method: EPA 7470							
Mercury	ND	ug/L	0.20	1	01/27/17 23:59	01/31/17 17:17	7439-97-6	
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
Acetone	ND	ug/L	25.0	1		01/30/17 15:24	67-64-1	
Acrylonitrile	ND	ug/L	10.0	1		01/30/17 15:24	107-13-1	
Benzene	ND	ug/L	1.0	1		01/30/17 15:24	71-43-2	
Bromochloromethane	ND	ug/L	1.0	1		01/30/17 15:24	74-97-5	
Bromodichloromethane	ND	ug/L	1.0	1		01/30/17 15:24	75-27-4	
Bromoform	ND	ug/L	1.0	1		01/30/17 15:24	75-25-2	
Bromomethane	ND	ug/L	2.0	1		01/30/17 15:24	74-83-9	
2-Butanone (MEK)	ND	ug/L	5.0	1		01/30/17 15:24	78-93-3	
Carbon disulfide	ND	ug/L	2.0	1		01/30/17 15:24	75-15-0	
Carbon tetrachloride	ND	ug/L	1.0	1		01/30/17 15:24	56-23-5	
Chlorobenzene	ND	ug/L	1.0	1		01/30/17 15:24	108-90-7	
Chloroethane	ND	ug/L	1.0	1		01/30/17 15:24	75-00-3	
Chloroform	ND	ug/L	1.0	1		01/30/17 15:24	67-66-3	
Chloromethane	ND	ug/L	1.0	1		01/30/17 15:24	74-87-3	
Dibromochloromethane	ND	ug/L	1.0	1		01/30/17 15:24	124-48-1	

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(704)875-9092

ANALYTICAL RESULTS

Project: Charrah-Brickhaven
Pace Project No.: 92327809

Sample: SW-2 **Lab ID: 92327809004** Collected: 01/25/17 13:15 Received: 01/25/17 19:30 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
Dibromomethane	ND	ug/L	1.0	1		01/30/17 15:24	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	1.0	1		01/30/17 15:24	95-50-1	
1,4-Dichlorobenzene	ND	ug/L	1.0	1		01/30/17 15:24	106-46-7	
trans-1,4-Dichloro-2-butene	ND	ug/L	1.0	1		01/30/17 15:24	110-57-6	
1,1-Dichloroethane	ND	ug/L	1.0	1		01/30/17 15:24	75-34-3	
1,2-Dichloroethane	ND	ug/L	1.0	1		01/30/17 15:24	107-06-2	
1,1-Dichloroethene	ND	ug/L	1.0	1		01/30/17 15:24	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	1.0	1		01/30/17 15:24	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	1.0	1		01/30/17 15:24	156-60-5	
1,2-Dichloropropane	ND	ug/L	1.0	1		01/30/17 15:24	78-87-5	
cis-1,3-Dichloropropene	ND	ug/L	1.0	1		01/30/17 15:24	10061-01-5	
trans-1,3-Dichloropropene	ND	ug/L	1.0	1		01/30/17 15:24	10061-02-6	
Ethylbenzene	ND	ug/L	1.0	1		01/30/17 15:24	100-41-4	
2-Hexanone	ND	ug/L	5.0	1		01/30/17 15:24	591-78-6	
Iodomethane	ND	ug/L	5.0	1		01/30/17 15:24	74-88-4	
Methylene Chloride	ND	ug/L	1.0	1		01/30/17 15:24	75-09-2	
4-Methyl-2-pentanone (MIBK)	ND	ug/L	5.0	1		01/30/17 15:24	108-10-1	
Styrene	ND	ug/L	1.0	1		01/30/17 15:24	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0	1		01/30/17 15:24	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0	1		01/30/17 15:24	79-34-5	
Tetrachloroethene	ND	ug/L	1.0	1		01/30/17 15:24	127-18-4	
Toluene	ND	ug/L	1.0	1		01/30/17 15:24	108-88-3	
1,1,1-Trichloroethane	ND	ug/L	1.0	1		01/30/17 15:24	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	1.0	1		01/30/17 15:24	79-00-5	
Trichloroethene	ND	ug/L	1.0	1		01/30/17 15:24	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0	1		01/30/17 15:24	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0	1		01/30/17 15:24	96-18-4	
Vinyl acetate	ND	ug/L	2.0	1		01/30/17 15:24	108-05-4	
Vinyl chloride	ND	ug/L	1.0	1		01/30/17 15:24	75-01-4	
Xylene (Total)	ND	ug/L	1.0	1		01/30/17 15:24	1330-20-7	
Surrogates								
4-Bromofluorobenzene (S)	98	%	70-130	1		01/30/17 15:24	460-00-4	
1,2-Dichloroethane-d4 (S)	95	%	70-130	1		01/30/17 15:24	17060-07-0	
Toluene-d8 (S)	103	%	70-130	1		01/30/17 15:24	2037-26-5	
2540C Total Dissolved Solids	Analytical Method: SM 2540C							
Total Dissolved Solids	**148**	mg/L	25.0	1		01/31/17 12:07		

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(704)875-9092

ANALYTICAL RESULTS

Project: Charrah-Brickhaven
Pace Project No.: 92327809

Sample: MW-1 **Lab ID: 92327809005** Collected: 01/25/17 17:35 Received: 01/25/17 19:30 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
3000 IC Anions 28 Days, GWD	Analytical Method: EPA 300.0							
Chloride	**401**	mg/L	8.0	8		02/02/17 17:29	16887-00-6	
Fluoride	**0.12**	mg/L	0.10	1		02/02/17 16:04	16984-48-8	
Sulfate	**7.0**	mg/L	1.0	1		02/02/17 16:04	14808-79-8	
6010 MET ICP	Analytical Method: EPA 6010 Preparation Method: EPA 3010A							
Antimony	ND	ug/L	5.0	1	01/27/17 22:00	01/31/17 08:39	7440-36-0	
Arsenic	ND	ug/L	10.0	1	01/27/17 22:00	01/31/17 08:39	7440-38-2	
Barium	**131**	ug/L	5.0	1	01/27/17 22:00	01/31/17 08:39	7440-39-3	
Beryllium	ND	ug/L	1.0	1	01/27/17 22:00	01/31/17 08:39	7440-41-7	
Cadmium	ND	ug/L	1.0	1	01/27/17 22:00	01/31/17 08:39	7440-43-9	
Calcium	**112000**	ug/L	1000	10	01/27/17 22:00	01/31/17 15:06	7440-70-2	
Chromium	**6.6**	ug/L	5.0	1	01/27/17 22:00	01/31/17 08:39	7440-47-3	
Cobalt	ND	ug/L	5.0	1	01/27/17 22:00	01/31/17 08:39	7440-48-4	
Copper	ND	ug/L	5.0	1	01/27/17 22:00	01/31/17 08:39	7440-50-8	
Lead	ND	ug/L	5.0	1	01/27/17 22:00	01/31/17 08:39	7439-92-1	
Molybdenum	ND	ug/L	5.0	1	01/27/17 22:00	01/31/17 08:39	7439-98-7	
Nickel	ND	ug/L	5.0	1	01/27/17 22:00	01/31/17 08:39	7440-02-0	
Selenium	ND	ug/L	10.0	1	01/27/17 22:00	01/31/17 08:39	7782-49-2	
Silver	ND	ug/L	5.0	1	01/27/17 22:00	01/31/17 08:39	7440-22-4	
Vanadium	ND	ug/L	5.0	1	01/27/17 22:00	01/31/17 08:39	7440-62-2	
Zinc	ND	ug/L	10.0	1	01/27/17 22:00	01/31/17 08:39	7440-66-6	
6020 MET ICPMS	Analytical Method: EPA 6020B Preparation Method: EPA 3010A							
Boron	ND	ug/L	25.0	1	01/27/17 18:55	01/30/17 14:59	7440-42-8	
Lithium	**31.2**	ug/L	2.5	1	01/27/17 18:55	01/28/17 15:31	7439-93-2	
Thallium	ND	ug/L	0.10	1	01/27/17 18:55	01/28/17 15:31	7440-28-0	
7470 Mercury	Analytical Method: EPA 7470 Preparation Method: EPA 7470							
Mercury	ND	ug/L	0.20	1	01/27/17 23:59	01/31/17 17:20	7439-97-6	
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
Acetone	ND	ug/L	25.0	1		01/30/17 15:41	67-64-1	
Acrylonitrile	ND	ug/L	10.0	1		01/30/17 15:41	107-13-1	
Benzene	ND	ug/L	1.0	1		01/30/17 15:41	71-43-2	
Bromochloromethane	ND	ug/L	1.0	1		01/30/17 15:41	74-97-5	
Bromodichloromethane	ND	ug/L	1.0	1		01/30/17 15:41	75-27-4	
Bromoform	ND	ug/L	1.0	1		01/30/17 15:41	75-25-2	
Bromomethane	ND	ug/L	2.0	1		01/30/17 15:41	74-83-9	
2-Butanone (MEK)	ND	ug/L	5.0	1		01/30/17 15:41	78-93-3	
Carbon disulfide	ND	ug/L	2.0	1		01/30/17 15:41	75-15-0	
Carbon tetrachloride	ND	ug/L	1.0	1		01/30/17 15:41	56-23-5	
Chlorobenzene	ND	ug/L	1.0	1		01/30/17 15:41	108-90-7	
Chloroethane	ND	ug/L	1.0	1		01/30/17 15:41	75-00-3	
Chloroform	ND	ug/L	1.0	1		01/30/17 15:41	67-66-3	
Chloromethane	ND	ug/L	1.0	1		01/30/17 15:41	74-87-3	
Dibromochloromethane	ND	ug/L	1.0	1		01/30/17 15:41	124-48-1	

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ANALYTICAL RESULTS

Project: Charrah-Brickhaven
Pace Project No.: 92327809

Sample: MW-1 **Lab ID: 92327809005** Collected: 01/25/17 17:35 Received: 01/25/17 19:30 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
Dibromomethane	ND	ug/L	1.0	1		01/30/17 15:41	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	1.0	1		01/30/17 15:41	95-50-1	
1,4-Dichlorobenzene	ND	ug/L	1.0	1		01/30/17 15:41	106-46-7	
trans-1,4-Dichloro-2-butene	ND	ug/L	1.0	1		01/30/17 15:41	110-57-6	
1,1-Dichloroethane	ND	ug/L	1.0	1		01/30/17 15:41	75-34-3	
1,2-Dichloroethane	ND	ug/L	1.0	1		01/30/17 15:41	107-06-2	
1,1-Dichloroethene	ND	ug/L	1.0	1		01/30/17 15:41	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	1.0	1		01/30/17 15:41	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	1.0	1		01/30/17 15:41	156-60-5	
1,2-Dichloropropane	ND	ug/L	1.0	1		01/30/17 15:41	78-87-5	
cis-1,3-Dichloropropene	ND	ug/L	1.0	1		01/30/17 15:41	10061-01-5	
trans-1,3-Dichloropropene	ND	ug/L	1.0	1		01/30/17 15:41	10061-02-6	
Ethylbenzene	ND	ug/L	1.0	1		01/30/17 15:41	100-41-4	
2-Hexanone	ND	ug/L	5.0	1		01/30/17 15:41	591-78-6	
Iodomethane	ND	ug/L	5.0	1		01/30/17 15:41	74-88-4	
Methylene Chloride	ND	ug/L	1.0	1		01/30/17 15:41	75-09-2	
4-Methyl-2-pentanone (MIBK)	ND	ug/L	5.0	1		01/30/17 15:41	108-10-1	
Styrene	ND	ug/L	1.0	1		01/30/17 15:41	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0	1		01/30/17 15:41	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0	1		01/30/17 15:41	79-34-5	
Tetrachloroethene	ND	ug/L	1.0	1		01/30/17 15:41	127-18-4	
Toluene	ND	ug/L	1.0	1		01/30/17 15:41	108-88-3	
1,1,1-Trichloroethane	ND	ug/L	1.0	1		01/30/17 15:41	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	1.0	1		01/30/17 15:41	79-00-5	
Trichloroethene	ND	ug/L	1.0	1		01/30/17 15:41	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0	1		01/30/17 15:41	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0	1		01/30/17 15:41	96-18-4	
Vinyl acetate	ND	ug/L	2.0	1		01/30/17 15:41	108-05-4	
Vinyl chloride	ND	ug/L	1.0	1		01/30/17 15:41	75-01-4	
Xylene (Total)	ND	ug/L	1.0	1		01/30/17 15:41	1330-20-7	
Surrogates								
4-Bromofluorobenzene (S)	96	%	70-130	1		01/30/17 15:41	460-00-4	
1,2-Dichloroethane-d4 (S)	100	%	70-130	1		01/30/17 15:41	17060-07-0	
Toluene-d8 (S)	102	%	70-130	1		01/30/17 15:41	2037-26-5	
2540C Total Dissolved Solids	Analytical Method: SM 2540C							
Total Dissolved Solids	**931**	mg/L	25.0	1		01/31/17 12:08		

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ANALYTICAL RESULTS

Project: Charrah-Brickhaven
Pace Project No.: 92327809

Sample: AMB **Lab ID: 92327809006** Collected: 01/25/17 17:30 Received: 01/25/17 19:30 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
3000 IC Anions 28 Days, GWD	Analytical Method: EPA 300.0							
Chloride	ND	mg/L	1.0	1		02/01/17 14:20	16887-00-6	
Fluoride	ND	mg/L	0.10	1		02/01/17 14:20	16984-48-8	
Sulfate	ND	mg/L	1.0	1		02/01/17 14:20	14808-79-8	
6010 MET ICP	Analytical Method: EPA 6010 Preparation Method: EPA 3010A							
Antimony	ND	ug/L	5.0	1	01/27/17 22:00	01/31/17 08:51	7440-36-0	
Arsenic	ND	ug/L	10.0	1	01/27/17 22:00	01/31/17 08:51	7440-38-2	
Barium	ND	ug/L	5.0	1	01/27/17 22:00	01/31/17 08:51	7440-39-3	
Beryllium	ND	ug/L	1.0	1	01/27/17 22:00	01/31/17 08:51	7440-41-7	
Cadmium	ND	ug/L	1.0	1	01/27/17 22:00	01/31/17 08:51	7440-43-9	
Calcium	ND	ug/L	100	1	01/27/17 22:00	01/31/17 08:51	7440-70-2	
Chromium	ND	ug/L	5.0	1	01/27/17 22:00	01/31/17 08:51	7440-47-3	
Cobalt	ND	ug/L	5.0	1	01/27/17 22:00	01/31/17 08:51	7440-48-4	
Copper	ND	ug/L	5.0	1	01/27/17 22:00	01/31/17 08:51	7440-50-8	
Lead	ND	ug/L	5.0	1	01/27/17 22:00	01/31/17 08:51	7439-92-1	
Molybdenum	ND	ug/L	5.0	1	01/27/17 22:00	01/31/17 08:51	7439-98-7	
Nickel	ND	ug/L	5.0	1	01/27/17 22:00	01/31/17 08:51	7440-02-0	
Selenium	ND	ug/L	10.0	1	01/27/17 22:00	01/31/17 08:51	7782-49-2	
Silver	ND	ug/L	5.0	1	01/27/17 22:00	01/31/17 08:51	7440-22-4	
Vanadium	ND	ug/L	5.0	1	01/27/17 22:00	01/31/17 08:51	7440-62-2	
Zinc	ND	ug/L	10.0	1	01/27/17 22:00	01/31/17 08:51	7440-66-6	
6020 MET ICPMS	Analytical Method: EPA 6020B Preparation Method: EPA 3010A							
Boron	ND	ug/L	25.0	1	01/27/17 18:55	01/30/17 15:01	7440-42-8	
Lithium	ND	ug/L	2.5	1	01/27/17 18:55	01/28/17 15:33	7439-93-2	
Thallium	ND	ug/L	0.10	1	01/27/17 18:55	01/28/17 15:33	7440-28-0	
7470 Mercury	Analytical Method: EPA 7470 Preparation Method: EPA 7470							
Mercury	ND	ug/L	0.20	1	01/27/17 23:59	01/31/17 17:29	7439-97-6	
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
Acetone	ND	ug/L	25.0	1		01/30/17 15:59	67-64-1	
Acrylonitrile	ND	ug/L	10.0	1		01/30/17 15:59	107-13-1	
Benzene	ND	ug/L	1.0	1		01/30/17 15:59	71-43-2	
Bromochloromethane	ND	ug/L	1.0	1		01/30/17 15:59	74-97-5	
Bromodichloromethane	ND	ug/L	1.0	1		01/30/17 15:59	75-27-4	
Bromoform	ND	ug/L	1.0	1		01/30/17 15:59	75-25-2	
Bromomethane	ND	ug/L	2.0	1		01/30/17 15:59	74-83-9	
2-Butanone (MEK)	ND	ug/L	5.0	1		01/30/17 15:59	78-93-3	
Carbon disulfide	ND	ug/L	2.0	1		01/30/17 15:59	75-15-0	
Carbon tetrachloride	ND	ug/L	1.0	1		01/30/17 15:59	56-23-5	
Chlorobenzene	ND	ug/L	1.0	1		01/30/17 15:59	108-90-7	
Chloroethane	ND	ug/L	1.0	1		01/30/17 15:59	75-00-3	
Chloroform	ND	ug/L	1.0	1		01/30/17 15:59	67-66-3	
Chloromethane	ND	ug/L	1.0	1		01/30/17 15:59	74-87-3	
Dibromochloromethane	ND	ug/L	1.0	1		01/30/17 15:59	124-48-1	

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9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

ANALYTICAL RESULTS

Project: Charrah-Brickhaven
Pace Project No.: 92327809

Sample: AMB **Lab ID: 92327809006** Collected: 01/25/17 17:30 Received: 01/25/17 19:30 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
Dibromomethane	ND	ug/L	1.0	1		01/30/17 15:59	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	1.0	1		01/30/17 15:59	95-50-1	
1,4-Dichlorobenzene	ND	ug/L	1.0	1		01/30/17 15:59	106-46-7	
trans-1,4-Dichloro-2-butene	ND	ug/L	1.0	1		01/30/17 15:59	110-57-6	
1,1-Dichloroethane	ND	ug/L	1.0	1		01/30/17 15:59	75-34-3	
1,2-Dichloroethane	ND	ug/L	1.0	1		01/30/17 15:59	107-06-2	
1,1-Dichloroethene	ND	ug/L	1.0	1		01/30/17 15:59	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	1.0	1		01/30/17 15:59	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	1.0	1		01/30/17 15:59	156-60-5	
1,2-Dichloropropane	ND	ug/L	1.0	1		01/30/17 15:59	78-87-5	
cis-1,3-Dichloropropene	ND	ug/L	1.0	1		01/30/17 15:59	10061-01-5	
trans-1,3-Dichloropropene	ND	ug/L	1.0	1		01/30/17 15:59	10061-02-6	
Ethylbenzene	ND	ug/L	1.0	1		01/30/17 15:59	100-41-4	
2-Hexanone	ND	ug/L	5.0	1		01/30/17 15:59	591-78-6	
Iodomethane	ND	ug/L	5.0	1		01/30/17 15:59	74-88-4	
Methylene Chloride	**4.7**	ug/L	1.0	1		01/30/17 15:59	75-09-2	C9
4-Methyl-2-pentanone (MIBK)	ND	ug/L	5.0	1		01/30/17 15:59	108-10-1	
Styrene	ND	ug/L	1.0	1		01/30/17 15:59	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0	1		01/30/17 15:59	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0	1		01/30/17 15:59	79-34-5	
Tetrachloroethene	ND	ug/L	1.0	1		01/30/17 15:59	127-18-4	
Toluene	ND	ug/L	1.0	1		01/30/17 15:59	108-88-3	
1,1,1-Trichloroethane	ND	ug/L	1.0	1		01/30/17 15:59	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	1.0	1		01/30/17 15:59	79-00-5	
Trichloroethene	ND	ug/L	1.0	1		01/30/17 15:59	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0	1		01/30/17 15:59	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0	1		01/30/17 15:59	96-18-4	
Vinyl acetate	ND	ug/L	2.0	1		01/30/17 15:59	108-05-4	
Vinyl chloride	ND	ug/L	1.0	1		01/30/17 15:59	75-01-4	
Xylene (Total)	ND	ug/L	1.0	1		01/30/17 15:59	1330-20-7	
Surrogates								
4-Bromofluorobenzene (S)	99	%	70-130	1		01/30/17 15:59	460-00-4	
1,2-Dichloroethane-d4 (S)	97	%	70-130	1		01/30/17 15:59	17060-07-0	
Toluene-d8 (S)	106	%	70-130	1		01/30/17 15:59	2037-26-5	
2540C Total Dissolved Solids	Analytical Method: SM 2540C							
Total Dissolved Solids	ND	mg/L	25.0	1		01/31/17 12:09		

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Huntersville, NC 28078
(704)875-9092

ANALYTICAL RESULTS

Project: Charrah-Brickhaven
Pace Project No.: 92327809

Sample: EQ BLANK **Lab ID: 92327809007** Collected: 01/25/17 19:05 Received: 01/25/17 19:30 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
3000 IC Anions 28 Days, GWD	Analytical Method: EPA 300.0							
Chloride	ND	mg/L	1.0	1		02/01/17 14:37	16887-00-6	
Fluoride	ND	mg/L	0.10	1		02/01/17 14:37	16984-48-8	
Sulfate	ND	mg/L	1.0	1		02/01/17 14:37	14808-79-8	
6010 MET ICP	Analytical Method: EPA 6010 Preparation Method: EPA 3010A							
Antimony	ND	ug/L	5.0	1	01/27/17 22:00	01/31/17 08:54	7440-36-0	
Arsenic	ND	ug/L	10.0	1	01/27/17 22:00	01/31/17 08:54	7440-38-2	
Barium	ND	ug/L	5.0	1	01/27/17 22:00	01/31/17 08:54	7440-39-3	
Beryllium	ND	ug/L	1.0	1	01/27/17 22:00	01/31/17 08:54	7440-41-7	
Cadmium	ND	ug/L	1.0	1	01/27/17 22:00	01/31/17 08:54	7440-43-9	
Calcium	ND	ug/L	100	1	01/27/17 22:00	01/31/17 08:54	7440-70-2	
Chromium	**7.7**	ug/L	5.0	1	01/27/17 22:00	01/31/17 08:54	7440-47-3	
Cobalt	ND	ug/L	5.0	1	01/27/17 22:00	01/31/17 08:54	7440-48-4	
Copper	ND	ug/L	5.0	1	01/27/17 22:00	01/31/17 08:54	7440-50-8	
Lead	ND	ug/L	5.0	1	01/27/17 22:00	01/31/17 08:54	7439-92-1	
Molybdenum	ND	ug/L	5.0	1	01/27/17 22:00	01/31/17 08:54	7439-98-7	
Nickel	**6.3**	ug/L	5.0	1	01/27/17 22:00	01/31/17 08:54	7440-02-0	
Selenium	ND	ug/L	10.0	1	01/27/17 22:00	01/31/17 08:54	7782-49-2	
Silver	ND	ug/L	5.0	1	01/27/17 22:00	01/31/17 08:54	7440-22-4	
Vanadium	ND	ug/L	5.0	1	01/27/17 22:00	01/31/17 08:54	7440-62-2	
Zinc	ND	ug/L	10.0	1	01/27/17 22:00	01/31/17 08:54	7440-66-6	
6020 MET ICPMS	Analytical Method: EPA 6020B Preparation Method: EPA 3010A							
Boron	ND	ug/L	25.0	1	01/27/17 18:55	01/30/17 15:08	7440-42-8	
Lithium	ND	ug/L	2.5	1	01/27/17 18:55	01/28/17 15:35	7439-93-2	
Thallium	ND	ug/L	0.10	1	01/27/17 18:55	01/28/17 15:35	7440-28-0	
7470 Mercury	Analytical Method: EPA 7470 Preparation Method: EPA 7470							
Mercury	ND	ug/L	0.20	1	01/27/17 23:59	01/31/17 17:31	7439-97-6	
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
Acetone	ND	ug/L	25.0	1		01/30/17 16:16	67-64-1	
Acrylonitrile	ND	ug/L	10.0	1		01/30/17 16:16	107-13-1	
Benzene	ND	ug/L	1.0	1		01/30/17 16:16	71-43-2	
Bromochloromethane	ND	ug/L	1.0	1		01/30/17 16:16	74-97-5	
Bromodichloromethane	ND	ug/L	1.0	1		01/30/17 16:16	75-27-4	
Bromoform	ND	ug/L	1.0	1		01/30/17 16:16	75-25-2	
Bromomethane	ND	ug/L	2.0	1		01/30/17 16:16	74-83-9	
2-Butanone (MEK)	ND	ug/L	5.0	1		01/30/17 16:16	78-93-3	
Carbon disulfide	ND	ug/L	2.0	1		01/30/17 16:16	75-15-0	
Carbon tetrachloride	ND	ug/L	1.0	1		01/30/17 16:16	56-23-5	
Chlorobenzene	ND	ug/L	1.0	1		01/30/17 16:16	108-90-7	
Chloroethane	ND	ug/L	1.0	1		01/30/17 16:16	75-00-3	
Chloroform	ND	ug/L	1.0	1		01/30/17 16:16	67-66-3	
Chloromethane	ND	ug/L	1.0	1		01/30/17 16:16	74-87-3	
Dibromochloromethane	ND	ug/L	1.0	1		01/30/17 16:16	124-48-1	

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(704)875-9092

ANALYTICAL RESULTS

Project: Charrah-Brickhaven
Pace Project No.: 92327809

Sample: EQ BLANK **Lab ID: 92327809007** Collected: 01/25/17 19:05 Received: 01/25/17 19:30 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
Dibromomethane	ND	ug/L	1.0	1		01/30/17 16:16	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	1.0	1		01/30/17 16:16	95-50-1	
1,4-Dichlorobenzene	ND	ug/L	1.0	1		01/30/17 16:16	106-46-7	
trans-1,4-Dichloro-2-butene	ND	ug/L	1.0	1		01/30/17 16:16	110-57-6	
1,1-Dichloroethane	ND	ug/L	1.0	1		01/30/17 16:16	75-34-3	
1,2-Dichloroethane	ND	ug/L	1.0	1		01/30/17 16:16	107-06-2	
1,1-Dichloroethene	ND	ug/L	1.0	1		01/30/17 16:16	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	1.0	1		01/30/17 16:16	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	1.0	1		01/30/17 16:16	156-60-5	
1,2-Dichloropropane	ND	ug/L	1.0	1		01/30/17 16:16	78-87-5	
cis-1,3-Dichloropropene	ND	ug/L	1.0	1		01/30/17 16:16	10061-01-5	
trans-1,3-Dichloropropene	ND	ug/L	1.0	1		01/30/17 16:16	10061-02-6	
Ethylbenzene	ND	ug/L	1.0	1		01/30/17 16:16	100-41-4	
2-Hexanone	ND	ug/L	5.0	1		01/30/17 16:16	591-78-6	
Iodomethane	ND	ug/L	5.0	1		01/30/17 16:16	74-88-4	
Methylene Chloride	ND	ug/L	1.0	1		01/30/17 16:16	75-09-2	
4-Methyl-2-pentanone (MIBK)	ND	ug/L	5.0	1		01/30/17 16:16	108-10-1	
Styrene	ND	ug/L	1.0	1		01/30/17 16:16	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0	1		01/30/17 16:16	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0	1		01/30/17 16:16	79-34-5	
Tetrachloroethene	ND	ug/L	1.0	1		01/30/17 16:16	127-18-4	
Toluene	ND	ug/L	1.0	1		01/30/17 16:16	108-88-3	
1,1,1-Trichloroethane	ND	ug/L	1.0	1		01/30/17 16:16	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	1.0	1		01/30/17 16:16	79-00-5	
Trichloroethene	ND	ug/L	1.0	1		01/30/17 16:16	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0	1		01/30/17 16:16	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0	1		01/30/17 16:16	96-18-4	
Vinyl acetate	ND	ug/L	2.0	1		01/30/17 16:16	108-05-4	
Vinyl chloride	ND	ug/L	1.0	1		01/30/17 16:16	75-01-4	
Xylene (Total)	ND	ug/L	1.0	1		01/30/17 16:16	1330-20-7	
Surrogates								
4-Bromofluorobenzene (S)	94	%	70-130	1		01/30/17 16:16	460-00-4	
1,2-Dichloroethane-d4 (S)	99	%	70-130	1		01/30/17 16:16	17060-07-0	
Toluene-d8 (S)	108	%	70-130	1		01/30/17 16:16	2037-26-5	
2540C Total Dissolved Solids	Analytical Method: SM 2540C							
Total Dissolved Solids	ND	mg/L	25.0	1		01/31/17 12:09		

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ANALYTICAL RESULTS

Project: Charrah-Brickhaven
Pace Project No.: 92327809

Sample: TRIP BLANK **Lab ID: 92327809008** Collected: 01/25/17 00:00 Received: 01/25/17 19:30 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
Acetone	ND	ug/L	25.0	1		01/30/17 16:33	67-64-1	
Acrylonitrile	ND	ug/L	10.0	1		01/30/17 16:33	107-13-1	
Benzene	ND	ug/L	1.0	1		01/30/17 16:33	71-43-2	
Bromochloromethane	ND	ug/L	1.0	1		01/30/17 16:33	74-97-5	
Bromodichloromethane	ND	ug/L	1.0	1		01/30/17 16:33	75-27-4	
Bromoform	ND	ug/L	1.0	1		01/30/17 16:33	75-25-2	
Bromomethane	ND	ug/L	2.0	1		01/30/17 16:33	74-83-9	
2-Butanone (MEK)	ND	ug/L	5.0	1		01/30/17 16:33	78-93-3	
Carbon disulfide	ND	ug/L	2.0	1		01/30/17 16:33	75-15-0	
Carbon tetrachloride	ND	ug/L	1.0	1		01/30/17 16:33	56-23-5	
Chlorobenzene	ND	ug/L	1.0	1		01/30/17 16:33	108-90-7	
Chloroethane	ND	ug/L	1.0	1		01/30/17 16:33	75-00-3	
Chloroform	ND	ug/L	1.0	1		01/30/17 16:33	67-66-3	
Chloromethane	ND	ug/L	1.0	1		01/30/17 16:33	74-87-3	
Dibromochloromethane	ND	ug/L	1.0	1		01/30/17 16:33	124-48-1	
Dibromomethane	ND	ug/L	1.0	1		01/30/17 16:33	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	1.0	1		01/30/17 16:33	95-50-1	
1,4-Dichlorobenzene	ND	ug/L	1.0	1		01/30/17 16:33	106-46-7	
trans-1,4-Dichloro-2-butene	ND	ug/L	1.0	1		01/30/17 16:33	110-57-6	
1,1-Dichloroethane	ND	ug/L	1.0	1		01/30/17 16:33	75-34-3	
1,2-Dichloroethane	ND	ug/L	1.0	1		01/30/17 16:33	107-06-2	
1,1-Dichloroethene	ND	ug/L	1.0	1		01/30/17 16:33	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	1.0	1		01/30/17 16:33	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	1.0	1		01/30/17 16:33	156-60-5	
1,2-Dichloropropane	ND	ug/L	1.0	1		01/30/17 16:33	78-87-5	
cis-1,3-Dichloropropene	ND	ug/L	1.0	1		01/30/17 16:33	10061-01-5	
trans-1,3-Dichloropropene	ND	ug/L	1.0	1		01/30/17 16:33	10061-02-6	
Ethylbenzene	ND	ug/L	1.0	1		01/30/17 16:33	100-41-4	
2-Hexanone	ND	ug/L	5.0	1		01/30/17 16:33	591-78-6	
Iodomethane	ND	ug/L	5.0	1		01/30/17 16:33	74-88-4	
Methylene Chloride	ND	ug/L	1.0	1		01/30/17 16:33	75-09-2	
4-Methyl-2-pentanone (MIBK)	ND	ug/L	5.0	1		01/30/17 16:33	108-10-1	
Styrene	ND	ug/L	1.0	1		01/30/17 16:33	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0	1		01/30/17 16:33	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0	1		01/30/17 16:33	79-34-5	
Tetrachloroethene	ND	ug/L	1.0	1		01/30/17 16:33	127-18-4	
Toluene	ND	ug/L	1.0	1		01/30/17 16:33	108-88-3	
1,1,1-Trichloroethane	ND	ug/L	1.0	1		01/30/17 16:33	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	1.0	1		01/30/17 16:33	79-00-5	
Trichloroethene	ND	ug/L	1.0	1		01/30/17 16:33	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0	1		01/30/17 16:33	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0	1		01/30/17 16:33	96-18-4	
Vinyl acetate	ND	ug/L	2.0	1		01/30/17 16:33	108-05-4	
Vinyl chloride	ND	ug/L	1.0	1		01/30/17 16:33	75-01-4	
Xylene (Total)	ND	ug/L	1.0	1		01/30/17 16:33	1330-20-7	
Surrogates								
4-Bromofluorobenzene (S)	97	%	70-130	1		01/30/17 16:33	460-00-4	

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ANALYTICAL RESULTS

Project: Charrah-Brickhaven
Pace Project No.: 92327809

Sample: TRIP BLANK **Lab ID: 92327809008** Collected: 01/25/17 00:00 Received: 01/25/17 19:30 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
Surrogates								
1,2-Dichloroethane-d4 (S)	94	%	70-130	1		01/30/17 16:33	17060-07-0	
Toluene-d8 (S)	107	%	70-130	1		01/30/17 16:33	2037-26-5	

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QUALITY CONTROL DATA

Project: Charrah-Brickhaven
Pace Project No.: 92327809

QC Batch: 346503 Analysis Method: EPA 300.0
QC Batch Method: EPA 300.0 Analysis Description: 3000 IC Anions, GWD
Associated Lab Samples: 92327809002, 92327809003, 92327809004, 92327809006, 92327809007

METHOD BLANK: 1921930 Matrix: Water
Associated Lab Samples: 92327809002, 92327809003, 92327809004, 92327809006, 92327809007

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Chloride	mg/L	ND	1.0	02/01/17 12:05	
Fluoride	mg/L	ND	0.10	02/01/17 12:05	
Sulfate	mg/L	ND	1.0	02/01/17 12:05	

LABORATORY CONTROL SAMPLE: 1921931

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Chloride	mg/L	50	48.7	97	90-110	
Fluoride	mg/L	2.5	2.4	97	90-110	
Sulfate	mg/L	50	48.1	96	90-110	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1921932 1921933

Parameter	Units	92327809002 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Chloride	mg/L	519	50	50	571	567	103	95	90-110	1	20	
Fluoride	mg/L	0.22	2.5	2.5	1.8	1.7	62	61	90-110	3	20	M1
Sulfate	mg/L	10.1	50	50	56.4	59.9	93	100	90-110	6	20	

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QUALITY CONTROL DATA

Project: Charrah-Brickhaven
Pace Project No.: 92327809

QC Batch: 346715 Analysis Method: EPA 300.0
QC Batch Method: EPA 300.0 Analysis Description: 3000 IC Anions, GWD
Associated Lab Samples: 92327809001, 92327809005

METHOD BLANK: 1923257 Matrix: Water
Associated Lab Samples: 92327809001, 92327809005

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Chloride	mg/L	ND	1.0	02/02/17 14:40	
Fluoride	mg/L	ND	0.10	02/02/17 14:40	
Sulfate	mg/L	ND	1.0	02/02/17 14:40	

LABORATORY CONTROL SAMPLE: 1923258

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Chloride	mg/L	50	48.9	98	90-110	
Fluoride	mg/L	2.5	2.6	104	90-110	
Sulfate	mg/L	50	49.1	98	90-110	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1923259 1923260

Parameter	Units	92327809001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Chloride	mg/L	513	50	50	547	545	67	63	90-110	0	20	M6
Fluoride	mg/L	0.21	2.5	2.5	1.8	1.7	63	58	90-110	8	20	M1
Sulfate	mg/L	10.0	50	50	57.1	57.5	94	95	90-110	1	20	

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QUALITY CONTROL DATA

Project: Charrah-Brickhaven
Pace Project No.: 92327809

QC Batch: 345906 Analysis Method: EPA 7470
QC Batch Method: EPA 7470 Analysis Description: 7470 Mercury
Associated Lab Samples: 92327809001, 92327809002, 92327809003, 92327809004, 92327809005, 92327809006, 92327809007

METHOD BLANK: 1918939 Matrix: Water
Associated Lab Samples: 92327809001, 92327809002, 92327809003, 92327809004, 92327809005, 92327809006, 92327809007

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Mercury	ug/L	ND	0.20	01/31/17 16:39	

LABORATORY CONTROL SAMPLE: 1918940

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Mercury	ug/L	2.5	2.6	104	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1918941 1918942

Parameter	Units	92327809001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Mercury	ug/L	ND	2.5	2.5	1.8	1.8	74	73	75-125	2	25	M1

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QUALITY CONTROL DATA

Project: Charrah-Brickhaven
Pace Project No.: 92327809

QC Batch: 345883 Analysis Method: EPA 6010
QC Batch Method: EPA 3010A Analysis Description: 6010 MET
Associated Lab Samples: 92327809001, 92327809002, 92327809003, 92327809004, 92327809005, 92327809006, 92327809007

METHOD BLANK: 1918858 Matrix: Water
Associated Lab Samples: 92327809001, 92327809002, 92327809003, 92327809004, 92327809005, 92327809006, 92327809007

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Antimony	ug/L	ND	5.0	01/31/17 07:03	
Arsenic	ug/L	ND	10.0	01/31/17 07:03	
Barium	ug/L	ND	5.0	01/31/17 07:03	
Beryllium	ug/L	ND	1.0	01/31/17 07:03	
Cadmium	ug/L	ND	1.0	01/31/17 07:03	
Calcium	ug/L	ND	100	01/31/17 07:06	
Chromium	ug/L	ND	5.0	01/31/17 07:03	
Cobalt	ug/L	ND	5.0	01/31/17 07:03	
Copper	ug/L	ND	5.0	01/31/17 07:03	
Lead	ug/L	ND	5.0	01/31/17 07:03	
Molybdenum	ug/L	ND	5.0	01/31/17 07:03	
Nickel	ug/L	ND	5.0	01/31/17 07:03	
Selenium	ug/L	ND	10.0	01/31/17 07:03	
Silver	ug/L	ND	5.0	01/31/17 07:03	
Vanadium	ug/L	ND	5.0	01/31/17 07:03	
Zinc	ug/L	ND	10.0	01/31/17 07:06	

LABORATORY CONTROL SAMPLE: 1918859

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Antimony	ug/L	500	492	98	80-120	
Arsenic	ug/L	500	484	97	80-120	
Barium	ug/L	500	521	104	80-120	
Beryllium	ug/L	500	515	103	80-120	
Cadmium	ug/L	500	505	101	80-120	
Calcium	ug/L	5000	5540	111	80-120	
Chromium	ug/L	500	514	103	80-120	
Cobalt	ug/L	500	504	101	80-120	
Copper	ug/L	500	522	104	80-120	
Lead	ug/L	500	496	99	80-120	
Molybdenum	ug/L	500	509	102	80-120	
Nickel	ug/L	500	496	99	80-120	
Selenium	ug/L	500	512	102	80-120	
Silver	ug/L	250	252	101	80-120	
Vanadium	ug/L	500	499	100	80-120	
Zinc	ug/L	500	523	105	80-120	

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QUALITY CONTROL DATA

Project: Charrah-Brickhaven
Pace Project No.: 92327809

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1918860 1918861

Parameter	Units	92327827001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Antimony	ug/L	8.5	500	500	531	527	104	104	75-125	1	20	
Arsenic	ug/L	ND	500	500	524	519	104	103	75-125	1	20	
Barium	ug/L	19.0	500	500	528	528	102	102	75-125	0	20	
Beryllium	ug/L	ND	500	500	505	508	101	102	75-125	1	20	
Cadmium	ug/L	10.3	500	500	542	537	106	105	75-125	1	20	
Calcium	ug/L	67000	5000	5000	67500	63900	10	-62	75-125	5	20	M1
Chromium	ug/L	22.4	500	500	521	518	100	99	75-125	1	20	
Cobalt	ug/L	73.5	500	500	589	581	103	101	75-125	1	20	
Copper	ug/L	174000	500	500	194000	160000	4040	-2960	75-125	20	20	M1
Lead	ug/L	56.4	500	500	566	546	102	98	75-125	4	20	
Molybdenum	ug/L	82.0	500	500	627	604	109	104	75-125	4	20	
Nickel	ug/L	1430	500	500	1920	1880	99	90	75-125	2	20	
Selenium	ug/L	ND	500	500	542	541	108	108	75-125	0	20	
Silver	ug/L	ND	250	250	250	253	99	100	75-125	1	20	
Vanadium	ug/L	ND	500	500	494	500	99	100	75-125	1	20	
Zinc	ug/L	3200	500	500	3740	3470	109	54	75-125	8	20	M1

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QUALITY CONTROL DATA

Project: Charrah-Brickhaven
Pace Project No.: 92327809

QC Batch: 345897 Analysis Method: EPA 6020B
QC Batch Method: EPA 3010A Analysis Description: 6020 MET
Associated Lab Samples: 92327809001, 92327809002, 92327809003, 92327809004, 92327809005, 92327809006, 92327809007

METHOD BLANK: 1918893 Matrix: Water
Associated Lab Samples: 92327809001, 92327809002, 92327809003, 92327809004, 92327809005, 92327809006, 92327809007

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Boron	ug/L	ND	25.0	01/30/17 14:43	
Lithium	ug/L	ND	2.5	01/28/17 15:10	
Thallium	ug/L	ND	0.10	01/28/17 15:10	

LABORATORY CONTROL SAMPLE: 1918894

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Boron	ug/L	100	99.4	99	80-120	
Lithium	ug/L	100	103	103	80-120	
Thallium	ug/L	100	92.3	92	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1918895 1918896

Parameter	Units	92327809001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Boron	ug/L	ND	100	100	106	109	98	101	75-125	3	20	
Lithium	ug/L	28.3	100	100	126	130	97	102	75-125	3	20	
Thallium	ug/L	ND	100	100	90.0	93.0	90	93	75-125	3	20	

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QUALITY CONTROL DATA

Project: Charrah-Brickhaven
Pace Project No.: 92327809

QC Batch: 346119 Analysis Method: EPA 8260
QC Batch Method: EPA 8260 Analysis Description: 8260 MSV Low Level Landfill
Associated Lab Samples: 92327809001, 92327809002, 92327809003, 92327809004, 92327809005, 92327809006, 92327809007, 92327809008

METHOD BLANK: 1920111 Matrix: Water
Associated Lab Samples: 92327809001, 92327809002, 92327809003, 92327809004, 92327809005, 92327809006, 92327809007, 92327809008

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
1,1,1,2-Tetrachloroethane	ug/L	ND	1.0	01/30/17 13:05	
1,1,1-Trichloroethane	ug/L	ND	1.0	01/30/17 13:05	
1,1,2,2-Tetrachloroethane	ug/L	ND	1.0	01/30/17 13:05	
1,1,2-Trichloroethane	ug/L	ND	1.0	01/30/17 13:05	
1,1-Dichloroethane	ug/L	ND	1.0	01/30/17 13:05	
1,1-Dichloroethene	ug/L	ND	1.0	01/30/17 13:05	
1,2,3-Trichloropropane	ug/L	ND	1.0	01/30/17 13:05	
1,2-Dichlorobenzene	ug/L	ND	1.0	01/30/17 13:05	
1,2-Dichloroethane	ug/L	ND	1.0	01/30/17 13:05	
1,2-Dichloropropane	ug/L	ND	1.0	01/30/17 13:05	
1,4-Dichlorobenzene	ug/L	ND	1.0	01/30/17 13:05	
2-Butanone (MEK)	ug/L	ND	5.0	01/30/17 13:05	
2-Hexanone	ug/L	ND	5.0	01/30/17 13:05	
4-Methyl-2-pentanone (MIBK)	ug/L	ND	5.0	01/30/17 13:05	
Acetone	ug/L	ND	25.0	01/30/17 13:05	
Acrylonitrile	ug/L	ND	10.0	01/30/17 13:05	
Benzene	ug/L	ND	1.0	01/30/17 13:05	
Bromochloromethane	ug/L	ND	1.0	01/30/17 13:05	
Bromodichloromethane	ug/L	ND	1.0	01/30/17 13:05	
Bromoform	ug/L	ND	1.0	01/30/17 13:05	
Bromomethane	ug/L	ND	2.0	01/30/17 13:05	
Carbon disulfide	ug/L	ND	2.0	01/30/17 13:05	
Carbon tetrachloride	ug/L	ND	1.0	01/30/17 13:05	
Chlorobenzene	ug/L	ND	1.0	01/30/17 13:05	
Chloroethane	ug/L	ND	1.0	01/30/17 13:05	
Chloroform	ug/L	ND	1.0	01/30/17 13:05	
Chloromethane	ug/L	ND	1.0	01/30/17 13:05	
cis-1,2-Dichloroethene	ug/L	ND	1.0	01/30/17 13:05	
cis-1,3-Dichloropropene	ug/L	ND	1.0	01/30/17 13:05	
Dibromochloromethane	ug/L	ND	1.0	01/30/17 13:05	
Dibromomethane	ug/L	ND	1.0	01/30/17 13:05	
Ethylbenzene	ug/L	ND	1.0	01/30/17 13:05	
Iodomethane	ug/L	ND	5.0	01/30/17 13:05	
Methylene Chloride	ug/L	ND	1.0	01/30/17 13:05	
Styrene	ug/L	ND	1.0	01/30/17 13:05	
Tetrachloroethene	ug/L	ND	1.0	01/30/17 13:05	
Toluene	ug/L	ND	1.0	01/30/17 13:05	
trans-1,2-Dichloroethene	ug/L	ND	1.0	01/30/17 13:05	
trans-1,3-Dichloropropene	ug/L	ND	1.0	01/30/17 13:05	
trans-1,4-Dichloro-2-butene	ug/L	ND	1.0	01/30/17 13:05	

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QUALITY CONTROL DATA

Project: Charrah-Brickhaven
Pace Project No.: 92327809

METHOD BLANK: 1920111 Matrix: Water

Associated Lab Samples: 92327809001, 92327809002, 92327809003, 92327809004, 92327809005, 92327809006, 92327809007, 92327809008

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Trichloroethene	ug/L	ND	1.0	01/30/17 13:05	
Trichlorofluoromethane	ug/L	ND	1.0	01/30/17 13:05	
Vinyl acetate	ug/L	ND	2.0	01/30/17 13:05	
Vinyl chloride	ug/L	ND	1.0	01/30/17 13:05	
Xylene (Total)	ug/L	ND	1.0	01/30/17 13:05	
1,2-Dichloroethane-d4 (S)	%	92	70-130	01/30/17 13:05	
4-Bromofluorobenzene (S)	%	95	70-130	01/30/17 13:05	
Toluene-d8 (S)	%	104	70-130	01/30/17 13:05	

LABORATORY CONTROL SAMPLE: 1920112

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
1,1,1,2-Tetrachloroethane	ug/L	50	55.0	110	80-125	
1,1,1-Trichloroethane	ug/L	50	45.1	90	71-129	
1,1,2,2-Tetrachloroethane	ug/L	50	50.6	101	79-124	
1,1,2-Trichloroethane	ug/L	50	50.6	101	85-125	
1,1-Dichloroethane	ug/L	50	45.2	90	73-126	
1,1-Dichloroethene	ug/L	50	47.5	95	66-135	
1,2,3-Trichloropropane	ug/L	50	51.0	102	75-130	
1,2-Dichlorobenzene	ug/L	50	53.8	108	80-133	
1,2-Dichloroethane	ug/L	50	45.8	92	67-128	
1,2-Dichloropropane	ug/L	50	48.8	98	75-132	
1,4-Dichlorobenzene	ug/L	50	52.9	106	78-130	
2-Butanone (MEK)	ug/L	100	82.3	82	61-144	
2-Hexanone	ug/L	100	96.6	97	68-143	
4-Methyl-2-pentanone (MIBK)	ug/L	100	88.3	88	72-135	
Acetone	ug/L	100	77.6	78	48-146	
Acrylonitrile	ug/L	250	214	86	40-160	
Benzene	ug/L	50	50.4	101	80-125	
Bromochloromethane	ug/L	50	47.1	94	71-125	
Bromodichloromethane	ug/L	50	50.2	100	78-124	
Bromoform	ug/L	50	51.6	103	71-128	
Bromomethane	ug/L	50	44.8	90	40-160	
Carbon disulfide	ug/L	50	52.0	104	50-160	
Carbon tetrachloride	ug/L	50	46.1	92	69-131	
Chlorobenzene	ug/L	50	53.2	106	81-122	
Chloroethane	ug/L	50	48.4	97	39-148	
Chloroform	ug/L	50	45.7	91	73-127	
Chloromethane	ug/L	50	45.2	90	44-146	
cis-1,2-Dichloroethene	ug/L	50	46.7	93	74-124	
cis-1,3-Dichloropropene	ug/L	50	49.8	100	72-132	
Dibromochloromethane	ug/L	50	55.4	111	78-125	
Dibromomethane	ug/L	50	47.7	95	82-120	

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QUALITY CONTROL DATA

Project: Charrah-Brickhaven
Pace Project No.: 92327809

LABORATORY CONTROL SAMPLE: 1920112

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Ethylbenzene	ug/L	50	53.5	107	79-121	
Iodomethane	ug/L	100	88.1	88	39-154	
Methylene Chloride	ug/L	50	43.2	86	64-133	
Styrene	ug/L	50	54.9	110	84-126	
Tetrachloroethene	ug/L	50	50.4	101	78-122	
Toluene	ug/L	50	47.7	95	80-121	
trans-1,2-Dichloroethene	ug/L	50	47.3	95	71-127	
trans-1,3-Dichloropropene	ug/L	50	49.7	99	69-141	
trans-1,4-Dichloro-2-butene	ug/L	50	49.7	99	40-160	
Trichloroethene	ug/L	50	48.8	98	78-122	
Trichlorofluoromethane	ug/L	50	51.2	102	53-137	
Vinyl acetate	ug/L	100	88.2	88	40-160	
Vinyl chloride	ug/L	50	39.7	79	58-137	
Xylene (Total)	ug/L	150	161	107	81-126	
1,2-Dichloroethane-d4 (S)	%			101	70-130	
4-Bromofluorobenzene (S)	%			99	70-130	
Toluene-d8 (S)	%			94	70-130	

MATRIX SPIKE SAMPLE: 1920113

Parameter	Units	92327809001 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
1,1,1,2-Tetrachloroethane	ug/L	ND	20	20.6	103	70-130	
1,1,1-Trichloroethane	ug/L	ND	20	20.6	103	70-130	
1,1,2,2-Tetrachloroethane	ug/L	ND	20	20.6	103	70-130	
1,1,2-Trichloroethane	ug/L	ND	20	21.0	105	70-130	
1,1-Dichloroethane	ug/L	ND	20	20.7	103	70-130	
1,1-Dichloroethene	ug/L	ND	20	22.4	112	70-166	
1,2,3-Trichloropropane	ug/L	ND	20	20.9	104	70-130	
1,2-Dichlorobenzene	ug/L	ND	20	22.3	111	70-130	
1,2-Dichloroethane	ug/L	ND	20	19.5	98	70-130	
1,2-Dichloropropane	ug/L	ND	20	21.7	109	70-130	
1,4-Dichlorobenzene	ug/L	ND	20	22.4	112	70-130	
2-Butanone (MEK)	ug/L	ND	40	41.3	103	70-130	
2-Hexanone	ug/L	ND	40	40.0	100	70-130	
4-Methyl-2-pentanone (MIBK)	ug/L	ND	40	36.9	92	70-130	
Acetone	ug/L	ND	40	39.5	99	70-130	
Acrylonitrile	ug/L	ND	100	93.2	93	70-130	
Benzene	ug/L	ND	20	22.8	114	70-148	
Bromochloromethane	ug/L	ND	20	20.4	102	70-130	
Bromodichloromethane	ug/L	ND	20	20.6	103	70-130	
Bromoform	ug/L	ND	20	16.3	81	70-130	
Bromomethane	ug/L	ND	20	12.7	63	70-130	M1
Carbon disulfide	ug/L	ND	20	23.1	116	70-130	
Carbon tetrachloride	ug/L	ND	20	20.1	101	70-130	
Chlorobenzene	ug/L	ND	20	22.8	114	70-146	

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QUALITY CONTROL DATA

Project: Charrah-Brickhaven
Pace Project No.: 92327809

MATRIX SPIKE SAMPLE: 1920113

Parameter	Units	92327809001 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Chloroethane	ug/L	ND	20	22.8	114	70-130	
Chloroform	ug/L	ND	20	20.8	104	70-130	
Chloromethane	ug/L	ND	20	20.2	101	70-130	
cis-1,2-Dichloroethene	ug/L	ND	20	21.1	105	70-130	
cis-1,3-Dichloropropene	ug/L	ND	20	19.4	97	70-130	
Dibromochloromethane	ug/L	ND	20	20.1	101	70-130	
Dibromomethane	ug/L	ND	20	21.0	105	70-130	
Ethylbenzene	ug/L	ND	20	23.0	115	70-130	
Iodomethane	ug/L	ND	40	30.1	75	70-130	
Methylene Chloride	ug/L	ND	20	17.9	89	70-130	
Styrene	ug/L	ND	20	23.1	115	70-130	
Tetrachloroethene	ug/L	ND	20	21.4	107	70-130	
Toluene	ug/L	ND	20	21.5	107	70-155	
trans-1,2-Dichloroethene	ug/L	ND	20	21.6	108	70-130	
trans-1,3-Dichloropropene	ug/L	ND	20	19.1	95	70-130	
trans-1,4-Dichloro-2-butene	ug/L	ND	20	16.1	80	70-130	
Trichloroethene	ug/L	ND	20	21.8	109	69-151	
Trichlorofluoromethane	ug/L	ND	20	22.6	113	70-130	
Vinyl acetate	ug/L	ND	40	31.4	79	70-130	
Vinyl chloride	ug/L	ND	20	17.6	88	70-130	
1,2-Dichloroethane-d4 (S)	%				100	70-130	
4-Bromofluorobenzene (S)	%				97	70-130	
Toluene-d8 (S)	%				97	70-130	

SAMPLE DUPLICATE: 1920114

Parameter	Units	92327809002 Result	Dup Result	RPD	Max RPD	Qualifiers
1,1,1,2-Tetrachloroethane	ug/L	ND	ND		30	
1,1,1-Trichloroethane	ug/L	ND	ND		30	
1,1,2,2-Tetrachloroethane	ug/L	ND	ND		30	
1,1,2-Trichloroethane	ug/L	ND	ND		30	
1,1-Dichloroethane	ug/L	ND	ND		30	
1,1-Dichloroethene	ug/L	ND	ND		30	
1,2,3-Trichloropropane	ug/L	ND	ND		30	
1,2-Dichlorobenzene	ug/L	ND	ND		30	
1,2-Dichloroethane	ug/L	ND	ND		30	
1,2-Dichloropropane	ug/L	ND	ND		30	
1,4-Dichlorobenzene	ug/L	ND	ND		30	
2-Butanone (MEK)	ug/L	ND	ND		30	
2-Hexanone	ug/L	ND	ND		30	
4-Methyl-2-pentanone (MIBK)	ug/L	ND	ND		30	
Acetone	ug/L	ND	ND		30	
Acrylonitrile	ug/L	ND	ND		30	
Benzene	ug/L	ND	ND		30	
Bromochloromethane	ug/L	ND	ND		30	

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QUALITY CONTROL DATA

Project: Charrah-Brickhaven
Pace Project No.: 92327809

SAMPLE DUPLICATE: 1920114

Parameter	Units	92327809002 Result	Dup Result	RPD	Max RPD	Qualifiers
Bromodichloromethane	ug/L	ND	ND		30	
Bromoform	ug/L	ND	ND		30	
Bromomethane	ug/L	ND	ND		30	
Carbon disulfide	ug/L	ND	ND		30	
Carbon tetrachloride	ug/L	ND	ND		30	
Chlorobenzene	ug/L	ND	ND		30	
Chloroethane	ug/L	ND	ND		30	
Chloroform	ug/L	ND	ND		30	
Chloromethane	ug/L	ND	ND		30	
cis-1,2-Dichloroethene	ug/L	ND	ND		30	
cis-1,3-Dichloropropene	ug/L	ND	ND		30	
Dibromochloromethane	ug/L	ND	ND		30	
Dibromomethane	ug/L	ND	ND		30	
Ethylbenzene	ug/L	ND	ND		30	
Iodomethane	ug/L	ND	ND		30	
Methylene Chloride	ug/L	ND	ND		30	
Styrene	ug/L	ND	ND		30	
Tetrachloroethene	ug/L	ND	ND		30	
Toluene	ug/L	ND	ND		30	
trans-1,2-Dichloroethene	ug/L	ND	ND		30	
trans-1,3-Dichloropropene	ug/L	ND	ND		30	
trans-1,4-Dichloro-2-butene	ug/L	ND	ND		30	
Trichloroethene	ug/L	ND	ND		30	
Trichlorofluoromethane	ug/L	ND	ND		30	
Vinyl acetate	ug/L	ND	ND		30	
Vinyl chloride	ug/L	ND	ND		30	
Xylene (Total)	ug/L	ND	ND		30	
1,2-Dichloroethane-d4 (S)	%	93	97	5		
4-Bromofluorobenzene (S)	%	94	98	4		
Toluene-d8 (S)	%	106	106	0		

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QUALITY CONTROL DATA

Project: Charrah-Brickhaven
Pace Project No.: 92327809

QC Batch: 346216 Analysis Method: SM 2540C
QC Batch Method: SM 2540C Analysis Description: 2540C Total Dissolved Solids
Associated Lab Samples: 92327809001, 92327809002, 92327809003

METHOD BLANK: 1920721 Matrix: Water
Associated Lab Samples: 92327809001, 92327809002, 92327809003

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Total Dissolved Solids	mg/L	ND	25.0	01/31/17 00:00	

LABORATORY CONTROL SAMPLE: 1920722

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Total Dissolved Solids	mg/L	250	240	96	90-110	

SAMPLE DUPLICATE: 1920723

Parameter	Units	92327703007 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	32.0	ND		5	

SAMPLE DUPLICATE: 1920724

Parameter	Units	92327703017 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	ND	ND		5	

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QUALITY CONTROL DATA

Project: Charrah-Brickhaven
Pace Project No.: 92327809

QC Batch: 346259 Analysis Method: SM 2540C
QC Batch Method: SM 2540C Analysis Description: 2540C Total Dissolved Solids
Associated Lab Samples: 92327809004, 92327809005, 92327809006, 92327809007

METHOD BLANK: 1920852 Matrix: Water
Associated Lab Samples: 92327809004, 92327809005, 92327809006, 92327809007

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Total Dissolved Solids	mg/L	ND	25.0	01/31/17 12:06	

LABORATORY CONTROL SAMPLE: 1920853

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Total Dissolved Solids	mg/L	250	240	96	90-110	

SAMPLE DUPLICATE: 1920854

Parameter	Units	92327809004 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	148	146	1	5	

SAMPLE DUPLICATE: 1920855

Parameter	Units	92327801003 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	520	515	1	5	

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: Charrah-Brickhaven
Pace Project No.: 92327809

Sample: MW-4 **Lab ID: 92327809001** Collected: 01/25/17 09:45 Received: 01/25/17 19:30 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**0.224 ± 0.441 (0.791) C:NA T:102%**	pCi/L	02/20/17 12:53	13982-63-3	
Radium-228	EPA 904.0	**0.243 ± 0.447 (0.980) C:58% T:84%**	pCi/L	02/20/17 20:07	15262-20-1	

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: Charrah-Brickhaven
Pace Project No.: 92327809

Sample: MW-4 DUP **Lab ID: 92327809002** Collected: 01/25/17 09:45 Received: 01/25/17 19:30 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**0.137 ± 0.330 (0.637) C:NA T:88%**	pCi/L	02/20/17 12:53	13982-63-3	
Radium-228	EPA 904.0	**-0.231 ± 0.401 (0.998) C:52% T:91%**	pCi/L	02/20/17 20:07	15262-20-1	

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: Charrah-Brickhaven
Pace Project No.: 92327809

Sample: SW-1 **Lab ID: 92327809003** Collected: 01/25/17 12:05 Received: 01/25/17 19:30 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**0.316 ± 0.746 (1.38) C:NA T:56%**	pCi/L	02/20/17 12:53	13982-63-3	
Radium-228	EPA 904.0	**-0.216 ± 0.472 (1.15) C:53% T:84%**	pCi/L	02/20/17 20:07	15262-20-1	

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: Charrah-Brickhaven
Pace Project No.: 92327809

Sample: SW-2 **Lab ID: 92327809004** Collected: 01/25/17 13:15 Received: 01/25/17 19:30 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**0.147 ± 0.353 (0.681) C:NA T:79%**	pCi/L	02/20/17 13:06	13982-63-3	
Radium-228	EPA 904.0	**0.298 ± 0.529 (1.16) C:53% T:73%**	pCi/L	02/20/17 20:07	15262-20-1	

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: Charrah-Brickhaven
Pace Project No.: 92327809

Sample: MW-1 **Lab ID: 92327809005** Collected: 01/25/17 17:35 Received: 01/25/17 19:30 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**-0.188 ± 0.369 (0.883) C:NA T:97%**	pCi/L	02/20/17 13:06	13982-63-3	
Radium-228	EPA 904.0	**0.237 ± 0.494 (1.09) C:53% T:87%**	pCi/L	02/20/17 20:07	15262-20-1	

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: Charrah-Brickhaven
Pace Project No.: 92327809

Sample: AMB **Lab ID: 92327809006** Collected: 01/25/17 17:30 Received: 01/25/17 19:30 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**-0.125 ± 0.346 (0.818) C:NA T:88%**	pCi/L	02/20/17 13:24	13982-63-3	
Radium-228	EPA 904.0	**0.0595 ± 0.519 (1.20) C:50% T:84%**	pCi/L	02/20/17 20:07	15262-20-1	

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: Charrah-Brickhaven
Pace Project No.: 92327809

Sample: EQ BLANK **Lab ID: 92327809007** Collected: 01/25/17 19:05 Received: 01/25/17 19:30 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**0.000 ± 0.304 (0.619) C:NA T:85%**	pCi/L	02/20/17 13:24	13982-63-3	
Radium-228	EPA 904.0	**0.144 ± 0.506 (1.14) C:58% T:81%**	pCi/L	02/20/17 20:07	15262-20-1	

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QUALITY CONTROL - RADIOCHEMISTRY

Project: Charrah-Brickhaven
Pace Project No.: 92327809

QC Batch: 248873 Analysis Method: EPA 903.1
QC Batch Method: EPA 903.1 Analysis Description: 903.1 Radium-226
Associated Lab Samples: 92327809001, 92327809002, 92327809003, 92327809004, 92327809005, 92327809006, 92327809007

METHOD BLANK: 1223918 Matrix: Water
Associated Lab Samples: 92327809001, 92327809002, 92327809003, 92327809004, 92327809005, 92327809006, 92327809007

Parameter	Act ± Unc (MDC) Carr Trac	Units	Analyzed	Qualifiers
Radium-226	0.113 ± 0.351 (0.680) C:NA T:98%	pCi/L	02/20/17 12:24	

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QUALITY CONTROL - RADIOCHEMISTRY

Project: Charrah-Brickhaven
Pace Project No.: 92327809

QC Batch: 248874 Analysis Method: EPA 904.0
QC Batch Method: EPA 904.0 Analysis Description: 904.0 Radium 228
Associated Lab Samples: 92327809001, 92327809002, 92327809003, 92327809004, 92327809005, 92327809006, 92327809007

METHOD BLANK: 1223919 Matrix: Water
Associated Lab Samples: 92327809001, 92327809002, 92327809003, 92327809004, 92327809005, 92327809006, 92327809007

Parameter	Act ± Unc (MDC) Carr Trac	Units	Analyzed	Qualifiers
Radium-228	0.570 ± 0.500 (1.02) C:58% T:91%	pCi/L	02/20/17 20:10	

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QUALIFIERS

Project: Charrah-Brickhaven
Pace Project No.: 92327809

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above adjusted reporting limit.

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

Acid preservation may not be appropriate for 2 Chloroethylvinyl ether.

A separate vial preserved to a pH of 4-5 is recommended in SW846 Chapter 4 for the analysis of Acrolein and Acrylonitrile by EPA Method 8260.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Act - Activity

Unc - Uncertainty: SDWA = 1.96 sigma count uncertainty, all other matrices = Expanded Uncertainty (95% confidence interval). Gamma Spec = Expanded Uncertainty (95.4% Confidence Interval)

(MDC) - Minimum Detectable Concentration

Trac - Tracer Recovery (%)

Carr - Carrier Recovery (%)

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TNI - The NELAC Institute.

LABORATORIES

PASI-A	Pace Analytical Services - Asheville
PASI-C	Pace Analytical Services - Charlotte
PASI-PA	Pace Analytical Services - Greensburg
PASI-W	Pace Analytical Services - Greenwood

ANALYTE QUALIFIERS

C9	Common Laboratory Contaminant.
M1	Matrix spike recovery exceeded QC limits. Batch accepted based on laboratory control sample (LCS) recovery.
M6	Matrix spike and Matrix spike duplicate recovery not evaluated against control limits due to sample dilution.

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QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: Charrah-Brickhaven
Pace Project No.: 92327809

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
92327809001	**MW-4**	EPA 300.0	346715		
92327809002	**MW-4 DUP**	EPA 300.0	346503		
92327809003	**SW-1**	EPA 300.0	346503		
92327809004	**SW-2**	EPA 300.0	346503		
92327809005	**MW-1**	EPA 300.0	346715		
92327809006	**AMB**	EPA 300.0	346503		
92327809007	**EQ BLANK**	EPA 300.0	346503		
92327809001	**MW-4**	EPA 3010A	345883	EPA 6010	346209
92327809002	**MW-4 DUP**	EPA 3010A	345883	EPA 6010	346209
92327809003	**SW-1**	EPA 3010A	345883	EPA 6010	346209
92327809004	**SW-2**	EPA 3010A	345883	EPA 6010	346209
92327809005	**MW-1**	EPA 3010A	345883	EPA 6010	346209
92327809006	**AMB**	EPA 3010A	345883	EPA 6010	346209
92327809007	**EQ BLANK**	EPA 3010A	345883	EPA 6010	346209
92327809001	**MW-4**	EPA 3010A	345897	EPA 6020B	346053
92327809002	**MW-4 DUP**	EPA 3010A	345897	EPA 6020B	346053
92327809003	**SW-1**	EPA 3010A	345897	EPA 6020B	346053
92327809004	**SW-2**	EPA 3010A	345897	EPA 6020B	346053
92327809005	**MW-1**	EPA 3010A	345897	EPA 6020B	346053
92327809006	**AMB**	EPA 3010A	345897	EPA 6020B	346053
92327809007	**EQ BLANK**	EPA 3010A	345897	EPA 6020B	346053
92327809001	**MW-4**	EPA 7470	345906	EPA 7470	346058
92327809002	**MW-4 DUP**	EPA 7470	345906	EPA 7470	346058
92327809003	**SW-1**	EPA 7470	345906	EPA 7470	346058
92327809004	**SW-2**	EPA 7470	345906	EPA 7470	346058
92327809005	**MW-1**	EPA 7470	345906	EPA 7470	346058
92327809006	**AMB**	EPA 7470	345906	EPA 7470	346058
92327809007	**EQ BLANK**	EPA 7470	345906	EPA 7470	346058
92327809001	**MW-4**	EPA 8260	346119		
92327809002	**MW-4 DUP**	EPA 8260	346119		
92327809003	**SW-1**	EPA 8260	346119		
92327809004	**SW-2**	EPA 8260	346119		
92327809005	**MW-1**	EPA 8260	346119		
92327809006	**AMB**	EPA 8260	346119		
92327809007	**EQ BLANK**	EPA 8260	346119		
92327809008	**TRIP BLANK**	EPA 8260	346119		
92327809001	**MW-4**	EPA 903.1	248873		
92327809002	**MW-4 DUP**	EPA 903.1	248873		
92327809003	**SW-1**	EPA 903.1	248873		
92327809004	**SW-2**	EPA 903.1	248873		
92327809005	**MW-1**	EPA 903.1	248873		
92327809006	**AMB**	EPA 903.1	248873		
92327809007	**EQ BLANK**	EPA 903.1	248873		
92327809001	**MW-4**	EPA 904.0	248874		

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QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: Charrah-Brickhaven
Pace Project No.: 92327809

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
92327809002	**MW-4 DUP**	EPA 904.0	248874		
92327809003	**SW-1**	EPA 904.0	248874		
92327809004	**SW-2**	EPA 904.0	248874		
92327809005	**MW-1**	EPA 904.0	248874		
92327809006	**AMB**	EPA 904.0	248874		
92327809007	**EQ BLANK**	EPA 904.0	248874		
92327809001	**MW-4**	SM 2540C	346216		
92327809002	**MW-4 DUP**	SM 2540C	346216		
92327809003	**SW-1**	SM 2540C	346216		
92327809004	**SW-2**	SM 2540C	346259		
92327809005	**MW-1**	SM 2540C	346259		
92327809006	**AMB**	SM 2540C	346259		
92327809007	**EQ BLANK**	SM 2540C	346259		

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Pace Analytical®	Sample Condition Upon Receipt(SCUR)	Page 1 of 2
	Document No.: F-CAR-CS-033-Rev.01	Issuing Authority: Pace Quality Office

Laboratory receiving samples:

Asheville ☐ Eden ☐ Greenwood ☐ Huntersville ☒ Raleigh ☐ Mechanicsville ☐

Sample Condition Upon Receipt

WO# : 92327809

92327809

Client Name: HDR Engineering **Project #:**

Courier: ☐ Commercial ☒ Pace ☐ Fed Ex ☐ UPS ☒ USPS ☐ Other:____ ☐ Client

Custody Seal Present? ☐ Yes ☒ No **Seals Intact?** ☐ Yes ☒ No

Date/Initials Person Examining Contents: 1/20/17

Packing Material: ☐ Bubble Wrap ☐ Bubble Bags ☒ None ☐ Other:____

Thermometer: ☒ IR Gun ID: T1603 **Type of Ice:** ☒ Wet ☐ Blue ☐ None ☒ Samples on ice, cooling process has begun

Correction Factor: **Cooler Temp Corrected (°C):** 2.6 **Biological Tissue Frozen?** ☐ Yes ☒ No ☐ N/A

Temp should be above freezing to 6°C

USDA Regulated Soil (☒ N/A, water sample)

Did samples originate in a quarantine zone within the United States: CA, NY, or SC (check maps)? ☐ Yes ☒ No

Did samples originate from a foreign source (internationally, including Hawaii and Puerto Rico)? ☐ Yes ☒ No

				Comments/Discrepancy:
Chain of Custody Present?	☒ Yes	☐ No	☐ N/A	1.
Samples Arrived within Hold Time?	☒ Yes	☐ No	☐ N/A	2.
Short Hold Time Analysis (<72 hr.)?	☐ Yes	☒ No	☐ N/A	3.
Rush Turn Around Time Requested?	☐ Yes	☒ No	☐ N/A	4.
Sufficient Volume?	☒ Yes	☐ No	☐ N/A	5.
Correct Containers Used?	☒ Yes	☐ No	☐ N/A	6.
-Pace Containers Used?	☒ Yes	☐ No	☐ N/A	
Containers Intact?	☒ Yes	☐ No	☐ N/A	7.
Samples Field Filtered?	☐ Yes	☐ No	☒ N/A	8. Note if sediment is visible in the dissolved container
Sample Labels Match COC?	☒ Yes	☐ No	☐ N/A	9.
-Includes Date/Time/ID/Analysis Matrix: WT				
Headspace in VOA Vials (>5-6mm)?	☐ Yes	☒ No	☐ N/A	10.
Trip Blank Present?	☒ Yes	☐ No	☐ N/A	11.
Trip Blank Custody Seals Present?	☐ Yes	☐ No	☐ N/A	

CLIENT NOTIFICATION/RESOLUTION

Field Data Required? ☐ Yes ☐ No

Person Contacted: _____ Date/Time: _____

Comments/Sample Discrepancy: _____

Project Manager SCURF Review: JY **Date:** 1/20/17

Project Manager SRF Review: JY **Date:** 1/20/17

Note: Whenever there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office (i.e. out of hold, incorrect preservative, out of temp, incorrect containers)

*Check mark top half of box if pH and/or dechlorination is verified and within the acceptance range for preservation samples.

**Bottom half of box is to list number of bottles

Project # **WO# : 92327809**

PM: KRG Due Date: 02/02/17

CLIENT: 92-HDR

Item#	BP4U-125 mL Plastic Unpreserved (N/A) (Cl-)	BP3U-250 mL Plastic Unpreserved (N/A)	BP2U-500 mL Plastic Unpreserved (N/A)	BP1U-1 liter Plastic Unpreserved (N/A)	BP3S-250 mL Plastic H2SO4 (pH < 2) (Cl-)	BP3N-250 mL plastic HNO3 (pH < 2)	BP3Z-250 mL Plastic ZN Acetate & NaOH (>9)	BP3C-250 mL Plastic NaOH (pH > 12) (Cl-)	WGFU-Wide-mouthed Glass jar Unpreserved	AG1U-1 liter Amber Unpreserved (N/A) (Cl-)	AG1H-1 liter Amber HCl (pH < 2)	AG3U-250 mL Amber Unpreserved (N/A) (Cl-)	AG1S-1 liter Amber H2SO4 (pH < 2)	AG3S-250 mL Amber H2SO4 (pH < 2)	AG3A(DG3A)-250 mL Amber NH4Cl (N/A)(Cl-)	DG9H-40 mL VOA HCl (N/A)	VG9T-40 mL VOA Na2S2O3 (N/A)	VG9U-40 mL VOA Unp (N/A)	DG9P-40 mL VOA H3PO4 (N/A)	VOAK (6 vials per kit)-5035 kit (N/A)	V/GK (3 vials per kit)-VPH/Gas kit (N/A)	SP5T-125 mL Sterile Plastic (N/A – lab)	SP2T-250 mL Sterile Plastic (N/A – lab)	ADIN	BP3A-250 mL Plastic (NH2)2SO4 (9.3-9.7)	Cubitainer	VSGU-20 mL Scintillation vials (N/A)	GN
1		1	1			2										3								3				
2		1	1			2										3								3				
3		1	1			2										3								3				
4		1	1			2										3								3				
5		1	1			2										3								3				
6		1	1			2										3								3				
7		1	1			2										3								3				
8																2												
9																												
10																												
11																												
12																												

pH Adjustment Log for Preserved Samples

Sample ID	Type of Preservative	pH upon receipt	Date preservation adjusted	Time preservation adjusted	Amount of Preservative added	Lot #

Pace Analytical

CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

Page : 1 Of 1

Section A Required Client Information:		Section B Required Project Information:		Section C Invoice Information:	
Company:	HDR Engineering	Report To:	Sean Quarry	Attention:	
Address:	440 South Church Street	Copy To:		Company Name:	
Charlotte, NC 28202				Address:	Regulatory Agency
Email:	sean.quarry@hdrinc.com	Purchase Order #:		Pace Quote:	
Phone:	(704)248-3632 Fax	Project Name:	Charrah-Brickhaven	Pace Project Manager:	kevin.godwin@pacelabs.com, State / Location
Requested Due Date:		Project #:		Pace Profile #:	7672-1 NC

ITEM #	SAMPLE ID (One Character per box. (A-Z, 0-9 / , -) Sample Ids must be unique)	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED START DATE	COLLECTED START TIME	COLLECTED END DATE	COLLECTED END TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Preservatives: Unpreserved	H2SO4	HNO3	HCl	NaOH	Na2S2O3	Methanol	Other	Analyses Test Y/N	Trip BLANK	8260	300.0-Cl,F,Sulfate	TDS	Radium 226/228	6010/7470	6020 (B, Li)	Residual Chlorine (Y/N)	92327809
1	MW-4	GW	G	1-25-17		1-25-17	0945		10											3	1	1	3	1	1		001
2	MW-4 DUP	GW	G	1-25-17		1-25-17	0945		10											3	1	1	3	1	1		002
3	SW-1	GW	G	1-25-17		1-25-17	1205		12										2	3	1	1	3	1	1		003
4	SW-2	GW	G	1-25-17		1-25-17	1315		10											3	1	1	3	1	1		004
5	MW-1	GW	G	1-25-17		1-25-17	1735		10											3	1	1	3	1	1		005
6	AMB	WT	G	1-25-17		1-25-17	1730		10											3	1	1	3	1	1		006
7	EQ Blank	WT	G	1-25-17		1-25-17	1905		10											3	1	1	3	1	1		007
8																											008
9																											
10																											
11																											
12																											

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	SAMPLE CONDITIONS
	William Thomas / Pace	1-25-17	1930	Odell Pace	1/25/17	1930	
				Pace	1/26/17	0840	
		1/26/17	1350	Pace HC	1/27/17	1350	2.0 Y N Y

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER: William Thomas

SIGNATURE of SAMPLER: William Thomas DATE Signed: 1/25/17

TEMP in C | Received on Ice (Y/N) | Custody Sealed Cooler (Y/N) | Samples Intact (Y/N)

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

February 23, 2017

Sean Quarry
HDR Engineering
440 South Church Street
Suite 1000
Charlotte, NC 28202

RE: Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327973

Dear Sean Quarry:
Enclosed are the analytical results for sample(s) received by the laboratory on January 26, 2017. The results relate only to the samples included in this report. Results reported herein conform to the most current, applicable TNI/NELAC standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Kevin Godwin
kevin.godwin@pacelabs.com
Project Manager

Enclosures

cc: Mike Plummer, HDR

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CERTIFICATIONS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327973

Pennsylvania Certification IDs

1638 Roseytown Rd Suites 2,3&4, Greensburg, PA 15601
L-A-B DOD-ELAP Accreditation #: L2417
Alabama Certification #: 41590
Arizona Certification #: AZ0734
Arkansas Certification
California Certification #: 04222CA
Colorado Certification
Connecticut Certification #: PH-0694
Delaware Certification
Florida/TNI Certification #: E87683
Georgia Certification #: C040
Guam Certification
Hawaii Certification
Idaho Certification
Illinois Certification
Indiana Certification
Iowa Certification #: 391
Kansas/TNI Certification #: E-10358
Kentucky Certification #: 90133
Louisiana DHH/TNI Certification #: LA140008
Louisiana DEQ/TNI Certification #: 4086
Maine Certification #: PA00091
Maryland Certification #: 308
Massachusetts Certification #: M-PA1457
Michigan/PADEP Certification
Missouri Certification #: 235
Montana Certification #: Cert 0082
Nebraska Certification #: NE-05-29-14
Nevada Certification #: PA014572015-1
New Hampshire/TNI Certification #: 2976
New Jersey/TNI Certification #: PA 051
New Mexico Certification #: PA01457
New York/TNI Certification #: 10888
North Carolina Certification #: 42706
North Dakota Certification #: R-190
Oregon/TNI Certification #: PA200002
Pennsylvania/TNI Certification #: 65-00282
Puerto Rico Certification #: PA01457
Rhode Island Certification #: 65-00282
South Dakota Certification
Tennessee Certification #: TN2867
Texas/TNI Certification #: T104704188-14-8
Utah/TNI Certification #: PA014572015-5
USDA Soil Permit #: P330-14-00213
Vermont Dept. of Health: ID# VT-0282
Virgin Island/PADEP Certification
Virginia/VELAP Certification #: 460198
Washington Certification #: C868
West Virginia DEP Certification #: 143
West Virginia DHHR Certification #: 9964C
Wisconsin Certification
Wyoming Certification #: 8TMS-L

Charlotte Certification IDs

9800 Kincey Ave. Ste 100, Huntersville, NC 28078
North Carolina Drinking Water Certification #: 37706
North Carolina Field Services Certification #: 5342
North Carolina Wastewater Certification #: 12
South Carolina Certification #: 99006001
Florida/NELAP Certification #: E87627
Kentucky UST Certification #: 84
Virginia/VELAP Certification #: 460221

Asheville Certification IDs

2225 Riverside Drive, Asheville, NC 28804
Florida/NELAP Certification #: E87648
Massachusetts Certification #: M-NC030
North Carolina Drinking Water Certification #: 37712
North Carolina Wastewater Certification #: 40
South Carolina Certification #: 99030001
Virginia/VELAP Certification #: 460222

Greenwood Certification IDs

816 Durst Avenue East, Greenwood, SC 29649
South Carolina Laboratory ID #: 24562
North Carolina Divison of Water Resources Certification number 25
Florida Certification number E87633
Virginia VELAP ID: 460250
Asbestos NVLAP accreditation: 101410-0

REPORT OF LABORATORY ANALYSIS

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9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

SAMPLE SUMMARY

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327973

Lab ID	Sample ID	Matrix	Date Collected	Date Received
92327973001	**MW-2**	Water	01/26/17 16:00	01/26/17 17:50
92327973002	**AMB**	Water	01/26/17 16:15	01/26/17 17:50
92327973003	**EQ BLANK**	Water	01/26/17 16:30	01/26/17 17:50
92327973004	**TRIP BLANK**	Water	01/26/17 00:00	01/26/17 17:50

REPORT OF LABORATORY ANALYSIS

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SAMPLE ANALYTE COUNT

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327973

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
92327973001	**MW-2**	EPA 300.0	CDC	3	PASI-W
		EPA 6010	SER, SH1	16	PASI-A
		EPA 6020B	CDF	3	PASI-A
		EPA 7470	WAB	1	PASI-A
		EPA 8260	ZDO	48	PASI-C
		EPA 903.1	KAC	1	PASI-PA
		EPA 904.0	JJY	1	PASI-PA
		SM 2540C	MJS1	1	PASI-A
92327973002	**AMB**	EPA 300.0	CDC	3	PASI-W
		EPA 6010	SER	16	PASI-A
		EPA 6020B	CDF	3	PASI-A
		EPA 7470	WAB	1	PASI-A
		EPA 8260	ZDO	48	PASI-C
		EPA 903.1	KAC	1	PASI-PA
		EPA 904.0	JJY	1	PASI-PA
		SM 2540C	MJS1	1	PASI-A
92327973003	**EQ BLANK**	EPA 300.0	CDC	3	PASI-W
		EPA 6010	SER	16	PASI-A
		EPA 6020B	CDF	3	PASI-A
		EPA 7470	WAB	1	PASI-A
		EPA 8260	ZDO	48	PASI-C
		EPA 903.1	KAC	1	PASI-PA
		EPA 904.0	JJY	1	PASI-PA
		SM 2540C	MJS1	1	PASI-A
92327973004	**TRIP BLANK**	EPA 8260	ZDO	48	PASI-C

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SUMMARY OF DETECTION

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327973

Lab Sample ID / Method	Client Sample ID / Parameters	Result	Units	Report Limit	Analyzed	Qualifiers
92327973001	**MW-2**					
EPA 300.0	Chloride	1320	mg/L	25.0	02/02/17 03:32	
EPA 300.0	Sulfate	338	mg/L	25.0	02/02/17 03:32	
EPA 6010	Antimony	5.6	ug/L	5.0	02/01/17 18:55	
EPA 6010	Barium	203	ug/L	5.0	02/01/17 18:55	
EPA 6010	Calcium	214000	ug/L	1000	02/02/17 11:41	
EPA 6010	Chromium	29.5	ug/L	5.0	02/01/17 18:55	
EPA 6010	Molybdenum	13.1	ug/L	5.0	02/01/17 18:55	
EPA 6010	Nickel	15.2	ug/L	5.0	02/01/17 18:55	
EPA 6010	Zinc	15.8	ug/L	10.0	02/01/17 18:55	
EPA 6020B	Boron	52.1	ug/L	25.0	02/01/17 12:59	
EPA 6020B	Lithium	195	ug/L	2.5	01/31/17 14:34	
EPA 903.1	Radium-226	1.02 ± 0.591 (0.630) C:NA T:92%	pCi/L		02/22/17 22:07	
EPA 904.0	Radium-228	0.979 ± 0.667 (1.32) C:66% T:81%	pCi/L		02/22/17 17:16	
SM 2540C	Total Dissolved Solids	2780	mg/L	50.0	01/31/17 22:10	D6
92327973002	**AMB**					
EPA 903.1	Radium-226	0.000 ± 0.294 (0.598) C:NA T:93%	pCi/L		02/22/17 22:07	
EPA 904.0	Radium-228	0.231 ± 0.448 (0.985) C:66% T:87%	pCi/L		02/22/17 17:16	
SM 2540C	Total Dissolved Solids	46.0	mg/L	25.0	01/31/17 22:10	
92327973003	**EQ BLANK**					
EPA 903.1	Radium-226	0.0641 ± 0.377 (0.769) C:NA T:95%	pCi/L		02/22/17 22:17	
EPA 904.0	Radium-228	0.0212 ± 0.556 (1.27) C:61% T:82%	pCi/L		02/22/17 17:16	

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327973

Sample: MW-2 **Lab ID: 92327973001** Collected: 01/26/17 16:00 Received: 01/26/17 17:50 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
3000 IC Anions 28 Days, GWD	Analytical Method: EPA 300.0							
Chloride	**1320**	mg/L	25.0	25		02/02/17 03:32	16887-00-6	
Fluoride	ND	mg/L	0.10	1		02/01/17 14:54	16984-48-8	
Sulfate	**338**	mg/L	25.0	25		02/02/17 03:32	14808-79-8	
6010 MET ICP	Analytical Method: EPA 6010 Preparation Method: EPA 3010A							
Antimony	**5.6**	ug/L	5.0	1	01/31/17 00:20	02/01/17 18:55	7440-36-0	
Arsenic	ND	ug/L	10.0	1	01/31/17 00:20	02/01/17 18:55	7440-38-2	
Barium	**203**	ug/L	5.0	1	01/31/17 00:20	02/01/17 18:55	7440-39-3	
Beryllium	ND	ug/L	1.0	1	01/31/17 00:20	02/01/17 18:55	7440-41-7	
Cadmium	ND	ug/L	1.0	1	01/31/17 00:20	02/01/17 18:55	7440-43-9	
Calcium	**214000**	ug/L	1000	10	01/31/17 00:20	02/02/17 11:41	7440-70-2	
Chromium	**29.5**	ug/L	5.0	1	01/31/17 00:20	02/01/17 18:55	7440-47-3	
Cobalt	ND	ug/L	5.0	1	01/31/17 00:20	02/01/17 18:55	7440-48-4	
Copper	ND	ug/L	5.0	1	01/31/17 00:20	02/01/17 18:55	7440-50-8	
Lead	ND	ug/L	5.0	1	01/31/17 00:20	02/01/17 18:55	7439-92-1	
Molybdenum	**13.1**	ug/L	5.0	1	01/31/17 00:20	02/01/17 18:55	7439-98-7	
Nickel	**15.2**	ug/L	5.0	1	01/31/17 00:20	02/01/17 18:55	7440-02-0	
Selenium	ND	ug/L	10.0	1	01/31/17 00:20	02/01/17 18:55	7782-49-2	
Silver	ND	ug/L	5.0	1	01/31/17 00:20	02/01/17 18:55	7440-22-4	
Vanadium	ND	ug/L	5.0	1	01/31/17 00:20	02/01/17 18:55	7440-62-2	
Zinc	**15.8**	ug/L	10.0	1	01/31/17 00:20	02/01/17 18:55	7440-66-6	
6020 MET ICPMS	Analytical Method: EPA 6020B Preparation Method: EPA 3010A							
Boron	**52.1**	ug/L	25.0	1	01/30/17 18:40	02/01/17 12:59	7440-42-8	
Lithium	**195**	ug/L	2.5	1	01/30/17 18:40	01/31/17 14:34	7439-93-2	
Thallium	ND	ug/L	0.10	1	01/30/17 18:40	01/31/17 14:34	7440-28-0	
7470 Mercury	Analytical Method: EPA 7470 Preparation Method: EPA 7470							
Mercury	ND	ug/L	0.20	1	02/01/17 12:30	02/01/17 15:18	7439-97-6	
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
Acetone	ND	ug/L	25.0	1		01/30/17 16:51	67-64-1	
Acrylonitrile	ND	ug/L	10.0	1		01/30/17 16:51	107-13-1	
Benzene	ND	ug/L	1.0	1		01/30/17 16:51	71-43-2	
Bromochloromethane	ND	ug/L	1.0	1		01/30/17 16:51	74-97-5	
Bromodichloromethane	ND	ug/L	1.0	1		01/30/17 16:51	75-27-4	
Bromoform	ND	ug/L	1.0	1		01/30/17 16:51	75-25-2	
Bromomethane	ND	ug/L	2.0	1		01/30/17 16:51	74-83-9	
2-Butanone (MEK)	ND	ug/L	5.0	1		01/30/17 16:51	78-93-3	
Carbon disulfide	ND	ug/L	2.0	1		01/30/17 16:51	75-15-0	
Carbon tetrachloride	ND	ug/L	1.0	1		01/30/17 16:51	56-23-5	
Chlorobenzene	ND	ug/L	1.0	1		01/30/17 16:51	108-90-7	
Chloroethane	ND	ug/L	1.0	1		01/30/17 16:51	75-00-3	
Chloroform	ND	ug/L	1.0	1		01/30/17 16:51	67-66-3	
Chloromethane	ND	ug/L	1.0	1		01/30/17 16:51	74-87-3	
Dibromochloromethane	ND	ug/L	1.0	1		01/30/17 16:51	124-48-1	

REPORT OF LABORATORY ANALYSIS

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Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

ANALYTICAL RESULTS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327973

Sample: MW-2 **Lab ID: 92327973001** Collected: 01/26/17 16:00 Received: 01/26/17 17:50 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
Dibromomethane	ND	ug/L	1.0	1		01/30/17 16:51	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	1.0	1		01/30/17 16:51	95-50-1	
1,4-Dichlorobenzene	ND	ug/L	1.0	1		01/30/17 16:51	106-46-7	
trans-1,4-Dichloro-2-butene	ND	ug/L	1.0	1		01/30/17 16:51	110-57-6	
1,1-Dichloroethane	ND	ug/L	1.0	1		01/30/17 16:51	75-34-3	
1,2-Dichloroethane	ND	ug/L	1.0	1		01/30/17 16:51	107-06-2	
1,1-Dichloroethene	ND	ug/L	1.0	1		01/30/17 16:51	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	1.0	1		01/30/17 16:51	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	1.0	1		01/30/17 16:51	156-60-5	
1,2-Dichloropropane	ND	ug/L	1.0	1		01/30/17 16:51	78-87-5	
cis-1,3-Dichloropropene	ND	ug/L	1.0	1		01/30/17 16:51	10061-01-5	
trans-1,3-Dichloropropene	ND	ug/L	1.0	1		01/30/17 16:51	10061-02-6	
Ethylbenzene	ND	ug/L	1.0	1		01/30/17 16:51	100-41-4	
2-Hexanone	ND	ug/L	5.0	1		01/30/17 16:51	591-78-6	
Iodomethane	ND	ug/L	5.0	1		01/30/17 16:51	74-88-4	
Methylene Chloride	ND	ug/L	1.0	1		01/30/17 16:51	75-09-2	
4-Methyl-2-pentanone (MIBK)	ND	ug/L	5.0	1		01/30/17 16:51	108-10-1	
Styrene	ND	ug/L	1.0	1		01/30/17 16:51	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0	1		01/30/17 16:51	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0	1		01/30/17 16:51	79-34-5	
Tetrachloroethene	ND	ug/L	1.0	1		01/30/17 16:51	127-18-4	
Toluene	ND	ug/L	1.0	1		01/30/17 16:51	108-88-3	
1,1,1-Trichloroethane	ND	ug/L	1.0	1		01/30/17 16:51	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	1.0	1		01/30/17 16:51	79-00-5	
Trichloroethene	ND	ug/L	1.0	1		01/30/17 16:51	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0	1		01/30/17 16:51	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0	1		01/30/17 16:51	96-18-4	
Vinyl acetate	ND	ug/L	2.0	1		01/30/17 16:51	108-05-4	
Vinyl chloride	ND	ug/L	1.0	1		01/30/17 16:51	75-01-4	
Xylene (Total)	ND	ug/L	1.0	1		01/30/17 16:51	1330-20-7	
Surrogates								
4-Bromofluorobenzene (S)	95	%	70-130	1		01/30/17 16:51	460-00-4	
1,2-Dichloroethane-d4 (S)	98	%	70-130	1		01/30/17 16:51	17060-07-0	
Toluene-d8 (S)	105	%	70-130	1		01/30/17 16:51	2037-26-5	
2540C Total Dissolved Solids	Analytical Method: SM 2540C							
Total Dissolved Solids	**2780**	mg/L	50.0	1		01/31/17 22:10		D6

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Huntersville, NC 28078
(704)875-9092

ANALYTICAL RESULTS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327973

Sample: AMB **Lab ID: 92327973002** Collected: 01/26/17 16:15 Received: 01/26/17 17:50 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
3000 IC Anions 28 Days, GWD	Analytical Method: EPA 300.0							
Chloride	ND	mg/L	1.0	1		02/01/17 15:11	16887-00-6	
Fluoride	ND	mg/L	0.10	1		02/01/17 15:11	16984-48-8	
Sulfate	ND	mg/L	1.0	1		02/01/17 15:11	14808-79-8	
6010 MET ICP	Analytical Method: EPA 6010 Preparation Method: EPA 3010A							
Antimony	ND	ug/L	5.0	1	01/31/17 00:20	02/01/17 18:58	7440-36-0	
Arsenic	ND	ug/L	10.0	1	01/31/17 00:20	02/01/17 18:58	7440-38-2	
Barium	ND	ug/L	5.0	1	01/31/17 00:20	02/01/17 18:58	7440-39-3	
Beryllium	ND	ug/L	1.0	1	01/31/17 00:20	02/01/17 18:58	7440-41-7	
Cadmium	ND	ug/L	1.0	1	01/31/17 00:20	02/01/17 18:58	7440-43-9	
Calcium	ND	ug/L	100	1	01/31/17 00:20	02/01/17 18:58	7440-70-2	
Chromium	ND	ug/L	5.0	1	01/31/17 00:20	02/01/17 18:58	7440-47-3	
Cobalt	ND	ug/L	5.0	1	01/31/17 00:20	02/01/17 18:58	7440-48-4	
Copper	ND	ug/L	5.0	1	01/31/17 00:20	02/01/17 18:58	7440-50-8	
Lead	ND	ug/L	5.0	1	01/31/17 00:20	02/01/17 18:58	7439-92-1	
Molybdenum	ND	ug/L	5.0	1	01/31/17 00:20	02/01/17 18:58	7439-98-7	
Nickel	ND	ug/L	5.0	1	01/31/17 00:20	02/01/17 18:58	7440-02-0	
Selenium	ND	ug/L	10.0	1	01/31/17 00:20	02/01/17 18:58	7782-49-2	
Silver	ND	ug/L	5.0	1	01/31/17 00:20	02/01/17 18:58	7440-22-4	
Vanadium	ND	ug/L	5.0	1	01/31/17 00:20	02/01/17 18:58	7440-62-2	
Zinc	ND	ug/L	10.0	1	01/31/17 00:20	02/01/17 18:58	7440-66-6	
6020 MET ICPMS	Analytical Method: EPA 6020B Preparation Method: EPA 3010A							
Boron	ND	ug/L	25.0	1	01/30/17 18:40	01/31/17 14:42	7440-42-8	
Lithium	ND	ug/L	2.5	1	01/30/17 18:40	01/31/17 14:42	7439-93-2	
Thallium	ND	ug/L	0.10	1	01/30/17 18:40	01/31/17 14:42	7440-28-0	
7470 Mercury	Analytical Method: EPA 7470 Preparation Method: EPA 7470							
Mercury	ND	ug/L	0.20	1	02/01/17 12:30	02/01/17 15:25	7439-97-6	
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
Acetone	ND	ug/L	25.0	1		01/30/17 17:08	67-64-1	
Acrylonitrile	ND	ug/L	10.0	1		01/30/17 17:08	107-13-1	
Benzene	ND	ug/L	1.0	1		01/30/17 17:08	71-43-2	
Bromochloromethane	ND	ug/L	1.0	1		01/30/17 17:08	74-97-5	
Bromodichloromethane	ND	ug/L	1.0	1		01/30/17 17:08	75-27-4	
Bromoform	ND	ug/L	1.0	1		01/30/17 17:08	75-25-2	
Bromomethane	ND	ug/L	2.0	1		01/30/17 17:08	74-83-9	
2-Butanone (MEK)	ND	ug/L	5.0	1		01/30/17 17:08	78-93-3	
Carbon disulfide	ND	ug/L	2.0	1		01/30/17 17:08	75-15-0	
Carbon tetrachloride	ND	ug/L	1.0	1		01/30/17 17:08	56-23-5	
Chlorobenzene	ND	ug/L	1.0	1		01/30/17 17:08	108-90-7	
Chloroethane	ND	ug/L	1.0	1		01/30/17 17:08	75-00-3	
Chloroform	ND	ug/L	1.0	1		01/30/17 17:08	67-66-3	
Chloromethane	ND	ug/L	1.0	1		01/30/17 17:08	74-87-3	
Dibromochloromethane	ND	ug/L	1.0	1		01/30/17 17:08	124-48-1	

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ANALYTICAL RESULTS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327973

Sample: AMB **Lab ID: 92327973002** Collected: 01/26/17 16:15 Received: 01/26/17 17:50 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
Dibromomethane	ND	ug/L	1.0	1		01/30/17 17:08	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	1.0	1		01/30/17 17:08	95-50-1	
1,4-Dichlorobenzene	ND	ug/L	1.0	1		01/30/17 17:08	106-46-7	
trans-1,4-Dichloro-2-butene	ND	ug/L	1.0	1		01/30/17 17:08	110-57-6	
1,1-Dichloroethane	ND	ug/L	1.0	1		01/30/17 17:08	75-34-3	
1,2-Dichloroethane	ND	ug/L	1.0	1		01/30/17 17:08	107-06-2	
1,1-Dichloroethene	ND	ug/L	1.0	1		01/30/17 17:08	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	1.0	1		01/30/17 17:08	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	1.0	1		01/30/17 17:08	156-60-5	
1,2-Dichloropropane	ND	ug/L	1.0	1		01/30/17 17:08	78-87-5	
cis-1,3-Dichloropropene	ND	ug/L	1.0	1		01/30/17 17:08	10061-01-5	
trans-1,3-Dichloropropene	ND	ug/L	1.0	1		01/30/17 17:08	10061-02-6	
Ethylbenzene	ND	ug/L	1.0	1		01/30/17 17:08	100-41-4	
2-Hexanone	ND	ug/L	5.0	1		01/30/17 17:08	591-78-6	
Iodomethane	ND	ug/L	5.0	1		01/30/17 17:08	74-88-4	
Methylene Chloride	ND	ug/L	1.0	1		01/30/17 17:08	75-09-2	
4-Methyl-2-pentanone (MIBK)	ND	ug/L	5.0	1		01/30/17 17:08	108-10-1	
Styrene	ND	ug/L	1.0	1		01/30/17 17:08	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0	1		01/30/17 17:08	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0	1		01/30/17 17:08	79-34-5	
Tetrachloroethene	ND	ug/L	1.0	1		01/30/17 17:08	127-18-4	
Toluene	ND	ug/L	1.0	1		01/30/17 17:08	108-88-3	
1,1,1-Trichloroethane	ND	ug/L	1.0	1		01/30/17 17:08	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	1.0	1		01/30/17 17:08	79-00-5	
Trichloroethene	ND	ug/L	1.0	1		01/30/17 17:08	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0	1		01/30/17 17:08	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0	1		01/30/17 17:08	96-18-4	
Vinyl acetate	ND	ug/L	2.0	1		01/30/17 17:08	108-05-4	
Vinyl chloride	ND	ug/L	1.0	1		01/30/17 17:08	75-01-4	
Xylene (Total)	ND	ug/L	1.0	1		01/30/17 17:08	1330-20-7	
Surrogates								
4-Bromofluorobenzene (S)	97	%	70-130	1		01/30/17 17:08	460-00-4	
1,2-Dichloroethane-d4 (S)	96	%	70-130	1		01/30/17 17:08	17060-07-0	
Toluene-d8 (S)	104	%	70-130	1		01/30/17 17:08	2037-26-5	
2540C Total Dissolved Solids	Analytical Method: SM 2540C							
Total Dissolved Solids	**46.0**	mg/L	25.0	1		01/31/17 22:10		

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(704)875-9092

ANALYTICAL RESULTS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327973

Sample: EQ BLANK **Lab ID: 92327973003** Collected: 01/26/17 16:30 Received: 01/26/17 17:50 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
3000 IC Anions 28 Days, GWD	Analytical Method: EPA 300.0							
Chloride	ND	mg/L	1.0	1		02/01/17 15:28	16887-00-6	
Fluoride	ND	mg/L	0.10	1		02/01/17 15:28	16984-48-8	
Sulfate	ND	mg/L	1.0	1		02/01/17 15:28	14808-79-8	
6010 MET ICP	Analytical Method: EPA 6010 Preparation Method: EPA 3010A							
Antimony	ND	ug/L	5.0	1	01/31/17 00:20	02/01/17 19:02	7440-36-0	
Arsenic	ND	ug/L	10.0	1	01/31/17 00:20	02/01/17 19:02	7440-38-2	
Barium	ND	ug/L	5.0	1	01/31/17 00:20	02/01/17 19:02	7440-39-3	
Beryllium	ND	ug/L	1.0	1	01/31/17 00:20	02/01/17 19:02	7440-41-7	
Cadmium	ND	ug/L	1.0	1	01/31/17 00:20	02/01/17 19:02	7440-43-9	
Calcium	ND	ug/L	100	1	01/31/17 00:20	02/01/17 19:02	7440-70-2	
Chromium	ND	ug/L	5.0	1	01/31/17 00:20	02/01/17 19:02	7440-47-3	
Cobalt	ND	ug/L	5.0	1	01/31/17 00:20	02/01/17 19:02	7440-48-4	
Copper	ND	ug/L	5.0	1	01/31/17 00:20	02/01/17 19:02	7440-50-8	
Lead	ND	ug/L	5.0	1	01/31/17 00:20	02/01/17 19:02	7439-92-1	
Molybdenum	ND	ug/L	5.0	1	01/31/17 00:20	02/01/17 19:02	7439-98-7	
Nickel	ND	ug/L	5.0	1	01/31/17 00:20	02/01/17 19:02	7440-02-0	
Selenium	ND	ug/L	10.0	1	01/31/17 00:20	02/01/17 19:02	7782-49-2	
Silver	ND	ug/L	5.0	1	01/31/17 00:20	02/01/17 19:02	7440-22-4	
Vanadium	ND	ug/L	5.0	1	01/31/17 00:20	02/01/17 19:02	7440-62-2	
Zinc	ND	ug/L	10.0	1	01/31/17 00:20	02/01/17 19:02	7440-66-6	
6020 MET ICPMS	Analytical Method: EPA 6020B Preparation Method: EPA 3010A							
Boron	ND	ug/L	25.0	1	01/30/17 18:40	01/31/17 14:43	7440-42-8	
Lithium	ND	ug/L	2.5	1	01/30/17 18:40	01/31/17 14:43	7439-93-2	
Thallium	ND	ug/L	0.10	1	01/30/17 18:40	01/31/17 14:43	7440-28-0	
7470 Mercury	Analytical Method: EPA 7470 Preparation Method: EPA 7470							
Mercury	ND	ug/L	0.20	1	02/01/17 12:30	02/01/17 15:27	7439-97-6	
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
Acetone	ND	ug/L	25.0	1		01/30/17 17:25	67-64-1	
Acrylonitrile	ND	ug/L	10.0	1		01/30/17 17:25	107-13-1	
Benzene	ND	ug/L	1.0	1		01/30/17 17:25	71-43-2	
Bromochloromethane	ND	ug/L	1.0	1		01/30/17 17:25	74-97-5	
Bromodichloromethane	ND	ug/L	1.0	1		01/30/17 17:25	75-27-4	
Bromoform	ND	ug/L	1.0	1		01/30/17 17:25	75-25-2	
Bromomethane	ND	ug/L	2.0	1		01/30/17 17:25	74-83-9	
2-Butanone (MEK)	ND	ug/L	5.0	1		01/30/17 17:25	78-93-3	
Carbon disulfide	ND	ug/L	2.0	1		01/30/17 17:25	75-15-0	
Carbon tetrachloride	ND	ug/L	1.0	1		01/30/17 17:25	56-23-5	
Chlorobenzene	ND	ug/L	1.0	1		01/30/17 17:25	108-90-7	
Chloroethane	ND	ug/L	1.0	1		01/30/17 17:25	75-00-3	
Chloroform	ND	ug/L	1.0	1		01/30/17 17:25	67-66-3	
Chloromethane	ND	ug/L	1.0	1		01/30/17 17:25	74-87-3	
Dibromochloromethane	ND	ug/L	1.0	1		01/30/17 17:25	124-48-1	

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ANALYTICAL RESULTS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327973

Sample: EQ BLANK **Lab ID: 92327973003** Collected: 01/26/17 16:30 Received: 01/26/17 17:50 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
Dibromomethane	ND	ug/L	1.0	1		01/30/17 17:25	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	1.0	1		01/30/17 17:25	95-50-1	
1,4-Dichlorobenzene	ND	ug/L	1.0	1		01/30/17 17:25	106-46-7	
trans-1,4-Dichloro-2-butene	ND	ug/L	1.0	1		01/30/17 17:25	110-57-6	
1,1-Dichloroethane	ND	ug/L	1.0	1		01/30/17 17:25	75-34-3	
1,2-Dichloroethane	ND	ug/L	1.0	1		01/30/17 17:25	107-06-2	
1,1-Dichloroethene	ND	ug/L	1.0	1		01/30/17 17:25	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	1.0	1		01/30/17 17:25	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	1.0	1		01/30/17 17:25	156-60-5	
1,2-Dichloropropane	ND	ug/L	1.0	1		01/30/17 17:25	78-87-5	
cis-1,3-Dichloropropene	ND	ug/L	1.0	1		01/30/17 17:25	10061-01-5	
trans-1,3-Dichloropropene	ND	ug/L	1.0	1		01/30/17 17:25	10061-02-6	
Ethylbenzene	ND	ug/L	1.0	1		01/30/17 17:25	100-41-4	
2-Hexanone	ND	ug/L	5.0	1		01/30/17 17:25	591-78-6	
Iodomethane	ND	ug/L	5.0	1		01/30/17 17:25	74-88-4	
Methylene Chloride	ND	ug/L	1.0	1		01/30/17 17:25	75-09-2	
4-Methyl-2-pentanone (MIBK)	ND	ug/L	5.0	1		01/30/17 17:25	108-10-1	
Styrene	ND	ug/L	1.0	1		01/30/17 17:25	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0	1		01/30/17 17:25	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0	1		01/30/17 17:25	79-34-5	
Tetrachloroethene	ND	ug/L	1.0	1		01/30/17 17:25	127-18-4	
Toluene	ND	ug/L	1.0	1		01/30/17 17:25	108-88-3	
1,1,1-Trichloroethane	ND	ug/L	1.0	1		01/30/17 17:25	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	1.0	1		01/30/17 17:25	79-00-5	
Trichloroethene	ND	ug/L	1.0	1		01/30/17 17:25	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0	1		01/30/17 17:25	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0	1		01/30/17 17:25	96-18-4	
Vinyl acetate	ND	ug/L	2.0	1		01/30/17 17:25	108-05-4	
Vinyl chloride	ND	ug/L	1.0	1		01/30/17 17:25	75-01-4	
Xylene (Total)	ND	ug/L	1.0	1		01/30/17 17:25	1330-20-7	
Surrogates								
4-Bromofluorobenzene (S)	97	%	70-130	1		01/30/17 17:25	460-00-4	
1,2-Dichloroethane-d4 (S)	95	%	70-130	1		01/30/17 17:25	17060-07-0	
Toluene-d8 (S)	104	%	70-130	1		01/30/17 17:25	2037-26-5	
2540C Total Dissolved Solids	Analytical Method: SM 2540C							
Total Dissolved Solids	ND	mg/L	25.0	1		01/31/17 22:10		

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ANALYTICAL RESULTS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327973

Sample: TRIP BLANK **Lab ID: 92327973004** Collected: 01/26/17 00:00 Received: 01/26/17 17:50 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
Acetone	ND	ug/L	25.0	1		01/30/17 17:43	67-64-1	
Acrylonitrile	ND	ug/L	10.0	1		01/30/17 17:43	107-13-1	
Benzene	ND	ug/L	1.0	1		01/30/17 17:43	71-43-2	
Bromochloromethane	ND	ug/L	1.0	1		01/30/17 17:43	74-97-5	
Bromodichloromethane	ND	ug/L	1.0	1		01/30/17 17:43	75-27-4	
Bromoform	ND	ug/L	1.0	1		01/30/17 17:43	75-25-2	
Bromomethane	ND	ug/L	2.0	1		01/30/17 17:43	74-83-9	
2-Butanone (MEK)	ND	ug/L	5.0	1		01/30/17 17:43	78-93-3	
Carbon disulfide	ND	ug/L	2.0	1		01/30/17 17:43	75-15-0	
Carbon tetrachloride	ND	ug/L	1.0	1		01/30/17 17:43	56-23-5	
Chlorobenzene	ND	ug/L	1.0	1		01/30/17 17:43	108-90-7	
Chloroethane	ND	ug/L	1.0	1		01/30/17 17:43	75-00-3	
Chloroform	ND	ug/L	1.0	1		01/30/17 17:43	67-66-3	
Chloromethane	ND	ug/L	1.0	1		01/30/17 17:43	74-87-3	
Dibromochloromethane	ND	ug/L	1.0	1		01/30/17 17:43	124-48-1	
Dibromomethane	ND	ug/L	1.0	1		01/30/17 17:43	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	1.0	1		01/30/17 17:43	95-50-1	
1,4-Dichlorobenzene	ND	ug/L	1.0	1		01/30/17 17:43	106-46-7	
trans-1,4-Dichloro-2-butene	ND	ug/L	1.0	1		01/30/17 17:43	110-57-6	
1,1-Dichloroethane	ND	ug/L	1.0	1		01/30/17 17:43	75-34-3	
1,2-Dichloroethane	ND	ug/L	1.0	1		01/30/17 17:43	107-06-2	
1,1-Dichloroethene	ND	ug/L	1.0	1		01/30/17 17:43	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	1.0	1		01/30/17 17:43	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	1.0	1		01/30/17 17:43	156-60-5	
1,2-Dichloropropane	ND	ug/L	1.0	1		01/30/17 17:43	78-87-5	
cis-1,3-Dichloropropene	ND	ug/L	1.0	1		01/30/17 17:43	10061-01-5	
trans-1,3-Dichloropropene	ND	ug/L	1.0	1		01/30/17 17:43	10061-02-6	
Ethylbenzene	ND	ug/L	1.0	1		01/30/17 17:43	100-41-4	
2-Hexanone	ND	ug/L	5.0	1		01/30/17 17:43	591-78-6	
Iodomethane	ND	ug/L	5.0	1		01/30/17 17:43	74-88-4	
Methylene Chloride	ND	ug/L	1.0	1		01/30/17 17:43	75-09-2	
4-Methyl-2-pentanone (MIBK)	ND	ug/L	5.0	1		01/30/17 17:43	108-10-1	
Styrene	ND	ug/L	1.0	1		01/30/17 17:43	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0	1		01/30/17 17:43	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0	1		01/30/17 17:43	79-34-5	
Tetrachloroethene	ND	ug/L	1.0	1		01/30/17 17:43	127-18-4	
Toluene	ND	ug/L	1.0	1		01/30/17 17:43	108-88-3	
1,1,1-Trichloroethane	ND	ug/L	1.0	1		01/30/17 17:43	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	1.0	1		01/30/17 17:43	79-00-5	
Trichloroethene	ND	ug/L	1.0	1		01/30/17 17:43	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0	1		01/30/17 17:43	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0	1		01/30/17 17:43	96-18-4	
Vinyl acetate	ND	ug/L	2.0	1		01/30/17 17:43	108-05-4	
Vinyl chloride	ND	ug/L	1.0	1		01/30/17 17:43	75-01-4	
Xylene (Total)	ND	ug/L	1.0	1		01/30/17 17:43	1330-20-7	
Surrogates								
4-Bromofluorobenzene (S)	96	%	70-130	1		01/30/17 17:43	460-00-4	

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ANALYTICAL RESULTS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327973

Sample: TRIP BLANK **Lab ID: 92327973004** Collected: 01/26/17 00:00 Received: 01/26/17 17:50 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
Surrogates								
1,2-Dichloroethane-d4 (S)	98	%	70-130	1		01/30/17 17:43	17060-07-0	
Toluene-d8 (S)	102	%	70-130	1		01/30/17 17:43	2037-26-5	

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QUALITY CONTROL DATA

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327973

QC Batch: 346503 Analysis Method: EPA 300.0
QC Batch Method: EPA 300.0 Analysis Description: 3000 IC Anions, GWD
Associated Lab Samples: 92327973001, 92327973002, 92327973003

METHOD BLANK: 1921930 Matrix: Water
Associated Lab Samples: 92327973001, 92327973002, 92327973003

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Chloride	mg/L	ND	1.0	02/01/17 12:05	
Fluoride	mg/L	ND	0.10	02/01/17 12:05	
Sulfate	mg/L	ND	1.0	02/01/17 12:05	

LABORATORY CONTROL SAMPLE: 1921931

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Chloride	mg/L	50	48.7	97	90-110	
Fluoride	mg/L	2.5	2.4	97	90-110	
Sulfate	mg/L	50	48.1	96	90-110	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1921932 1921933

Parameter	Units	92327809002 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Chloride	mg/L	519	50	50	571	567	103	95	90-110	1	20	
Fluoride	mg/L	0.22	2.5	2.5	1.8	1.7	62	61	90-110	3	20	M1
Sulfate	mg/L	10.1	50	50	56.4	59.9	93	100	90-110	6	20	

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QUALITY CONTROL DATA

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327973

QC Batch: 346420 Analysis Method: EPA 7470
QC Batch Method: EPA 7470 Analysis Description: 7470 Mercury
Associated Lab Samples: 92327973001, 92327973002, 92327973003

METHOD BLANK: 1921618 Matrix: Water
Associated Lab Samples: 92327973001, 92327973002, 92327973003

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Mercury	ug/L	ND	0.20	02/01/17 15:13	

LABORATORY CONTROL SAMPLE: 1921619

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Mercury	ug/L	2.5	2.6	102	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1921620 1921621

Parameter	Units	92327973001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Mercury	ug/L	ND	2.5	2.5	2.4	2.5	93	99	75-125	6	25	

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QUALITY CONTROL DATA

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327973

QC Batch: 346141 Analysis Method: EPA 6010
QC Batch Method: EPA 3010A Analysis Description: 6010 MET
Associated Lab Samples: 92327973001, 92327973002, 92327973003

METHOD BLANK: 1920267 Matrix: Water
Associated Lab Samples: 92327973001, 92327973002, 92327973003

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Antimony	ug/L	ND	5.0	02/01/17 17:59	
Arsenic	ug/L	ND	10.0	02/01/17 17:59	
Barium	ug/L	ND	5.0	02/02/17 11:17	
Beryllium	ug/L	ND	1.0	02/01/17 17:59	
Cadmium	ug/L	ND	1.0	02/01/17 17:59	
Calcium	ug/L	ND	100	02/01/17 17:59	
Chromium	ug/L	ND	5.0	02/01/17 17:59	
Cobalt	ug/L	ND	5.0	02/01/17 17:59	
Copper	ug/L	ND	5.0	02/01/17 17:59	
Lead	ug/L	ND	5.0	02/01/17 17:59	
Molybdenum	ug/L	ND	5.0	02/01/17 17:59	
Nickel	ug/L	ND	5.0	02/01/17 17:59	
Selenium	ug/L	ND	10.0	02/01/17 17:59	
Silver	ug/L	ND	5.0	02/01/17 17:59	
Vanadium	ug/L	ND	5.0	02/01/17 17:59	
Zinc	ug/L	ND	10.0	02/01/17 17:59	

LABORATORY CONTROL SAMPLE: 1920268

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Antimony	ug/L	500	514	103	80-120	
Arsenic	ug/L	500	510	102	80-120	
Barium	ug/L	500	504	101	80-120	
Beryllium	ug/L	500	502	100	80-120	
Cadmium	ug/L	500	508	102	80-120	
Calcium	ug/L	5000	4700	94	80-120	
Chromium	ug/L	500	488	98	80-120	
Cobalt	ug/L	500	519	104	80-120	
Copper	ug/L	500	517	103	80-120	
Lead	ug/L	500	511	102	80-120	
Molybdenum	ug/L	500	518	104	80-120	
Nickel	ug/L	500	495	99	80-120	
Selenium	ug/L	500	527	105	80-120	
Silver	ug/L	250	249	99	80-120	
Vanadium	ug/L	500	486	97	80-120	
Zinc	ug/L	500	520	104	80-120	

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QUALITY CONTROL DATA

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327973

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1920269 1920270

Parameter	Units	92327811007 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Antimony	ug/L	ND	500	500	491	496	98	99	75-125	1	20	
Arsenic	ug/L	ND	500	500	491	497	98	99	75-125	1	20	
Barium	ug/L	42.0	500	500	530	535	98	99	75-125	1	20	
Beryllium	ug/L	ND	500	500	489	481	98	96	75-125	2	20	
Cadmium	ug/L	ND	500	500	488	490	98	98	75-125	0	20	
Calcium	ug/L	4560	5000	5000	8900	8820	87	85	75-125	1	20	
Chromium	ug/L	ND	500	500	465	472	93	94	75-125	1	20	
Cobalt	ug/L	ND	500	500	499	500	100	100	75-125	0	20	
Copper	ug/L	ND	500	500	491	498	98	100	75-125	1	20	
Lead	ug/L	ND	500	500	487	490	97	98	75-125	1	20	
Molybdenum	ug/L	ND	500	500	497	501	99	100	75-125	1	20	
Nickel	ug/L	ND	500	500	476	478	95	95	75-125	0	20	
Selenium	ug/L	ND	500	500	507	512	101	102	75-125	1	20	
Silver	ug/L	ND	250	250	239	240	96	96	75-125	0	20	
Vanadium	ug/L	ND	500	500	471	474	94	95	75-125	1	20	
Zinc	ug/L	18.0	500	500	516	518	100	100	75-125	0	20	

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QUALITY CONTROL DATA

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327973

QC Batch: 346042 Analysis Method: EPA 6020B
QC Batch Method: EPA 3010A Analysis Description: 6020 MET
Associated Lab Samples: 92327973001, 92327973002, 92327973003

METHOD BLANK: 1919791 Matrix: Water
Associated Lab Samples: 92327973001, 92327973002, 92327973003

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Boron	ug/L	ND	25.0	02/01/17 12:49	
Lithium	ug/L	ND	2.5	01/31/17 14:24	
Thallium	ug/L	ND	0.10	01/31/17 14:24	

LABORATORY CONTROL SAMPLE: 1919792

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Boron	ug/L	100	103	103	80-120	
Lithium	ug/L	100	102	102	80-120	
Thallium	ug/L	100	99.2	99	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1919793 1919794

Parameter	Units	92327801014 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Boron	ug/L	ND	100	100	102	103	99	101	75-125	1	20	
Lithium	ug/L	ND	100	100	104	103	104	103	75-125	1	20	
Thallium	ug/L	ND	100	100	99.6	105	100	105	75-125	6	20	

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QUALITY CONTROL DATA

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327973

QC Batch: 346119 Analysis Method: EPA 8260
QC Batch Method: EPA 8260 Analysis Description: 8260 MSV Low Level Landfill
Associated Lab Samples: 92327973001, 92327973002, 92327973003, 92327973004

METHOD BLANK: 1920111 Matrix: Water
Associated Lab Samples: 92327973001, 92327973002, 92327973003, 92327973004

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
1,1,1,2-Tetrachloroethane	ug/L	ND	1.0	01/30/17 13:05	
1,1,1-Trichloroethane	ug/L	ND	1.0	01/30/17 13:05	
1,1,2,2-Tetrachloroethane	ug/L	ND	1.0	01/30/17 13:05	
1,1,2-Trichloroethane	ug/L	ND	1.0	01/30/17 13:05	
1,1-Dichloroethane	ug/L	ND	1.0	01/30/17 13:05	
1,1-Dichloroethene	ug/L	ND	1.0	01/30/17 13:05	
1,2,3-Trichloropropane	ug/L	ND	1.0	01/30/17 13:05	
1,2-Dichlorobenzene	ug/L	ND	1.0	01/30/17 13:05	
1,2-Dichloroethane	ug/L	ND	1.0	01/30/17 13:05	
1,2-Dichloropropane	ug/L	ND	1.0	01/30/17 13:05	
1,4-Dichlorobenzene	ug/L	ND	1.0	01/30/17 13:05	
2-Butanone (MEK)	ug/L	ND	5.0	01/30/17 13:05	
2-Hexanone	ug/L	ND	5.0	01/30/17 13:05	
4-Methyl-2-pentanone (MIBK)	ug/L	ND	5.0	01/30/17 13:05	
Acetone	ug/L	ND	25.0	01/30/17 13:05	
Acrylonitrile	ug/L	ND	10.0	01/30/17 13:05	
Benzene	ug/L	ND	1.0	01/30/17 13:05	
Bromochloromethane	ug/L	ND	1.0	01/30/17 13:05	
Bromodichloromethane	ug/L	ND	1.0	01/30/17 13:05	
Bromoform	ug/L	ND	1.0	01/30/17 13:05	
Bromomethane	ug/L	ND	2.0	01/30/17 13:05	
Carbon disulfide	ug/L	ND	2.0	01/30/17 13:05	
Carbon tetrachloride	ug/L	ND	1.0	01/30/17 13:05	
Chlorobenzene	ug/L	ND	1.0	01/30/17 13:05	
Chloroethane	ug/L	ND	1.0	01/30/17 13:05	
Chloroform	ug/L	ND	1.0	01/30/17 13:05	
Chloromethane	ug/L	ND	1.0	01/30/17 13:05	
cis-1,2-Dichloroethene	ug/L	ND	1.0	01/30/17 13:05	
cis-1,3-Dichloropropene	ug/L	ND	1.0	01/30/17 13:05	
Dibromochloromethane	ug/L	ND	1.0	01/30/17 13:05	
Dibromomethane	ug/L	ND	1.0	01/30/17 13:05	
Ethylbenzene	ug/L	ND	1.0	01/30/17 13:05	
Iodomethane	ug/L	ND	5.0	01/30/17 13:05	
Methylene Chloride	ug/L	ND	1.0	01/30/17 13:05	
Styrene	ug/L	ND	1.0	01/30/17 13:05	
Tetrachloroethene	ug/L	ND	1.0	01/30/17 13:05	
Toluene	ug/L	ND	1.0	01/30/17 13:05	
trans-1,2-Dichloroethene	ug/L	ND	1.0	01/30/17 13:05	
trans-1,3-Dichloropropene	ug/L	ND	1.0	01/30/17 13:05	
trans-1,4-Dichloro-2-butene	ug/L	ND	1.0	01/30/17 13:05	
Trichloroethene	ug/L	ND	1.0	01/30/17 13:05	

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QUALITY CONTROL DATA

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327973

METHOD BLANK: 1920111 Matrix: Water
Associated Lab Samples: 92327973001, 92327973002, 92327973003, 92327973004

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Trichlorofluoromethane	ug/L	ND	1.0	01/30/17 13:05	
Vinyl acetate	ug/L	ND	2.0	01/30/17 13:05	
Vinyl chloride	ug/L	ND	1.0	01/30/17 13:05	
Xylene (Total)	ug/L	ND	1.0	01/30/17 13:05	
1,2-Dichloroethane-d4 (S)	%	92	70-130	01/30/17 13:05	
4-Bromofluorobenzene (S)	%	95	70-130	01/30/17 13:05	
Toluene-d8 (S)	%	104	70-130	01/30/17 13:05	

LABORATORY CONTROL SAMPLE: 1920112

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
1,1,1,2-Tetrachloroethane	ug/L	50	55.0	110	80-125	
1,1,1-Trichloroethane	ug/L	50	45.1	90	71-129	
1,1,2,2-Tetrachloroethane	ug/L	50	50.6	101	79-124	
1,1,2-Trichloroethane	ug/L	50	50.6	101	85-125	
1,1-Dichloroethane	ug/L	50	45.2	90	73-126	
1,1-Dichloroethene	ug/L	50	47.5	95	66-135	
1,2,3-Trichloropropane	ug/L	50	51.0	102	75-130	
1,2-Dichlorobenzene	ug/L	50	53.8	108	80-133	
1,2-Dichloroethane	ug/L	50	45.8	92	67-128	
1,2-Dichloropropane	ug/L	50	48.8	98	75-132	
1,4-Dichlorobenzene	ug/L	50	52.9	106	78-130	
2-Butanone (MEK)	ug/L	100	82.3	82	61-144	
2-Hexanone	ug/L	100	96.6	97	68-143	
4-Methyl-2-pentanone (MIBK)	ug/L	100	88.3	88	72-135	
Acetone	ug/L	100	77.6	78	48-146	
Acrylonitrile	ug/L	250	214	86	40-160	
Benzene	ug/L	50	50.4	101	80-125	
Bromochloromethane	ug/L	50	47.1	94	71-125	
Bromodichloromethane	ug/L	50	50.2	100	78-124	
Bromoform	ug/L	50	51.6	103	71-128	
Bromomethane	ug/L	50	44.8	90	40-160	
Carbon disulfide	ug/L	50	52.0	104	50-160	
Carbon tetrachloride	ug/L	50	46.1	92	69-131	
Chlorobenzene	ug/L	50	53.2	106	81-122	
Chloroethane	ug/L	50	48.4	97	39-148	
Chloroform	ug/L	50	45.7	91	73-127	
Chloromethane	ug/L	50	45.2	90	44-146	
cis-1,2-Dichloroethene	ug/L	50	46.7	93	74-124	
cis-1,3-Dichloropropene	ug/L	50	49.8	100	72-132	
Dibromochloromethane	ug/L	50	55.4	111	78-125	
Dibromomethane	ug/L	50	47.7	95	82-120	
Ethylbenzene	ug/L	50	53.5	107	79-121	
Iodomethane	ug/L	100	88.1	88	39-154	

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REPORT OF LABORATORY ANALYSIS

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(704)875-9092

QUALITY CONTROL DATA

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327973

LABORATORY CONTROL SAMPLE: 1920112

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Methylene Chloride	ug/L	50	43.2	86	64-133	
Styrene	ug/L	50	54.9	110	84-126	
Tetrachloroethene	ug/L	50	50.4	101	78-122	
Toluene	ug/L	50	47.7	95	80-121	
trans-1,2-Dichloroethene	ug/L	50	47.3	95	71-127	
trans-1,3-Dichloropropene	ug/L	50	49.7	99	69-141	
trans-1,4-Dichloro-2-butene	ug/L	50	49.7	99	40-160	
Trichloroethene	ug/L	50	48.8	98	78-122	
Trichlorofluoromethane	ug/L	50	51.2	102	53-137	
Vinyl acetate	ug/L	100	88.2	88	40-160	
Vinyl chloride	ug/L	50	39.7	79	58-137	
Xylene (Total)	ug/L	150	161	107	81-126	
1,2-Dichloroethane-d4 (S)	%			101	70-130	
4-Bromofluorobenzene (S)	%			99	70-130	
Toluene-d8 (S)	%			94	70-130	

MATRIX SPIKE SAMPLE: 1920113

Parameter	Units	92327809001 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
1,1,1,2-Tetrachloroethane	ug/L	ND	20	20.6	103	70-130	
1,1,1-Trichloroethane	ug/L	ND	20	20.6	103	70-130	
1,1,2,2-Tetrachloroethane	ug/L	ND	20	20.6	103	70-130	
1,1,2-Trichloroethane	ug/L	ND	20	21.0	105	70-130	
1,1-Dichloroethane	ug/L	ND	20	20.7	103	70-130	
1,1-Dichloroethene	ug/L	ND	20	22.4	112	70-166	
1,2,3-Trichloropropane	ug/L	ND	20	20.9	104	70-130	
1,2-Dichlorobenzene	ug/L	ND	20	22.3	111	70-130	
1,2-Dichloroethane	ug/L	ND	20	19.5	98	70-130	
1,2-Dichloropropane	ug/L	ND	20	21.7	109	70-130	
1,4-Dichlorobenzene	ug/L	ND	20	22.4	112	70-130	
2-Butanone (MEK)	ug/L	ND	40	41.3	103	70-130	
2-Hexanone	ug/L	ND	40	40.0	100	70-130	
4-Methyl-2-pentanone (MIBK)	ug/L	ND	40	36.9	92	70-130	
Acetone	ug/L	ND	40	39.5	99	70-130	
Acrylonitrile	ug/L	ND	100	93.2	93	70-130	
Benzene	ug/L	ND	20	22.8	114	70-148	
Bromochloromethane	ug/L	ND	20	20.4	102	70-130	
Bromodichloromethane	ug/L	ND	20	20.6	103	70-130	
Bromoform	ug/L	ND	20	16.3	81	70-130	
Bromomethane	ug/L	ND	20	12.7	63	70-130	M1
Carbon disulfide	ug/L	ND	20	23.1	116	70-130	
Carbon tetrachloride	ug/L	ND	20	20.1	101	70-130	
Chlorobenzene	ug/L	ND	20	22.8	114	70-146	
Chloroethane	ug/L	ND	20	22.8	114	70-130	
Chloroform	ug/L	ND	20	20.8	104	70-130	

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QUALITY CONTROL DATA

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327973

MATRIX SPIKE SAMPLE: 1920113

Parameter	Units	92327809001 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Chloromethane	ug/L	ND	20	20.2	101	70-130	
cis-1,2-Dichloroethene	ug/L	ND	20	21.1	105	70-130	
cis-1,3-Dichloropropene	ug/L	ND	20	19.4	97	70-130	
Dibromochloromethane	ug/L	ND	20	20.1	101	70-130	
Dibromomethane	ug/L	ND	20	21.0	105	70-130	
Ethylbenzene	ug/L	ND	20	23.0	115	70-130	
Iodomethane	ug/L	ND	40	30.1	75	70-130	
Methylene Chloride	ug/L	ND	20	17.9	89	70-130	
Styrene	ug/L	ND	20	23.1	115	70-130	
Tetrachloroethene	ug/L	ND	20	21.4	107	70-130	
Toluene	ug/L	ND	20	21.5	107	70-155	
trans-1,2-Dichloroethene	ug/L	ND	20	21.6	108	70-130	
trans-1,3-Dichloropropene	ug/L	ND	20	19.1	95	70-130	
trans-1,4-Dichloro-2-butene	ug/L	ND	20	16.1	80	70-130	
Trichloroethene	ug/L	ND	20	21.8	109	69-151	
Trichlorofluoromethane	ug/L	ND	20	22.6	113	70-130	
Vinyl acetate	ug/L	ND	40	31.4	79	70-130	
Vinyl chloride	ug/L	ND	20	17.6	88	70-130	
1,2-Dichloroethane-d4 (S)	%				100	70-130	
4-Bromofluorobenzene (S)	%				97	70-130	
Toluene-d8 (S)	%				97	70-130	

SAMPLE DUPLICATE: 1920114

Parameter	Units	92327809002 Result	Dup Result	RPD	Max RPD	Qualifiers
1,1,1,2-Tetrachloroethane	ug/L	ND	ND		30	
1,1,1-Trichloroethane	ug/L	ND	ND		30	
1,1,2,2-Tetrachloroethane	ug/L	ND	ND		30	
1,1,2-Trichloroethane	ug/L	ND	ND		30	
1,1-Dichloroethane	ug/L	ND	ND		30	
1,1-Dichloroethene	ug/L	ND	ND		30	
1,2,3-Trichloropropane	ug/L	ND	ND		30	
1,2-Dichlorobenzene	ug/L	ND	ND		30	
1,2-Dichloroethane	ug/L	ND	ND		30	
1,2-Dichloropropane	ug/L	ND	ND		30	
1,4-Dichlorobenzene	ug/L	ND	ND		30	
2-Butanone (MEK)	ug/L	ND	ND		30	
2-Hexanone	ug/L	ND	ND		30	
4-Methyl-2-pentanone (MIBK)	ug/L	ND	ND		30	
Acetone	ug/L	ND	ND		30	
Acrylonitrile	ug/L	ND	ND		30	
Benzene	ug/L	ND	ND		30	
Bromochloromethane	ug/L	ND	ND		30	
Bromodichloromethane	ug/L	ND	ND		30	
Bromoform	ug/L	ND	ND		30	

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QUALITY CONTROL DATA

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327973

SAMPLE DUPLICATE: 1920114

Parameter	Units	92327809002 Result	Dup Result	RPD	Max RPD	Qualifiers
Bromomethane	ug/L	ND	ND		30	
Carbon disulfide	ug/L	ND	ND		30	
Carbon tetrachloride	ug/L	ND	ND		30	
Chlorobenzene	ug/L	ND	ND		30	
Chloroethane	ug/L	ND	ND		30	
Chloroform	ug/L	ND	ND		30	
Chloromethane	ug/L	ND	ND		30	
cis-1,2-Dichloroethene	ug/L	ND	ND		30	
cis-1,3-Dichloropropene	ug/L	ND	ND		30	
Dibromochloromethane	ug/L	ND	ND		30	
Dibromomethane	ug/L	ND	ND		30	
Ethylbenzene	ug/L	ND	ND		30	
Iodomethane	ug/L	ND	ND		30	
Methylene Chloride	ug/L	ND	ND		30	
Styrene	ug/L	ND	ND		30	
Tetrachloroethene	ug/L	ND	ND		30	
Toluene	ug/L	ND	ND		30	
trans-1,2-Dichloroethene	ug/L	ND	ND		30	
trans-1,3-Dichloropropene	ug/L	ND	ND		30	
trans-1,4-Dichloro-2-butene	ug/L	ND	ND		30	
Trichloroethene	ug/L	ND	ND		30	
Trichlorofluoromethane	ug/L	ND	ND		30	
Vinyl acetate	ug/L	ND	ND		30	
Vinyl chloride	ug/L	ND	ND		30	
Xylene (Total)	ug/L	ND	ND		30	
1,2-Dichloroethane-d4 (S)	%	93	97	5		
4-Bromofluorobenzene (S)	%	94	98	4		
Toluene-d8 (S)	%	106	106	0		

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QUALITY CONTROL DATA

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327973

QC Batch: 346384 Analysis Method: SM 2540C
QC Batch Method: SM 2540C Analysis Description: 2540C Total Dissolved Solids
Associated Lab Samples: 92327973001, 92327973002, 92327973003

METHOD BLANK: 1921417 Matrix: Water
Associated Lab Samples: 92327973001, 92327973002, 92327973003

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Total Dissolved Solids	mg/L	ND	25.0	01/31/17 22:09	

LABORATORY CONTROL SAMPLE: 1921418

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Total Dissolved Solids	mg/L	250	262	105	90-110	

SAMPLE DUPLICATE: 1921419

Parameter	Units	92327973001 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	2780	2620	6	5	D6

SAMPLE DUPLICATE: 1921420

Parameter	Units	92327852027 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	2250	2620	15	5	D6

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327973

Sample: MW-2 **Lab ID: 92327973001** Collected: 01/26/17 16:00 Received: 01/26/17 17:50 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**1.02 ± 0.591 (0.630) C:NA T:92%**	pCi/L	02/22/17 22:07	13982-63-3	
Radium-228	EPA 904.0	**0.979 ± 0.667 (1.32) C:66% T:81%**	pCi/L	02/22/17 17:16	15262-20-1	

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327973

Sample: AMB **Lab ID: 92327973002** Collected: 01/26/17 16:15 Received: 01/26/17 17:50 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**0.000 ± 0.294 (0.598) C:NA T:93%**	pCi/L	02/22/17 22:07	13982-63-3	
Radium-228	EPA 904.0	**0.231 ± 0.448 (0.985) C:66% T:87%**	pCi/L	02/22/17 17:16	15262-20-1	

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327973

Sample: EQ BLANK **Lab ID: 92327973003** Collected: 01/26/17 16:30 Received: 01/26/17 17:50 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**0.0641 ± 0.377 (0.769) C:NA T:95%**	pCi/L	02/22/17 22:17	13982-63-3	
Radium-228	EPA 904.0	**0.0212 ± 0.556 (1.27) C:61% T:82%**	pCi/L	02/22/17 17:16	15262-20-1	

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QUALITY CONTROL - RADIOCHEMISTRY

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327973

QC Batch: 249391 Analysis Method: EPA 904.0
QC Batch Method: EPA 904.0 Analysis Description: 904.0 Radium 228
Associated Lab Samples: 92327973001, 92327973002, 92327973003

METHOD BLANK: 1226692 Matrix: Water
Associated Lab Samples: 92327973001, 92327973002, 92327973003

Parameter	Act ± Unc (MDC) Carr Trac	Units	Analyzed	Qualifiers
Radium-228	-0.222 ± 0.399 (0.981) C:67% T:72%	pCi/L	02/22/17 17:14	

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QUALITY CONTROL - RADIOCHEMISTRY

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327973

QC Batch: 249392 Analysis Method: EPA 903.1
QC Batch Method: EPA 903.1 Analysis Description: 903.1 Radium-226
Associated Lab Samples: 92327973001, 92327973002, 92327973003

METHOD BLANK: 1226693 Matrix: Water
Associated Lab Samples: 92327973001, 92327973002, 92327973003

Parameter	Act ± Unc (MDC) Carr Trac	Units	Analyzed	Qualifiers
Radium-226	-0.064 ± 0.331 (0.768) C:NA T:98%	pCi/L	02/22/17 21:35	

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QUALIFIERS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327973

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above adjusted reporting limit.

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

Acid preservation may not be appropriate for 2 Chloroethylvinyl ether.

A separate vial preserved to a pH of 4-5 is recommended in SW846 Chapter 4 for the analysis of Acrolein and Acrylonitrile by EPA Method 8260.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Act - Activity

Unc - Uncertainty: SDWA = 1.96 sigma count uncertainty, all other matrices = Expanded Uncertainty (95% confidence interval). Gamma Spec = Expanded Uncertainty (95.4% Confidence Interval)

(MDC) - Minimum Detectable Concentration

Trac - Tracer Recovery (%)

Carr - Carrier Recovery (%)

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

LABORATORIES

PASI-A	Pace Analytical Services - Asheville
PASI-C	Pace Analytical Services - Charlotte
PASI-PA	Pace Analytical Services - Greensburg
PASI-W	Pace Analytical Services - Greenwood

ANALYTE QUALIFIERS

D6	The precision between the sample and sample duplicate exceeded laboratory control limits.
M1	Matrix spike recovery exceeded QC limits. Batch accepted based on laboratory control sample (LCS) recovery.

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QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92327973

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
92327973001	**MW-2**	EPA 300.0	346503		
92327973002	**AMB**	EPA 300.0	346503		
92327973003	**EQ BLANK**	EPA 300.0	346503		
92327973001	**MW-2**	EPA 3010A	346141	EPA 6010	346263
92327973002	**AMB**	EPA 3010A	346141	EPA 6010	346263
92327973003	**EQ BLANK**	EPA 3010A	346141	EPA 6010	346263
92327973001	**MW-2**	EPA 3010A	346042	EPA 6020B	346236
92327973002	**AMB**	EPA 3010A	346042	EPA 6020B	346236
92327973003	**EQ BLANK**	EPA 3010A	346042	EPA 6020B	346236
92327973001	**MW-2**	EPA 7470	346420	EPA 7470	346535
92327973002	**AMB**	EPA 7470	346420	EPA 7470	346535
92327973003	**EQ BLANK**	EPA 7470	346420	EPA 7470	346535
92327973001	**MW-2**	EPA 8260	346119		
92327973002	**AMB**	EPA 8260	346119		
92327973003	**EQ BLANK**	EPA 8260	346119		
92327973004	**TRIP BLANK**	EPA 8260	346119		
92327973001	**MW-2**	EPA 903.1	249392		
92327973002	**AMB**	EPA 903.1	249392		
92327973003	**EQ BLANK**	EPA 903.1	249392		
92327973001	**MW-2**	EPA 904.0	249391		
92327973002	**AMB**	EPA 904.0	249391		
92327973003	**EQ BLANK**	EPA 904.0	249391		
92327973001	**MW-2**	SM 2540C	346384		
92327973002	**AMB**	SM 2540C	346384		
92327973003	**EQ BLANK**	SM 2540C	346384		

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Laboratory receiving samples:

Asheville ☐ Eden ☐ Greenwood ☐ Huntersville ☑ Raleigh ☐ Mechanicsville ☐

Sample Condition Upon Receipt

Client Name: HDR

Project # WO# : 92327973

92327973

Courier: ☐ Commercial ☑ Fed Ex ☐ Pace ☐ UPS ☐ USPS ☐ Other:____ ☐ Client

Custody Seal Present? ☐ Yes ☐ No **Seals Intact?** ☐ Yes ☐ No

Packing Material: ☐ Bubble Wrap ☑ Bubble Bags ☐ None ☐ Other:____

Date/Initials Person Examining Contents: JM 1.27.17

Thermometer: ☑ IR Gun ID: T1603

Type of Ice: ☑ Wet ☐ Blue ☐ None ☑ Samples on ice, cooling process has begun

Correction Factor: **Cooler Temp Corrected (°C):** 1.9

Biological Tissue Frozen? ☐ Yes ☑ No ☐ N/A

Temp should be above freezing to 6°C

USDA Regulated Soil (☑ N/A, water sample)

Did samples originate in a quarantine zone within the United States: CA, NY, or SC (check maps)? ☐ Yes ☑ No

Did samples originate from a foreign source (internationally, including Hawaii and Puerto Rico)? ☐ Yes ☑ No

				Comments/Discrepancy:
Chain of Custody Present?	☐ Yes	☑ No	☐ N/A	1.
Samples Arrived within Hold Time?	☑ Yes	☐ No	☐ N/A	2.
Short Hold Time Analysis (<72 hr.)?	☐ Yes	☑ No	☐ N/A	3.
Rush Turn Around Time Requested?	☐ Yes	☐ No	☑ N/A	4. ~~No COC~~ RG 1/31/17
Sufficient Volume?	☑ Yes	☐ No	☐ N/A	5.
Correct Containers Used?	☑ Yes	☐ No	☐ N/A	6.
-Pace Containers Used?	☑ Yes	☐ No	☐ N/A	
Containers Intact?	☑ Yes	☐ No	☐ N/A	7.
Samples Field Filtered?	☐ Yes	☐ No	☑ N/A	8. Note if sediment is visible in the dissolved container
Sample Labels Match COC?	☐ Yes	☐ No	☑ N/A	9. see note on bottom.
-Includes Date/Time/ID/Analysis Matrix: WT				
Headspace in VOA Vials (>5-6mm)?	☐ Yes	☑ No	☐ N/A	10.
Trip Blank Present?	☑ Yes	☐ No	☐ N/A	11.
Trip Blank Custody Seals Present?	☐ Yes	☑ No	☐ N/A	

CLIENT NOTIFICATION/RESOLUTION

Field Data Required? ☐ Yes ☐ No

Person Contacted: _____ Date/Time: _____

Comments/Sample Discrepancy: _____

Project Manager SCURF Review: JY **Date:** 1/31/17

Project Manager SRF Review: JY **Date:** 1/31/17

(2) VG9U - Trip Blank 1-26-17, 715

Note: Whenever there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office (i.e. Out of hold, incorrect preservative, out of temp, incorrect containers)

(3) BPIN - MW-2, 1-26-17, 1600 Radium
(1) BP2U - MW-2, 1-26-17, 1600 TDS.
(1) BP3U - MW-2, 1-26-17, 1600 300.0.
(1) BP3N - MW-2, 1-26-17, 1600 6020.
(1) BP3N - MW-2, 1-26-17, 1600 6010/7470

(3) DG9H - MW-2, 1-26-17 1600 8260
(3) BPIN - AMB, 1-26-17, 1615, Radium
(1) BP2U AMB, 1-26-17, 1615, TDS.
(1) BP3U - AMB, 1-26-17, 1615, 300.0
(1) BP3N AMB, 1-26-17, 1615 6020
(1) BP3N AMB, 1-26-17 1615 6010/7470

(3) DG9H - AMB 3260, 1-26-17 1615
(3) BPIN - EQ Blank, 1-26-17, 1630 Radium
(1) BP2U - EQ Blank, 1-26-17, 1630, TDS
(1) BP3U - EQ Blank, 1-26-17, 1630, 300.0
(1) BP3N - EQ Blank, 1-26-17, 1630, 6020
(1) BP3N - EQ Blank, 1-26-17, 1630, 6010/7470
(3) DG9H EQ Blank, 1-26-17/1630 8260.

Pace Analytical®	Document Name: Sample Condition Upon Receipt(SCUR)	Page 2 of 2
	Document No.: F-CAR-CS-033-Rev.01	Issuing Authority: Pace Quality Office

*Check mark top half of box if pH and/or dechlorination is verified and within the acceptance range for preservation samples.

**Bottom half of box is to list number of bottles

Project # **WO#: 92327973**

PM: KRG Due Date: 02/03/17

CLIENT: 92-HDR

Item#	BP4U-125 mL Plastic Unpreserved (N/A) (Cl-)	BP3U-250 mL Plastic Unpreserved (N/A)	BP2U-500 mL Plastic Unpreserved (N/A)	BP1U-1 liter Plastic Unpreserved (N/A)	BP3S-250 mL Plastic H2SO4 (pH < 2) (Cl-)	BP3N-250 mL plastic HNO3 (pH < 2)	BP3Z-250 mL Plastic ZN Acetate & NaOH (>9)	BP3C-250 mL Plastic NaOH (pH > 12) (Cl-)	WGFU-Wide-mouthed Glass jar Unpreserved	AG1U-1 liter Amber Unpreserved (N/A) (Cl-)	AG1H-1 liter Amber HCl (pH < 2)	AG3U-250 mL Amber Unpreserved (N/A) (Cl-)	AG1S-1 liter Amber H2SO4 (pH < 2)	AG3S-250 mL Amber H2SO4 (pH < 2)	AG3A(DG3A)-250 mL Amber NH4Cl (N/A)(Cl-)	DG9H-40 mL VOA HCl (N/A)	VG9T-40 mL VOA Na2S2O3 (N/A)	VG9U-40 mL VOA Unp (N/A) Trip Blank	DG9P-40 mL VOA H3PO4 (N/A)	VOAK (6 vials per kit)-5035 kit (N/A)	V/GK (3 vials per kit)-VPH/Gas kit (N/A)	SP5T-125 mL Sterile Plastic (N/A – lab)	SP2T-250 mL Sterile Plastic (N/A – lab)	BPIN	BP3A-250 mL Plastic (NH2)2SO4 (9.3-9.7)	Cubitainer	VSGU-20 mL Scintillation vials (N/A)	GN
1		1	1	+	1-26	2 17 2										3								3				
2		1	1			2										3								3				
3		1	1			2										3								3				
4																		2										
5																												
6																												
7																												
8																												
9																												
10																												
11																												
12																												

pH Adjustment Log for Preserved Samples

Sample ID	Type of Preservative	pH upon receipt	Date preservation adjusted	Time preservation adjusted	Amount of Preservative added	Lot #

Pace Analytical

CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

Page : 1 Of 1

Section A Required Client Information:		Section B Required Project Information:		Section C Invoice Information:	
Company:	HDR Engineering	Report To:	Sean Quarry	Attention:	
Address:	440 South Church Street	Copy To:		Company Name:	
Charlotte, NC 28202				Address:	
Email:	sean.quarry@hdrinc.com	Purchase Order #:		Pace Quote:	
Phone:	(704)248-3632 Fax	Project Name:	Charrah-Brickhaven	Pace Project Manager:	kevin.godwin@pacelabs.com,
Requested Due Date:		Project #:		Pace Profile #:	7672-1

Regulatory Agency:

State / Location: NC

Requested Analysis Filtered (Y/N)

ITEM #	SAMPLE ID (One Character per box. (A-Z, 0-9 / , -) Sample Ids must be unique)	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED START DATE	COLLECTED START TIME	COLLECTED END DATE	COLLECTED END TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Preservatives: Unpreserved	H2SO4	HNO3	HCl	NaOH	Na2S2O3	Methanol	Other	Y/N	Analyses Test: Trip BLANK	8260	300.0-Cl,F,Sulfate	TDS	Radium 226/228	6010/7470	6020 (B, Li)	Residual Chlorine (Y/N)	92327973
1	MW-2	WT	G			1-26-17	1600		12										2	3	1	1	3	1	1		001
2	AMB	WT	G			1-26-17	1615		10											3	1	1	3	1	1		002
3	EQ Blank	WT	G			1-26-17	1630		10											3	1	1	3	1	1		003
4																											004
5																											
6																											
7																											
8																											
9																											
10																											
11																											
12																											

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	SAMPLE CONDITIONS: TEMP in C	Received on Ice (Y/N)	Custody Sealed Cooler (Y/N)	Samples Intact (Y/N)
	William Thomas Pace	1-26-17	1750	Pace	1/26/17	1750				
	Pace	1-27-17	0915	PACE HVL	1-27-17	~~09~~ 1340 JS 2-1-17	1.9	Y	N	Y

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER: William Thomas

SIGNATURE of SAMPLER: William Thomas DATE Signed: 1-26-17

C

Appendix C – Electronic Data Deliverables (CD-ROM only)

D

Appendix D – Interwell Statistical Analysis

Summary Results of Chemstat Interwell Statistical Analysis for Groundwater Parameters

Brickhaven No. 2 Mine Tract “A” Structure Fill Site, January 2017

Interwell statistical analysis was conducted for the detected groundwater results during the January 2017 sampling event in the Brickhaven No. 2 Mine Tract “A” Structure Fill Site. All laboratory groundwater parameters for the background well (BG-1) and all compliance wells (MW-1 to MW-8) are included in the statistical analysis, which have been monitored for 9 events since August 2015. The results are summarized as follows:

1 Procedures

Interwell comparisons of parameter concentrations present in background and compliance wells are calculated based on historical data and the most recent sampling event. Groundwater monitoring data from both background well (BG-1) and downgradient wells (MW-1 to MW-8) from the past 9 monitoring events are input to the statistical program. One well (MW-7) was dry this sampling event and data were not collected. Comparisons are used to determine whether statistically significant increases (SSI) in compliance well concentrations have occurred relative to the pooled data from the background well for the most recent monitoring event and to assess whether trends exist. These calculations are performed using Starpoint Software, Inc.’s ChemStat® software package, Version 6.3.0.2. The groundwater monitoring at the site is considered as detection monitoring. Therefore statistical options and methods applicable to groundwater detection monitoring are selected. The interwell groundwater statistical methods selected are consistent with the Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities – Unified Guidance (USEPA, March 2009. The methods and the statistical procedures are outlined in the attached Interwell Statistical Analysis Flow Chart.

Steps in this analytical process depend on the proportion of samples that are considered to be “non-detects” (NDs) or otherwise below the Method Reporting Limit (MRL).

1.1 Test for Outliers

Parameters measured during prior sampling events and the most recent monitoring period (i.e., the entire record for a parameter pooled over the 8 downgradient wells and the background well) are tested for outliers using Rosner’s test (valid for sample sizes > 25). Any values identified as outliers are noted in a statistical summary table. However, outliers are not removed from subsequent analyses unless the analytical result’s quality assurance review determined that values in question were impacted and sources of impact were known. Outlier tests are not performed for parameters that do not have any measured values greater than its applicable MRL.

1.2 Adjustment of Non-Detects (NDs)

NDs (commonly described as “non-detects”) represent analytical results reported as below the MRL and are adjusted based on the percentage of bMRL values. When less than 15 percent of values for a parameter are NDs, those values are replaced with a value equals to ½ the MRL. When 15 percent to 50 percent of values are reported as NDs, the Aitcheson Adjustment is used. When more than 50 percent of values for a parameter are reported NDs, the value for a non-detect is replaced with the MRL.

1.3 Distribution Assessment

Data are evaluated to determine whether the distribution of each constituent for background well satisfies normality assumptions for further statistical analysis. Normality is evaluated using the Shapiro-Wilks test, which applies to cases where there are fewer than 50 samples from the 8 historic monitoring events from the background well. Distributions are first evaluated using non-transformed data and then, if the distribution does not satisfy normality assumptions, it is tested again using natural log (ln) transformed data.

1.4 Interwell Comparisons to Background Well Prediction Limits

Parameter concentrations from compliance wells are compared to corresponding Prediction Limits (PLs) from the background well. Concentrations measured during the most recent sampling event represent the compliance well condition in the interwell comparison. As previously described in the “Prediction Limit for Background Well Parameters” reported separately, the entire record of measurements from the background well is evaluated to determine whether a Parametric Prediction Limit (PPL) or a Non-parametric Prediction Limit (NPPL) can be used to estimate background well PLs. This evaluation depends on the percentage of measurements below their MRL and whether a distribution satisfies normality assumptions. For parameters with less than 50 percent of measurements from all wells reported as below their MRL and a distribution that satisfies normality assumptions from the background well, a PPL is calculated. For Parameters with >50 percent measurements reported as below their MRL or having a distribution that does not satisfy normality assumptions, a NPPL is calculated.

1.4.1 PPL Procedures

During the interwell PPL comparison, the detected result of the most recent monitoring event for the downgradient wells is compared to the PPL of the background well (BG-1).

1.4.2 NPPL Procedure

For parameters where more than 50 percent of the data were below the MRL (<50%ND) or where no discernable distribution was found, provided at least 4 detects were observed, a NPPL was calculated using 95% Chebyshev Upper Prediction Limit (95%CUPL). Otherwise, another NPPL method is used, in which the higher of either the MRL or the maximum detected result from the background well is used as the upper limit.

1.4.3 Interwell Comparison

The detected parameters above the MRL from each compliance well during the January 2017 sampling event is compared to the background well Parametric or non-parametric Prediction

Limit. Parameters are considered to be not statistically significant above the background data if the concentration from the compliance well is less than the background well's UPL. Otherwise, compliance well values are evaluated to determine the nature of any increases and trends over time.

1.5 Statistically Significant Increase (SSI) and Trend Assessment

If the most recently sampled compliance well value exceeds the background well UPL, then that value represents a statistically significant increase (SSI) over background. When the UPLs are exceeded, HDR will provide interpretation as to the impact of the exceedance by referencing the trend results. A statistically significant trend where concentrations are increasing over time does suggest that future samples are at a higher risk of exceedances than trends that are either flat or declining over time. The Thiel-Sen procedure ("Sen's Slope Estimator") is used to evaluate trends for each parameter where an SSI is found for the January 2017 monitoring event. The Sen's trend analysis will help to project if the result for a parameter will be increased, decreased, or unchanged. If the data had 5 or more non-detects over the 8 sampling events, no trend analysis was done as little statistical information can be gleaned at that level of censorship.

1.6 Time Series Plots

Graphs of concentration versus time for all wells are provided for each parameter. The trends in the time series plots graphically display changes in concentrations over time and substantiate the findings from Sen's Slope Estimator tests. The time series plots for all detected parameters can be found in the attached Output for Interwell Statistical Analysis and Time Series Plots.

2 Statistical Results

2.1 Outliers

The following outliers were detected during the January 2017 monitoring event are outliers relative to all these parameters' values collected over the nine sampling events from all wells:

- MW-1: SO4;
- MW-2: B, Cl, Cr, Li, Ni, and SO4;
- MW-3: Li;
- MW-8: Ba, Cr, Ni and Zn.

The outliers are included in the interwell statistics.

2.2 Prediction Limit Results

Based on the results from the "Prediction Limits for Background Well Parameters" report, the parameters Ba, Ca, Cl, Li, Ra-226, Ra-228, SO4, and TDS from the background wells follow normal distributions. Parametric 95 percent upper prediction limits (95% UPL) were estimated for these parameters. Compliance observations for these parameters from the January 2017 sampling event were compared to their respective 95% UPLs. Both boron (B) and Fluoride (F) data in background well follow a normal distribution pattern after data conversion to natural

logarithm scale. The Ln-95% UPL for both B and F were calculated and then converted back to 95% UPL. The detected B and F samples from the compliance wells were compared to their respective 95% UPLs.

For parameters with detections at or fewer than twice during the 9 sampling events from the background well (including Tl, Cr, Mo, Ni, and Zn), the UPLs were calculated using the Non-Parametric Prediction Limit (NPPL) method.

All the results are shown in the attached summary table (Table 1 Summary of Interwell Chemstat Statistics). The results are summarized as follows:

Parameters with Statistically Significant Increase above Background PL (SSI):

- **Antimony**: Antimony detected from MW-2 has statistically significant increases (SSIs) above the NPPL of background well. But the results did not show any trend.
- **Barium**: Barium observations from MW-3 and MW-8 have statistically significant increases (SSIs) above the background 95% UPL. But barium results show no trend over time for these wells using Sen's slope estimator tests.
- **Boron**: Boron observations from MW-2 and MW-5 have SSIs compared to the background 95% UPL. But the results show no trend or downward trend over time using Sen's slope estimator tests.
- **Calcium**: Calcium observations from MW-1 to MW-4 MW-8 have SSIs compared to the background 95% UPL. But the results show no trend overtime using Sen's slope estimator test.
- **Chloride**: Chloride observations from MW-1 to MW-4 and MW-8 have SSIs compared to the background 95% UPL. But only the result for MW-2 showed upward trend over time using Sen's slope estimator tests.
- **Chromium**: Chromium detected at MW-1, MW-2, and MW-8 have SSI compared to the background NPPL; but there is no trend in the chromium results over time at this well using Sen's slope estimator test.
- **Fluoride**: Fluoride observations from MW-5 and MW-6 have SSIs compared to the background 95% UPL. But the fluoride results showed no trend or downward trend over time for these wells using Sen's slope estimator tests.
- **Lithium**: Lithium observations from MW-2 and MW-3 have SSIs compared to the background 95% UPL. The results at MW-2 showed an upward trend, but there is no trend at MW-3 over time using Sen's slope estimator tests.
- **Molybdenum**: Molybdenum observations detected at MW-2, MW-3, and MW-4 showed SSIs above the background NPPL; but the results did not show any increasing trend over time using Sen's slope estimator tests.

- **Sulfate**: Sulfate observations from MW-2, MW-3, and MW-6 have SSIs over the background 95% UPL. But the results showed no trend over time for these wells using Sen's slope estimator tests.
- **Total Dissolved Solids** (TDS): TDS observations from MW-1, MW-2, MW-4, MW-6, and MW-8 have SSIs from the background 95% UPL. But the results show no trend over time for all wells except at MW-2 where TDS shows an upward trend using Sen's slope estimator tests.
- **Zinc**: Zinc observations detected from MW-2 and MW-8 have SSIs above the NPPL of background well; but Sen's slope test did not show any increasing trend for zinc from all these wells over time using Sen's slope estimator tests.

The remaining monitored parameters either are not detected, not above the MRL or are not statistically significant above the background concentration levels.

3 Literature Cited

USEPA, 2009. Unified Guidance - Statistical analysis of groundwater monitoring data at RCRA facilities. Office of Resource Conservation and Recovery Program Implementation and Information Division. EAP 530-R-09-007.

Attachments:

Interwell Statistical Analysis Flow Chart
Table 1 - Summary of Interwell Chemstat Statistics
Output for Interwell Statistical Analysis and Time Series Plots

FLOW CHART 1
INTERWELL COMPARISON CALCULATION
METHODS FOR DETECTED GROUNDWATER PARAMETERS

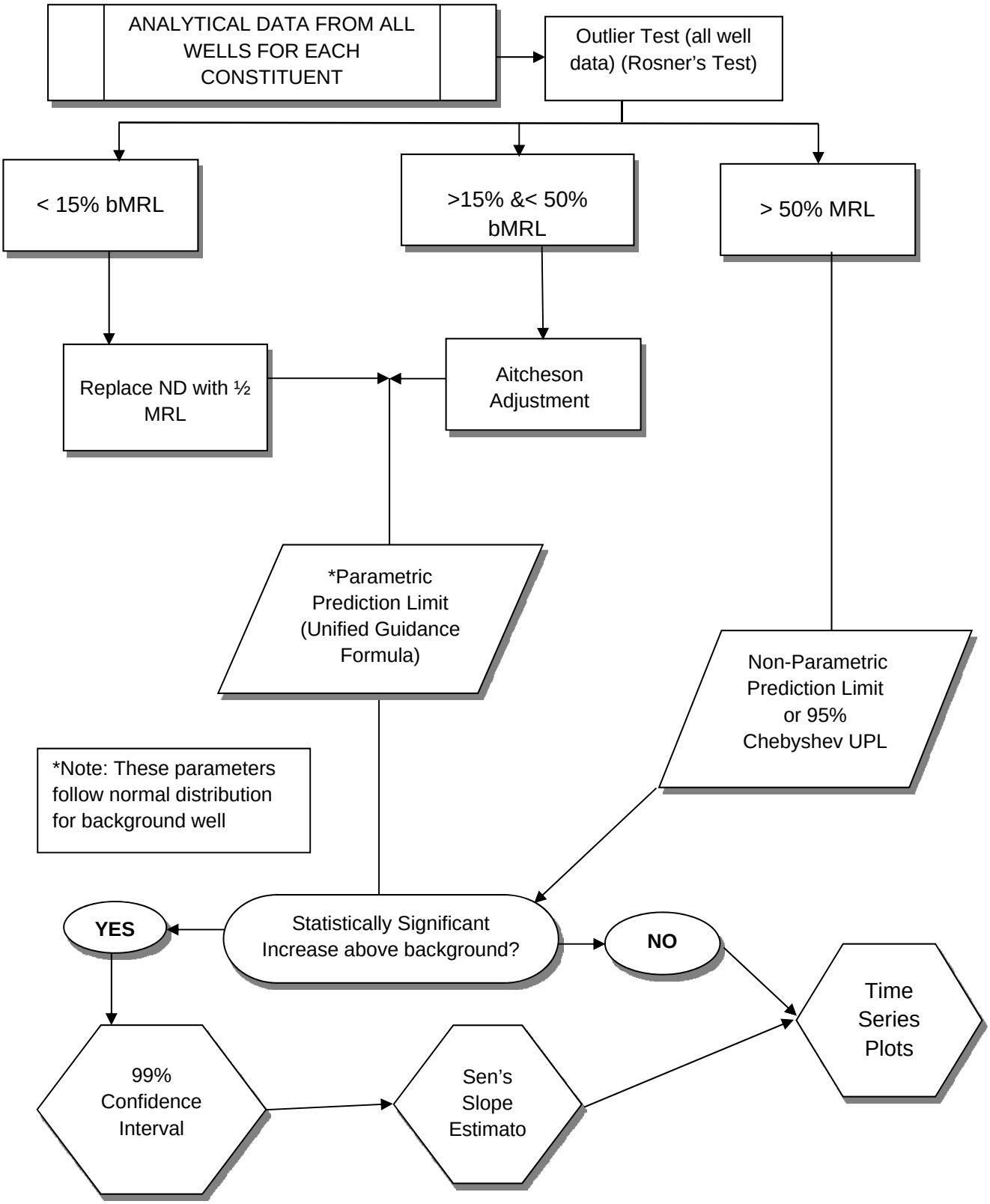


Table 1
Summary for Interwell Chemstat Statistics for Detected Groundwater Parameters Above the Method Reporting Limits
Charah Inc. Moncure Mine RD Structured Fill Site
Monitoring Event: January 23-26, 2017

WELL ID	PARAMETER	UNITS	RESULT	MRL	Rosner's Outlier	Total Monitoring Events	% ND (Background Well)	Shapiro-Wilks Normality Test	Non-Det. Adjustment	Background Well			SSI	99% LCL	Sen's Slope	Standard Value (2L Std./GWPS/SWSL)
										Ln-95%UPL	95% UPL	NPPL				
MW-2	Antimony	ug/L	5.6	5.0	No	9	88.9		MRL			5	Yes		No Trend	6***
MW-1	Barium	ug/L	131.0	5.0	No	9	0	Normal	NA		493		No			700*
MW-2	Barium	ug/L	203.0	5.0	No	9	0	Normal	NA		493		No			700*
MW-3	Barium	ug/L	531.0	5.0	No	9	0	Normal	NA		493		Yes	598	No Trend	700*
MW-4	Barium	ug/L	330.0	5.0	No	9	0	Normal	NA		493		No			700*
MW-5	Barium	ug/L	90.7	5.0	No	9	0	Normal	NA		493		No			700*
MW-6	Barium	ug/L	122.0	5.0	No	9	0	Normal	NA		493		No			700*
MW-8	Barium	ug/L	**1,360**	5.0	Yes	9	0	Normal	NA		493		Yes	1172	No Trend	700*
MW-2	Boron	ug/L	52.1	25.0	Yes	9	11	Ln-Normal	1/2MRL	2.8	16.4		Yes	33.5	No Trend	700*
MW-5	Boron	ug/L	39.3	25.0	No	9	11	Ln-Normal	1/2MRL	2.8	16.4		Yes	4.9	No Trend	700*
MW-1	Calcium	ug/L	112,000	1000	No	9	0	Normal	NA		41598		Yes	55,431	No Trend	NE
MW-2	Calcium	ug/L	214,000	1000	No	9	0	Normal	NA		41598		Yes	133,802	No Trend	NE
MW-3	Calcium	ug/L	160,000	500	No	9	0	Normal	NA		41598		Yes	162,801	No Trend	NE
MW-4	Calcium	ug/L	68,200	100	No	9	0	Normal	NA		41598		Yes	24563	No Trend	NE
MW-5	Calcium	ug/L	9,140	100	No	9	0	Normal	NA		41598		No			NE
MW-6	Calcium	ug/L	34,500	100	No	9	0	Normal	NA		41598		No			NE
MW-8	Calcium	ug/L	169,000	500	No	9	0	Normal	NA		41598		Yes	120,069	No Trend	NE
MW-1	Chloride	mg/L	**401**	8.0	No	9	0	Normal	NA		345		Yes	167	No Trend	250*
MW-2	Chloride	mg/L	**1,320**	25.0	Yes	9	0	Normal	NA		345		Yes	893	Upward	250*
MW-3	Chloride	mg/L	**1,060**	20.0	No	9	0	Normal	NA		345		Yes	1077	No Trend	250*
MW-4	Chloride	mg/L	**513**	10.0	No	9	0	Normal	NA		345		Yes	162	No Trend	250*
MW-5	Chloride	mg/L	18.2	1.0	No	9	0	Normal	NA		345		No			250*
MW-6	Chloride	mg/L	**263.0**	5.0	No	9	0	Normal	NA		345		No			250*
MW-8	Chloride	mg/L	**660**	13.0	No	9	0	Normal	NA		345		Yes	461	No Trend	250*
MW-1	Chromium	ug/L	6.6	5.0	No	9	100		MRL			5	Yes	3.33	No Trend	10*
MW-2	Chromium	ug/L	**29.5**	5.0	Yes	9	100		MRL			5	Yes	3.65	No Trend	10*
MW-8	Chromium	ug/L	**82.0**	5.0	Yes	9	100		MRL			5	Yes	0	No Trend	10*
MW-1	Fluoride	mg/L	0.12	0.10	No	9	0	Ln-Normal	NA	-1.3	0.27		No			2*
MW-4	Fluoride	mg/L	0.21	0.10	No	9	0	Ln-Normal	NA	-1.3	0.27		No			2*
MW-5	Fluoride	mg/L	0.52	0.10	No	9	0	Ln-Normal	NA	-1.3	0.27		Yes	0.491	Downward	2*
MW-6	Fluoride	mg/L	0.38	0.10	No	9	0	Ln-Normal	NA	-1.3	0.27		Yes	0.288	No Trend	2*
MW-1	Lithium	ug/L	31.2	2.5	No	9	0	Normal	NA		48.7		No			NE
MW-2	Lithium	ug/L	195.0	2.5	Yes	9	0	Normal	NA		48.7		Yes	34.4	Upward	NE
MW-3	Lithium	ug/L	103.0	2.5	Yes	9	0	Normal	NA		48.7		Yes	50.9	No Trend	NE
MW-4	Lithium	ug/L	28.3	2.5	No	9	0	Normal	NA		48.7		No			NE
MW-5	Lithium	ug/L	9.4	2.5	No	9	0	Normal	NA		48.7		No			NE
MW-6	Lithium	ug/L	48.5	2.5	No	9	0	Normal	NA		48.7		No			NE
MW-8	Lithium	ug/L	38.3	2.5	No	9	0	Normal	NA		48.7		No			NE
MW-2	Molybdenum	ug/L	13.1	5.0	No	9	77		MRL			6.8	Yes	10.2	No Trend	NE
MW-3	Molybdenum	ug/L	7.2	5.0	No	9	77		MRL			6.8	Yes	7.78	No Trend	NE
MW-4	Molybdenum	ug/L	8.9	5.0	No	9	77		MRL			6.8	Yes	3.29	No Trend	NE
MW-2	Nickel	ug/L	15.2	5.0	Yes	9	88		MRL			5	Yes	4.15	No Trend	100*
MW-8	Nickel	ug/L	42.1	5.0	Yes	9	88		MRL			5	Yes	0	No Trend	100*

Summary for Interwell Chemstat Statistics for Detected Groundwater Parameters Above the Method Reporting Limits
Charah Inc. Moncure Mine RD Structured Fill Site
Monitoring Event: January 23-26, 2017

WELL ID	PARAMETER	UNITS	RESULT	MRL	Rosner's Outlier	Total Monitoring Events	% ND (Background Well)	Shapiro-Wilks Normality Test	Non-Det. Adjustment	Background Well			SSI	99% LCL	Sen's Slope	Standard Value (2L Std./GWPS/SWSL)
										Ln-95%UPL	95% UPL	NPPL				
MW-2	Radium-226	pCi/L	1.02		No	9	11	Normal	1/2MRL		1.27		No			5[ε]
MW-3	Radium-226	pCi/L	1.25		No	9	11	Normal	1/2MRL		1.27		No			5[ε]
MW-4	Radium-226	pCi/L	0.224		No	9	11	Normal	1/2MRL		1.27		No			5[ε]
MW-5	Radium-226	pCi/L	0.0732		No	9	11	Normal	1/2MRL		1.27		No			5[ε]
MW-6	Radium-226	pCi/L	0.126		No	9	11	Normal	1/2MRL		1.27		No			5[ε]
MW-8	Radium-226	pCi/L	0.0618		No	9	11	Normal	1/2MRL		1.27		No			5[ε]
MW-1	Radium-228	pCi/L	0.237		No	9	11	Normal	1/2MRL		1.88		No			5[ε]
MW-2	Radium-228	pCi/L	0.979		No	9	11	Normal	1/2MRL		1.88		No			5[ε]
MW-3	Radium-228	pCi/L	0.387		No	9	11	Normal	1/2MRL		1.88		No			5[ε]
MW-4	Radium-228	pCi/L	0.243		No	9	11	Normal	1/2MRL		1.88		No			5[ε]
MW-5	Radium-228	pCi/L	1.08		No	9	11	Normal	1/2MRL		1.88		No			5[ε]
MW-6	Radium-228	pCi/L	0.416		No	9	11	Normal	1/2MRL		1.88		No			5[ε]
MW-8	Radium-228	pCi/L	0.392		No	9	11	Normal	1/2MRL		1.88		No			5[ε]
MW-1	Sulfate	mg/L	7	1	No	9	0	Normal	NA		26		No			250*
MW-2	Sulfate	mg/L	**338**	25	Yes	9	0	Normal	NA		26		Yes	147	No Trend	250*
MW-3	Sulfate	mg/L	174	3	Yes	9	0	Normal	NA		26		Yes	0	No Trend	250*
MW-4	Sulfate	mg/L	10	1	No	9	0	Normal	NA		26		No			250*
MW-5	Sulfate	mg/L	3.7	1	No	9	0	Normal	NA		26		No			250*
MW-6	Sulfate	mg/L	145	5	No	9	0	Normal	NA		26		Yes	49.1	No Trend	250*
MW-8	Sulfate	mg/L	6	1	No	9	0	Normal	NA		26		No			250*
MW-1	TDS	mg/L	**931**	25	No	9	0	Normal	NA		718		Yes	496	No Trend	500*
MW-2	TDS	mg/L	**2,780**	50	No	9	0	Normal	NA		718		Yes	1438	Upward	500*
MW-3	TDS	mg/L	303	25	No	9	0	Normal	NA		718		No			500*
MW-4	TDS	mg/L	**1,150**	25	No	9	0	Normal	NA		718		Yes	522	No Trend	500*
MW-5	TDS	mg/L	220	25	No	9	0	Normal	NA		718		No			500*
MW-6	TDS	mg/L	**776**	25	No	9	0	Normal	NA		718		Yes	558	No Trend	500*
MW-8	TDS	mg/L	**1,270**	25	No	9	0	Normal	NA		718		Yes	812	No Trend	500*
MW-2	Zinc	ug/L	15.8	10.0	No	9	77		MRL			10	Yes	2.25	No Trend	1000*
MW-8	Zinc	ug/L	29.2	10.0	Yes	9	77		MRL			10	Yes	7.49	No Trend	1000*

Note: MRL = Method Reporting Limit;
%ND = Percentage of historic data not detected above the MRL;
Shaded cell indicates that the analysis for the parameter is not required;
Ln-Normal - Data set shows normal distribution after natual log conversion;
95%UPL -95% Upper Prediction Limit (one side);
Ln-95% UPL - 95% upper prediction limit in natural log scale (one side);
SSI = Statistically Significant Increase over the background data;
NPPL - Non-parametric Prediction Limit;

* - 2L standard;
** - Groundwater Protection Standard;
*** - SWSL or NCDNR Solid Waste Standard;
NE - Not Established. Groundwater standard (2L, MCL, or GWPS) was not established;
Result in bold number is above the groundwater standard;
NA - Not Apply.
ε-Combined standard for Ra-226 and Ra-228.

Concentrations (ug/L)

Parameter: Antimony

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

Total Measurements: 80
Total Non-Detect: 44
Percent Non-Detects: 55%
Total Background Measurements: 9
There is 1 background location

Loc.	Meas.	ND	Date	Conc.	Original
BG-1	9	8 (88.8889%)	8/12/2015	0.55 J	0.55 J
			10/15/2015	ND<5 U	ND<5 U
			11/18/2015	ND<5 U	ND<5 U
			1/4/2016	ND<5 U	ND<5 U
			2/16/2016	ND<5 U	ND<5 U
			4/5/2016	ND<5 U	ND<5 U
			5/26/2016	ND<5 U	ND<5 U
			7/12/2016	ND<5 U	ND<5 U
			1/23/2017	ND<5 U	ND<5 U

There are 8 compliance locations

Loc.	Meas.	ND	Date	Conc.	Original
MW-1	9	7 (77.7778%)	8/12/2015	0.54 J	0.54 J
			10/15/2015	ND<5 U	ND<5 U
			11/20/2015	ND<5 U	ND<5 U
			1/6/2016	ND<5 U	ND<5 U
			2/17/2016	ND<5 U	ND<5 U
			4/6/2016	ND<5 U	ND<5 U
			5/27/2016	ND<5 U	ND<5 U
			7/12/2016	6.1	6.1
			1/25/2017	ND<5 U	ND<5 U
MW-2	9	0 (0%)	8/12/2015	0.72 J	0.72 J
			10/15/2015	9.4	9.4
			11/19/2015	9.3	9.3
			1/6/2016	8.7	8.7
			2/17/2016	10.7	10.7
			4/6/2016	10.6	10.6
			5/27/2016	8.9	8.9
			7/12/2016	12.3	12.3
			1/26/2017	5.6	5.6
MW-3	9	1 (11.1111%)	8/12/2015	0.44 J	0.44 J
			10/15/2015	12	12
			11/19/2015	10.1	10.1
			1/5/2016	9.2	9.2
			2/16/2016	10.8	10.8
			4/7/2016	8.7	8.7
			5/27/2016	10.7	10.7
			7/11/2016	11.4	11.4
			1/24/2017	ND<5 U	ND<5 U
MW-4	9	7 (77.7778%)	8/12/2015	0.26 J	0.26 J

			10/15/2015	ND<5 U	ND<5 U
			11/19/2015	ND<5 U	ND<5 U
			1/4/2016	ND<5 U	ND<5 U
			2/16/2016	5	5
			4/7/2016	ND<5 U	ND<5 U
			5/25/2016	ND<5 U	ND<5 U
			7/13/2016	ND<5 U	ND<5 U
			1/25/2017	ND<5 U	ND<5 U
MW-5	9	8 (88.8889%)	8/12/2015	0.58 J	0.58 J
			10/15/2015	ND<5 U	ND<5 U
			11/18/2015	ND<5 U	ND<5 U
			1/4/2016	ND<5 U	ND<5 U
			2/16/2016	ND<5 U	ND<5 U
			4/5/2016	ND<5 U	ND<5 U
			5/25/2016	ND<5 U	ND<5 U
			7/11/2016	ND<5 U	ND<5 U
			1/23/2017	ND<5 U	ND<5 U
MW-6	9	7 (77.7778%)	8/12/2015	0.53 J	0.53 J
			10/19/2015	5.6	5.6
			11/20/2015	ND<5 U	ND<5 U
			1/5/2016	ND<5 U	ND<5 U
			2/17/2016	ND<5 U	ND<5 U
			4/5/2016	ND<5 U	ND<5 U
			5/26/2016	ND<5 U	ND<5 U
			7/11/2016	ND<5 U	ND<5 U
			1/24/2017	ND<5 U	ND<5 U
MW-7	8	5 (62.5%)	8/12/2015	0.63 J	0.63 J
			10/16/2015	5.9	5.9
			11/20/2015	ND<5 U	ND<5 U
			1/5/2016	ND<5 U	ND<5 U
			2/18/2016	ND<5 U	ND<5 U
			4/6/2016	5.5	5.5
			5/26/2016	ND<5 U	ND<5 U
			7/11/2016	ND<5 U	ND<5 U
MW-8	9	1 (11.1111%)	8/12/2015	1.1	1.1
			10/15/2015	6.3	6.3
			11/20/2015	10.1	10.1
			1/6/2016	7.6	7.6
			2/18/2016	6.5	6.5
			4/6/2016	8.1	8.1
			5/26/2016	7.5	7.5
			7/12/2016	7.2	7.2
			1/24/2017	ND<5 U	ND<5 U

There are 0 unused locations

Loc.	Meas.	ND	Date	Conc.	Original

Rosner's Test for Outliers

Parameter: Antimony

All Locations

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

Data set mean = 5.68938

10 most extreme of 80 measurements

by order of magnitude difference from the mean

1	7/12/2016	MW-2	12.3	6.61063
2	10/15/2015	MW-3	12	6.31062
3	7/11/2016	MW-3	11.4	5.71063
4	8/12/2015	MW-4	0.26 J	-5.42938
5	8/12/2015	MW-3	0.44 J	-5.24937
6	8/12/2015	MW-6	0.53 J	-5.15937
7	8/12/2015	MW-1	0.54 J	-5.14938
8	8/12/2015	BG-1	0.55 J	-5.13938
9	2/16/2016	MW-3	10.8	5.11063
10	8/12/2015	MW-5	0.58 J	-5.10938

Iteration i = 9

Mean of 71 measurements = 5.72296
Std Dev = 2.12429
x(i+1) = 0.58 from measurement 8/12/2015 from location MW-5
Rosner Statistic R = |0.58 - 5.72296|/2.12429 = 2.42103
Lambda(80, 10, 0.05) = 3.26
2.42103 < 3.26 -- No outliers detected for i = 9

Iteration i = 8

Mean of 72 measurements = 5.79347
Std Dev = 2.1925
x(i+1) = 10.8 from measurement 2/16/2016 from location MW-3
Rosner Statistic R = |10.8 - 5.79347|/2.1925 = 2.28348
Lambda(80, 9, 0.05) = 3.266
2.28348 < 3.266 -- No outliers detected for i = 8

Iteration i = 7

Mean of 73 measurements = 5.72164
Std Dev = 2.26206
x(i+1) = 0.55 from measurement 8/12/2015 from location BG-1
Rosner Statistic R = |0.55 - 5.72164|/2.26206 = 2.28625
Lambda(80, 8, 0.05) = 3.272
2.28625 < 3.272 -- No outliers detected for i = 7

Iteration i = 6

Mean of 74 measurements = 5.65162
Std Dev = 2.32587
x(i+1) = 0.54 from measurement 8/12/2015 from location MW-1
Rosner Statistic R = |0.54 - 5.65162|/2.32587 = 2.19773
Lambda(80, 7, 0.05) = 3.278
2.19773 < 3.278 -- No outliers detected for i = 6

Iteration i = 5
Mean of 75 measurements = 5.58333
Std Dev = 2.3846
x(i+1) = 0.53 from measurement 8/12/2015 from location MW-6
Rosner Statistic R = |0.53 - 5.58333|/2.3846 = 2.11916
Lambda(80, 6, 0.05) = 3.284
2.11916 < 3.284 -- No outliers detected for i = 5

Iteration i = 4
Mean of 76 measurements = 5.51566
Std Dev = 2.44102
x(i+1) = 0.44 from measurement 8/12/2015 from location MW-3
Rosner Statistic R = |0.44 - 5.51566|/2.44102 = 2.07932
Lambda(80, 5, 0.05) = 3.29
2.07932 < 3.29 -- No outliers detected for i = 4

Iteration i = 3
Mean of 77 measurements = 5.4474
Std Dev = 2.49778
x(i+1) = 0.26 from measurement 8/12/2015 from location MW-4
Rosner Statistic R = |0.26 - 5.4474|/2.49778 = 2.07681
Lambda(80, 4, 0.05) = 3.29
2.07681 < 3.29 -- No outliers detected for i = 3

Iteration i = 2
Mean of 78 measurements = 5.52372
Std Dev = 2.57141
x(i+1) = 11.4 from measurement 7/11/2016 from location MW-3
Rosner Statistic R = |11.4 - 5.52372|/2.57141 = 2.28524
Lambda(80, 3, 0.05) = 3.3
2.28524 < 3.3 -- No outliers detected for i = 2

Iteration i = 1
Mean of 79 measurements = 5.6057
Std Dev = 2.65674
x(i+1) = 12 from measurement 10/15/2015 from location MW-3
Rosner Statistic R = |12 - 5.6057|/2.65674 = 2.40682
Lambda(80, 2, 0.05) = 3.3
2.40682 < 3.3 -- No outliers detected for i = 1

Iteration i = 0
Mean of 80 measurements = 5.68938
Std Dev = 2.74392
x(i+1) = 12.3 from measurement 7/12/2016 from location MW-2
Rosner Statistic R = |12.3 - 5.68938|/2.74392 = 2.40919
Lambda(80, 1, 0.05) = 3.31
2.40919 < 3.31 -- No outliers detected for i = 0

Non-Parametric Prediction Interval

Inter-Well Comparison

Parameter: Antimony

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

Total Percent Non-Detects = 54.1667%
Number of comparisons = 7
Future Samples (k) = 7
Recent Dates = 1
Background Measurements (n) = 9
Maximum Background Value = 5
Confidence Level = 56.3%
False Positive Rate = 43.7%

Location	Date	Count	Mean	Significant
MW-1	1/25/2017	1	5	FALSE
MW-2	**1/26/2017**	**1**	**5.6**	**TRUE**
MW-3	1/24/2017	1	5	FALSE
MW-4	1/25/2017	1	5	FALSE
MW-5	1/23/2017	1	5	FALSE
MW-6	1/24/2017	1	5	FALSE
MW-8	1/24/2017	1	5	FALSE

Sen's Slope Analysis

Parameter: Antimony

Location: MW-2

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

90% Confidence Level

Xj	Xk	(Xj - Xk)/(j-k)	Q
9.4 (10/15/2015)	0.72 J (8/12/2015)	(9.4 - 0.72)/(2 - 1)	8.68
9.3 (11/19/2015)	0.72 J (8/12/2015)	(9.3 - 0.72)/(3 - 1)	4.29
8.7 (1/6/2016)	0.72 J (8/12/2015)	(8.7 - 0.72)/(4 - 1)	2.66
10.7 (2/17/2016)	0.72 J (8/12/2015)	(10.7 - 0.72)/(5 - 1)	2.495
10.6 (4/6/2016)	0.72 J (8/12/2015)	(10.6 - 0.72)/(6 - 1)	1.976
8.9 (5/27/2016)	0.72 J (8/12/2015)	(8.9 - 0.72)/(7 - 1)	1.36333
12.3 (7/12/2016)	0.72 J (8/12/2015)	(12.3 - 0.72)/(8 - 1)	1.65429
5.6 (1/26/2017)	0.72 J (8/12/2015)	(5.6 - 0.72)/(9 - 1)	0.61
9.3 (11/19/2015)	9.4 (10/15/2015)	(9.3 - 9.4)/(3 - 2)	-0.1
8.7 (1/6/2016)	9.4 (10/15/2015)	(8.7 - 9.4)/(4 - 2)	-0.35
10.7 (2/17/2016)	9.4 (10/15/2015)	(10.7 - 9.4)/(5 - 2)	0.433333
10.6 (4/6/2016)	9.4 (10/15/2015)	(10.6 - 9.4)/(6 - 2)	0.3
8.9 (5/27/2016)	9.4 (10/15/2015)	(8.9 - 9.4)/(7 - 2)	-0.1
12.3 (7/12/2016)	9.4 (10/15/2015)	(12.3 - 9.4)/(8 - 2)	0.483333
5.6 (1/26/2017)	9.4 (10/15/2015)	(5.6 - 9.4)/(9 - 2)	-0.542857
8.7 (1/6/2016)	9.3 (11/19/2015)	(8.7 - 9.3)/(4 - 3)	-0.6
10.7 (2/17/2016)	9.3 (11/19/2015)	(10.7 - 9.3)/(5 - 3)	0.7
10.6 (4/6/2016)	9.3 (11/19/2015)	(10.6 - 9.3)/(6 - 3)	0.433333
8.9 (5/27/2016)	9.3 (11/19/2015)	(8.9 - 9.3)/(7 - 3)	-0.1
12.3 (7/12/2016)	9.3 (11/19/2015)	(12.3 - 9.3)/(8 - 3)	0.6
5.6 (1/26/2017)	9.3 (11/19/2015)	(5.6 - 9.3)/(9 - 3)	-0.616667
10.7 (2/17/2016)	8.7 (1/6/2016)	(10.7 - 8.7)/(5 - 4)	2
10.6 (4/6/2016)	8.7 (1/6/2016)	(10.6 - 8.7)/(6 - 4)	0.95
8.9 (5/27/2016)	8.7 (1/6/2016)	(8.9 - 8.7)/(7 - 4)	0.0666667
12.3 (7/12/2016)	8.7 (1/6/2016)	(12.3 - 8.7)/(8 - 4)	0.9
5.6 (1/26/2017)	8.7 (1/6/2016)	(5.6 - 8.7)/(9 - 4)	-0.62
10.6 (4/6/2016)	10.7 (2/17/2016)	(10.6 - 10.7)/(6 - 5)	-0.1
8.9 (5/27/2016)	10.7 (2/17/2016)	(8.9 - 10.7)/(7 - 5)	-0.9
12.3 (7/12/2016)	10.7 (2/17/2016)	(12.3 - 10.7)/(8 - 5)	0.533333
5.6 (1/26/2017)	10.7 (2/17/2016)	(5.6 - 10.7)/(9 - 5)	-1.275
8.9 (5/27/2016)	10.6 (4/6/2016)	(8.9 - 10.6)/(7 - 6)	-1.7
12.3 (7/12/2016)	10.6 (4/6/2016)	(12.3 - 10.6)/(8 - 6)	0.85
5.6 (1/26/2017)	10.6 (4/6/2016)	(5.6 - 10.6)/(9 - 6)	-1.66667
12.3 (7/12/2016)	8.9 (5/27/2016)	(12.3 - 8.9)/(8 - 7)	3.4
5.6 (1/26/2017)	8.9 (5/27/2016)	(5.6 - 8.9)/(9 - 7)	-1.65
5.6 (1/26/2017)	12.3 (7/12/2016)	(5.6 - 12.3)/(9 - 8)	-6.7

Number of Q values = 36

Ordered Q Values

n	Q
1	-6.7
2	-1.7
3	-1.66667
4	-1.65
5	-1.275
6	-0.9
7	-0.62
8	-0.616667
9	-0.6
10	-0.542857
11	-0.35
12	-0.1
13	-0.1
14	-0.1
15	-0.1
16	0.0666667
17	0.3
18	0.433333
19	0.433333
20	0.483333
21	0.533333
22	0.6
23	0.61
24	0.7
25	0.85
26	0.9
27	0.95
28	1.36333
29	1.65429
30	1.976
31	2
32	2.495
33	2.66
34	3.4
35	4.29
36	8.68

Sen's Estimator (Median Q) is 0.433333

Time Period	Observations
8/12/2015	1
10/15/2015	1
11/19/2015	1
1/6/2016	1
2/17/2016	1
4/6/2016	1
5/27/2016	1
7/12/2016	1
1/26/2017	1

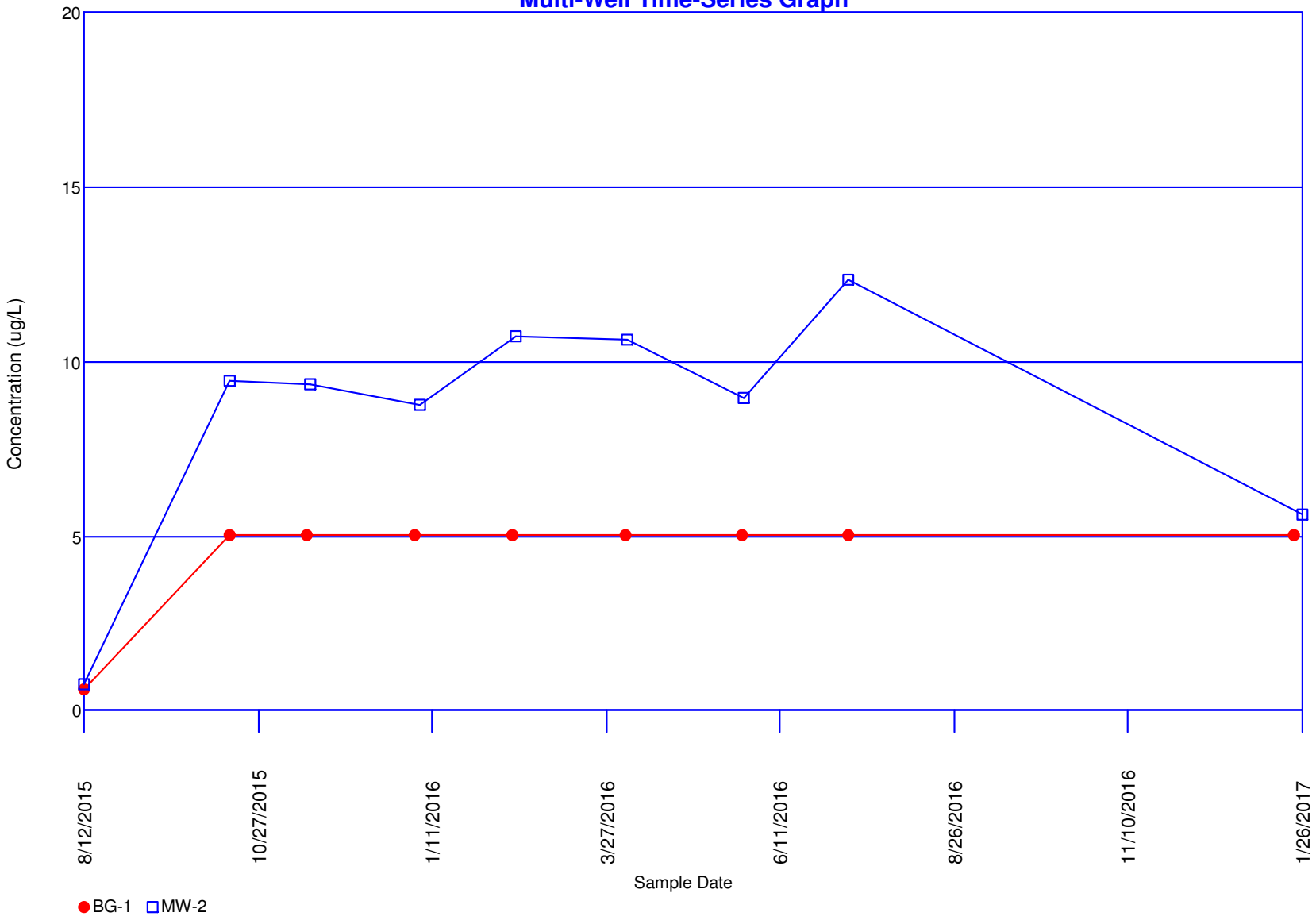
There are 0 time periods with multiple data

A = 0
B = 0
C = 0
D = 0
E = 0
F = 0

a = 1656
b = 4536
c = 144
Group Variance = 92
For 90% confidence interval (two-tailed), Z at (1-0.9)/2 = 1.64485
C = 15.7769
M1 = (36 - 15.7769)/2.0 = 10.1116
M2 = (36 + 15.7769)/2.0 + 1 = 26.8884
Lower limit is -0.542857 = Q(10)
Upper limit is 0.95 = Q(27)
-0.542857 < 0 < 0.95 indicating no trend in data.

Antimony

Multi-Well Time-Series Graph



Concentrations (ug/L)

Parameter: Barium

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

Total Measurements: 79
Total Non-Detect: 0
Percent Non-Detects: 0%
Total Background Measurements: 9
There is 1 background location

Loc.	Meas.	ND	Date	Conc.	Original
BG-1	9	0 (0%)	8/12/2015	380	380
			10/15/2015	443	443
			11/18/2015	344	344
			1/4/2016	310	310
			2/16/2016	354	354
			4/5/2016	302	302
			5/26/2016	330	330
			7/12/2016	363	363
			1/23/2017	321	321

There are 8 compliance locations

Loc.	Meas.	ND	Date	Conc.	Original
MW-1	9	0 (0%)	8/12/2015	230	230
			10/15/2015	117	117
			11/20/2015	153	153
			1/6/2016	220	220
			2/17/2016	70.3	70.3
			4/6/2016	129	129
			5/27/2016	121	121
			7/12/2016	225	225
			1/25/2017	131	131
MW-2	9	0 (0%)	8/12/2015	270	270
			10/15/2015	372	372
			11/19/2015	306	306
			1/6/2016	262	262
			2/17/2016	318	318
			4/6/2016	230	230
			5/27/2016	197	197
			7/12/2016	220	220
			1/26/2017	203	203
MW-3	8	0 (0%)	10/15/2015	860	860
			11/19/2015	718	718
			1/5/2016	802	802
			2/16/2016	855	855
			4/7/2016	578	578
			5/27/2016	728	728
			7/11/2016	728	728
			1/24/2017	531	531
MW-4	9	0 (0%)	8/12/2015	390	390
			10/15/2015	232	232

			11/19/2015	191	191
			1/4/2016	176	176
			2/16/2016	157	157
			4/7/2016	85.9	85.9
			5/25/2016	90.5	90.5
			7/13/2016	257	257
			1/25/2017	330	330
MW-5	9	0 (0%)	8/12/2015	160	160
			10/15/2015	306	306
			11/18/2015	93.2	93.2
			1/4/2016	102	102
			2/16/2016	129	129
			4/5/2016	91.4	91.4
			5/25/2016	100	100
			7/11/2016	93	93
			1/23/2017	90.7	90.7
MW-6	9	0 (0%)	8/12/2015	110	110
			10/19/2015	117	117
			11/20/2015	142	142
			1/5/2016	140	140
			2/17/2016	118	118
			4/5/2016	108	108
			5/26/2016	88.3	88.3
			7/11/2016	89.8	89.8
			1/24/2017	122	122
MW-7	8	0 (0%)	8/12/2015	290	290
			10/16/2015	237	237
			11/20/2015	364	364
			1/5/2016	269	269
			2/18/2016	254	254
			4/6/2016	208	208
			5/26/2016	222	222
			7/11/2016	224	224
MW-8	9	0 (0%)	8/12/2015	1100	1100
			10/15/2015	1240	1240
			11/20/2015	1550	1550
			1/6/2016	1430	1430
			2/18/2016	1490	1490
			4/6/2016	1220	1220
			5/26/2016	1260	1260
			7/12/2016	1200	1200
			1/24/2017	1360	1360

There are 0 unused locations

Loc.	Meas.	ND	Date	Conc.	Original

Rosner's Test for Outliers

Parameter: Barium

All Locations

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

Data set mean = 389.229

10 most extreme of 79 measurements

by order of magnitude difference from the mean

1	11/20/2015	MW-8	1550	1160.77
2	2/18/2016	MW-8	1490	1100.77
3	1/6/2016	MW-8	1430	1040.77
4	1/24/2017	MW-8	1360	970.771
5	5/26/2016	MW-8	1260	870.771
6	10/15/2015	MW-8	1240	850.771
7	4/6/2016	MW-8	1220	830.771
8	7/12/2016	MW-8	1200	810.771
9	8/12/2015	MW-8	1100	710.771
10	10/15/2015	MW-3	860	470.771

Iteration i = 9

Mean of 70 measurements = 269.987
Std Dev = 192.977
x(i+1) = 860 from measurement 10/15/2015 from location MW-3
Rosner Statistic R = |860 - 269.987|/192.977 = 3.05742
Lambda(79, 10, 0.05) = 3.255
3.05742 < 3.255 -- No outliers detected for i = 9

Iteration i = 8

Mean of 71 measurements = 281.677
Std Dev = 215.433
x(i+1) = 1100 from measurement 8/12/2015 from location MW-8
Rosner Statistic R = |1100 - 281.677|/215.433 = 3.7985
Lambda(79, 9, 0.05) = 3.261
3.7985 > 3.261 -- Measurement 8/12/2015 for location MW-8 is an outlier

---

Iteration i = 7

Mean of 72 measurements = 294.432
Std Dev = 239.73
x(i+1) = 1200 from measurement 7/12/2016 from location MW-8
Rosner Statistic R = |1200 - 294.432|/239.73 = 3.77745
Lambda(79, 8, 0.05) = 3.267
Measurement 7/12/2016 for location MW-8 is an outlier

Iteration i = 6

Mean of 73 measurements = 307.111
Std Dev = 261.548
x(i+1) = 1220 from measurement 4/6/2016 from location MW-8
Rosner Statistic R = |1220 - 307.111|/261.548 = 3.49033
Lambda(79, 7, 0.05) = 3.273
Measurement 4/6/2016 for location MW-8 is an outlier

Iteration i = 5
Mean of 74 measurements = 319.718
Std Dev = 281.48
x(i+1) = 1240 from measurement 10/15/2015 from location MW-8
Rosner Statistic R = |1240 - 319.718|/281.48 = 3.26944
Lambda(79, 6, 0.05) = 3.279
Measurement 10/15/2015 for location MW-8 is an outlier

Iteration i = 4
Mean of 75 measurements = 332.255
Std Dev = 299.915
x(i+1) = 1260 from measurement 5/26/2016 from location MW-8
Rosner Statistic R = |1260 - 332.255|/299.915 = 3.09337
Lambda(79, 5, 0.05) = 3.285
Measurement 5/26/2016 for location MW-8 is an outlier

Iteration i = 3
Mean of 76 measurements = 345.778
Std Dev = 320.387
x(i+1) = 1360 from measurement 1/24/2017 from location MW-8
Rosner Statistic R = |1360 - 345.778|/320.387 = 3.16562
Lambda(79, 4, 0.05) = 3.285
Measurement 1/24/2017 for location MW-8 is an outlier

Iteration i = 2
Mean of 77 measurements = 359.858
Std Dev = 341.414
x(i+1) = 1430 from measurement 1/6/2016 from location MW-8
Rosner Statistic R = |1430 - 359.858|/341.414 = 3.13444
Lambda(79, 3, 0.05) = 3.295
Measurement 1/6/2016 for location MW-8 is an outlier

Iteration i = 1
Mean of 78 measurements = 374.347
Std Dev = 362.525
x(i+1) = 1490 from measurement 2/18/2016 from location MW-8
Rosner Statistic R = |1490 - 374.347|/362.525 = 3.07745
Lambda(79, 2, 0.05) = 3.295
Measurement 2/18/2016 for location MW-8 is an outlier

Iteration i = 0
Mean of 79 measurements = 389.229
Std Dev = 383.712
x(i+1) = 1550 from measurement 11/20/2015 from location MW-8
Rosner Statistic R = |1550 - 389.229|/383.712 = 3.02511
Lambda(79, 1, 0.05) = 3.305
Measurement 11/20/2015 for location MW-8 is an outlier

Shapiro-Wilks Test of Normality

Parameter: Barium

All Locations

Normality Test of Parameter Concentrations

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

K = 4 for 9 measurements

i	x(i)	x(n-i+1)	x(n-1+1)-x(i)	a(n-i+1)	b(i)
1	302	443	141	0.5888	83.0208
2	310	380	70	0.3244	22.708
3	321	363	42	0.1976	8.2992
4	330	354	24	0.0947	2.2728
5	344	344	0		
6	354	330	-24		
7	363	321	-42		
8	380	310	-70		
9	443	302	-141		

Sum of b values = 116.301
Sample Standard Deviation = 43.177
W Statistic = 0.906925

5% Critical value of 0.829 is less than 0.906925
Data is normally distributed at 95% level of significance

1% Critical value of 0.764 is less than 0.906925
Data is normally distributed at 99% level of significance

Parametric Prediction Interval Analysis

Inter-Well Comparison

Parameter: Barium

Original Data (Not Transformed)

Non-Detects Replaced with 1/2 DL

Inter-Well Unified Guid. Formula 95% One-Sided Comparison

Background Samples = 9
Background Mean = 349.667
Background Std Dev = 43.177

Number of comparisons = 7
Future Samples (k) = 7
Actual confidence level is 1.0 - (0.05/7) = 99.2857 %
t is Percentile of Student's T-Test (0.95/7) = 0.992857
Degrees of Freedom = 9 (background observations) - 1
t(0.992857, 9) = 3.1587

Well MW-1

Date	Samples	Mean	Interval	Significant
1/25/2017	1	131	[0, 493.427]	FALSE

Well MW-2

Date	Samples	Mean	Interval	Significant
1/26/2017	1	203	[0, 493.427]	FALSE

Well MW-3

Date	Samples	Mean	Interval	Significant
1/24/2017	**1**	**531**	**[0, 493.427]**	**TRUE**

Well MW-4

Date	Samples	Mean	Interval	Significant
1/25/2017	1	330	[0, 493.427]	FALSE

Well MW-5

Date	Samples	Mean	Interval	Significant
1/23/2017	1	90.7	[0, 493.427]	FALSE

Well MW-6

Date	Samples	Mean	Interval	Significant
1/24/2017	1	122	[0, 493.427]	FALSE

Well MW-8

Date	Samples	Mean	Interval	Significant
1/24/2017	**1**	**1360**	**[0, 493.427]**	**TRUE**

Sen's Slope Analysis

Parameter: Barium

Location: MW-3

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

90% Confidence Level

Xj	Xk	(Xj - Xk)/(j-k)	Q
718 (11/19/2015)	860 (10/15/2015)	(718 - 860)/(2 - 1)	-142
802 (1/5/2016)	860 (10/15/2015)	(802 - 860)/(3 - 1)	-29
855 (2/16/2016)	860 (10/15/2015)	(855 - 860)/(4 - 1)	-1.66667
578 (4/7/2016)	860 (10/15/2015)	(578 - 860)/(5 - 1)	-70.5
728 (5/27/2016)	860 (10/15/2015)	(728 - 860)/(6 - 1)	-26.4
728 (7/11/2016)	860 (10/15/2015)	(728 - 860)/(7 - 1)	-22
531 (1/24/2017)	860 (10/15/2015)	(531 - 860)/(8 - 1)	-47
802 (1/5/2016)	718 (11/19/2015)	(802 - 718)/(3 - 2)	84
855 (2/16/2016)	718 (11/19/2015)	(855 - 718)/(4 - 2)	68.5
578 (4/7/2016)	718 (11/19/2015)	(578 - 718)/(5 - 2)	-46.6667
728 (5/27/2016)	718 (11/19/2015)	(728 - 718)/(6 - 2)	2.5
728 (7/11/2016)	718 (11/19/2015)	(728 - 718)/(7 - 2)	2
531 (1/24/2017)	718 (11/19/2015)	(531 - 718)/(8 - 2)	-31.1667
855 (2/16/2016)	802 (1/5/2016)	(855 - 802)/(4 - 3)	53
578 (4/7/2016)	802 (1/5/2016)	(578 - 802)/(5 - 3)	-112
728 (5/27/2016)	802 (1/5/2016)	(728 - 802)/(6 - 3)	-24.6667
728 (7/11/2016)	802 (1/5/2016)	(728 - 802)/(7 - 3)	-18.5
531 (1/24/2017)	802 (1/5/2016)	(531 - 802)/(8 - 3)	-54.2
578 (4/7/2016)	855 (2/16/2016)	(578 - 855)/(5 - 4)	-277
728 (5/27/2016)	855 (2/16/2016)	(728 - 855)/(6 - 4)	-63.5
728 (7/11/2016)	855 (2/16/2016)	(728 - 855)/(7 - 4)	-42.3333
531 (1/24/2017)	855 (2/16/2016)	(531 - 855)/(8 - 4)	-81
728 (5/27/2016)	578 (4/7/2016)	(728 - 578)/(6 - 5)	150
728 (7/11/2016)	578 (4/7/2016)	(728 - 578)/(7 - 5)	75
531 (1/24/2017)	578 (4/7/2016)	(531 - 578)/(8 - 5)	-15.6667
728 (7/11/2016)	728 (5/27/2016)	(728 - 728)/(7 - 6)	0
531 (1/24/2017)	728 (5/27/2016)	(531 - 728)/(8 - 6)	-98.5

531 (1/24/2017)	728 (7/11/2016)	(531 - 728)/(8 - 7)	-197

Number of Q values = 28

Ordered Q Values

n	Q
1	-277
2	-197
3	-142
4	-112
5	-98.5
6	-81
7	-70.5
8	-63.5
9	-54.2
10	-47
11	-46.6667
12	-42.3333
13	-31.1667
14	-29
15	-26.4
16	-24.6667
17	-22
18	-18.5
19	-15.6667
20	-1.66667
21	0
22	2
23	2.5
24	53
25	68.5
26	75
27	84
28	150

Sen's Estimator (Median Q) is -27.7

Tied Group	Value	Members
1	728	2

Time Period	Observations
10/15/2015	1
11/19/2015	1
1/5/2016	1
2/16/2016	1
4/7/2016	1
5/27/2016	1
7/11/2016	1
1/24/2017	1

There are 0 time periods with multiple data

A = 18
B = 0
C = 0
D = 0
E = 2
F = 0
a = 1176
b = 3024
c = 112
Group Variance = 64.3333
For 90% confidence interval (two-tailed), Z at (1-0.9)/2 = 1.64485
C = 13.193
M1 = (28 - 13.193)/2.0 = 7.40348
M2 = (28 + 13.193)/2.0 + 1 = 21.5965
Lower limit is -70.5 = Q(7)
Upper limit is 2 = Q(22)
-70.5 < 0 < 2 indicating no trend in data.

Sen's Slope Analysis

Parameter: Barium

Location: MW-8

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

90% Confidence Level

Xj	Xk	(Xj - Xk)/(j-k)	Q
1240 (10/15/2015)	1100 (8/12/2015)	(1240 - 1100)/(2 - 1)	140
1550 (11/20/2015)	1100 (8/12/2015)	(1550 - 1100)/(3 - 1)	225
1430 (1/6/2016)	1100 (8/12/2015)	(1430 - 1100)/(4 - 1)	110
1490 (2/18/2016)	1100 (8/12/2015)	(1490 - 1100)/(5 - 1)	97.5
1220 (4/6/2016)	1100 (8/12/2015)	(1220 - 1100)/(6 - 1)	24
1260 (5/26/2016)	1100 (8/12/2015)	(1260 - 1100)/(7 - 1)	26.6667
1200 (7/12/2016)	1100 (8/12/2015)	(1200 - 1100)/(8 - 1)	14.2857
1360 (1/24/2017)	1100 (8/12/2015)	(1360 - 1100)/(9 - 1)	32.5
1550 (11/20/2015)	1240 (10/15/2015)	(1550 - 1240)/(3 - 2)	310
1430 (1/6/2016)	1240 (10/15/2015)	(1430 - 1240)/(4 - 2)	95
1490 (2/18/2016)	1240 (10/15/2015)	(1490 - 1240)/(5 - 2)	83.3333
1220 (4/6/2016)	1240 (10/15/2015)	(1220 - 1240)/(6 - 2)	-5
1260 (5/26/2016)	1240 (10/15/2015)	(1260 - 1240)/(7 - 2)	4
1200 (7/12/2016)	1240 (10/15/2015)	(1200 - 1240)/(8 - 2)	-6.66667
1360 (1/24/2017)	1240 (10/15/2015)	(1360 - 1240)/(9 - 2)	17.1429
1430 (1/6/2016)	1550 (11/20/2015)	(1430 - 1550)/(4 - 3)	-120
1490 (2/18/2016)	1550 (11/20/2015)	(1490 - 1550)/(5 - 3)	-30
1220 (4/6/2016)	1550 (11/20/2015)	(1220 - 1550)/(6 - 3)	-110
1260 (5/26/2016)	1550 (11/20/2015)	(1260 - 1550)/(7 - 3)	-72.5
1200 (7/12/2016)	1550 (11/20/2015)	(1200 - 1550)/(8 - 3)	-70
1360 (1/24/2017)	1550 (11/20/2015)	(1360 - 1550)/(9 - 3)	-31.6667
1490 (2/18/2016)	1430 (1/6/2016)	(1490 - 1430)/(5 - 4)	60
1220 (4/6/2016)	1430 (1/6/2016)	(1220 - 1430)/(6 - 4)	-105
1260 (5/26/2016)	1430 (1/6/2016)	(1260 - 1430)/(7 - 4)	-56.6667
1200 (7/12/2016)	1430 (1/6/2016)	(1200 - 1430)/(8 - 4)	-57.5
1360 (1/24/2017)	1430 (1/6/2016)	(1360 - 1430)/(9 - 4)	-14
1220 (4/6/2016)	1490 (2/18/2016)	(1220 - 1490)/(6 - 5)	-270
1260 (5/26/2016)	1490 (2/18/2016)	(1260 - 1490)/(7 - 5)	-115
1200 (7/12/2016)	1490 (2/18/2016)	(1200 - 1490)/(8 - 5)	-96.6667
1360 (1/24/2017)	1490 (2/18/2016)	(1360 - 1490)/(9 - 5)	-32.5
1260 (5/26/2016)	1220 (4/6/2016)	(1260 - 1220)/(7 - 6)	40
1200 (7/12/2016)	1220 (4/6/2016)	(1200 - 1220)/(8 - 6)	-10
1360 (1/24/2017)	1220 (4/6/2016)	(1360 - 1220)/(9 - 6)	46.6667
1200 (7/12/2016)	1260 (5/26/2016)	(1200 - 1260)/(8 - 7)	-60
1360 (1/24/2017)	1260 (5/26/2016)	(1360 - 1260)/(9 - 7)	50
1360 (1/24/2017)	1200 (7/12/2016)	(1360 - 1200)/(9 - 8)	160

Number of Q values = 36

Ordered Q Values

n	Q
1	-270
2	-120
3	-115
4	-110
5	-105
6	-96.6667
7	-72.5
8	-70
9	-60
10	-57.5
11	-56.6667
12	-32.5
13	-31.6667
14	-30
15	-14
16	-10
17	-6.66667
18	-5
19	4
20	14.2857
21	17.1429
22	24
23	26.6667
24	32.5
25	40
26	46.6667
27	50
28	60
29	83.3333
30	95
31	97.5
32	110
33	140
34	160
35	225
36	310

Sen's Estimator (Median Q) is -0.5

Time Period	Observations
8/12/2015	1
10/15/2015	1
11/20/2015	1
1/6/2016	1
2/18/2016	1
4/6/2016	1
5/26/2016	1
7/12/2016	1
1/24/2017	1

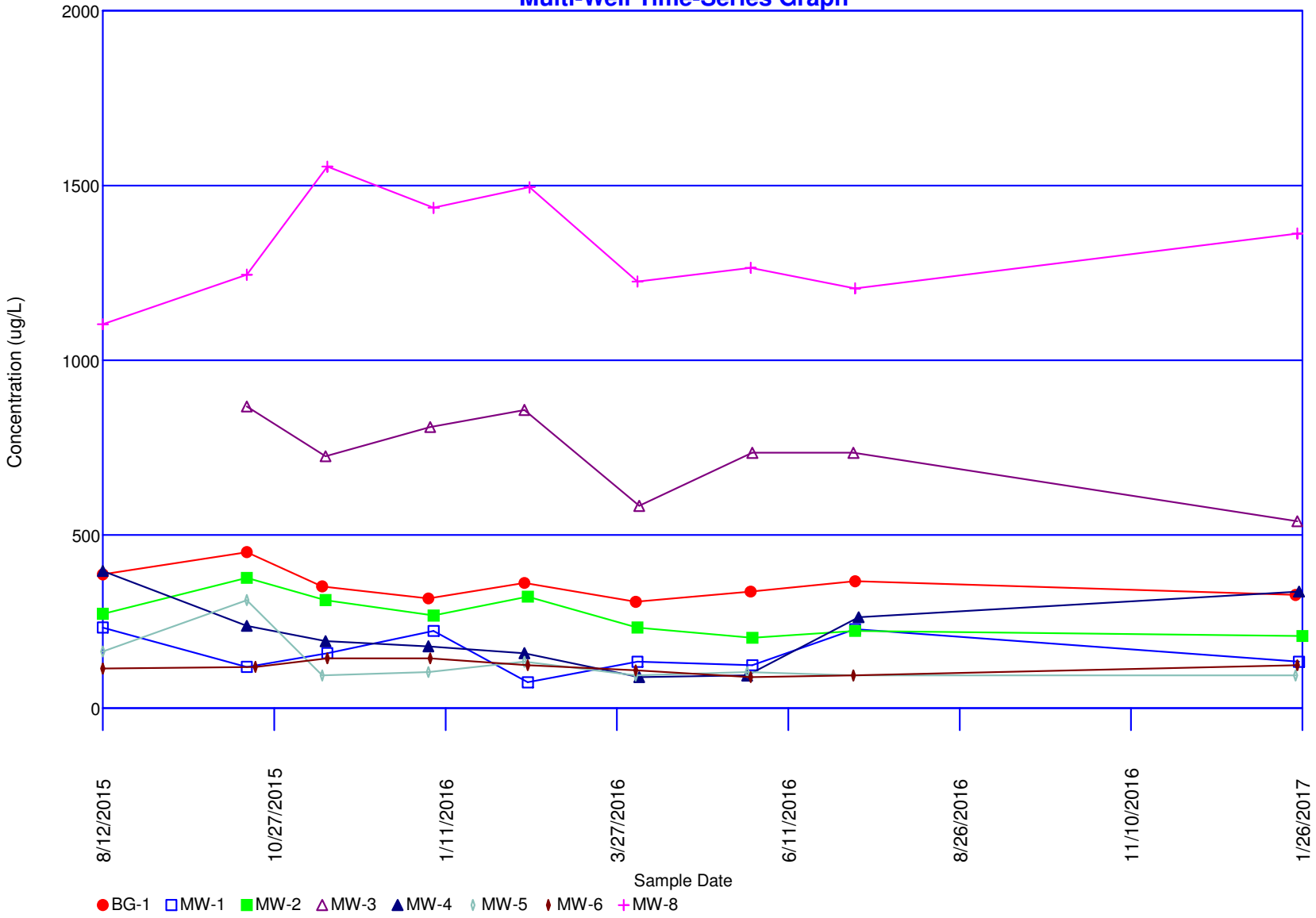
There are 0 time periods with multiple data

A = 0
B = 0
C = 0
D = 0
E = 0
F = 0

a = 1656
b = 4536
c = 144
Group Variance = 92
For 90% confidence interval (two-tailed), Z at (1-0.9)/2 = 1.64485
C = 15.7769
M1 = (36 - 15.7769)/2.0 = 10.1116
M2 = (36 + 15.7769)/2.0 + 1 = 26.8884
Lower limit is -57.5 = Q(10)
Upper limit is 50 = Q(27)
-57.5 < 0 < 50 indicating no trend in data.

Barium

Multi-Well Time-Series Graph



Concentrations (ug/L)

Parameter: Boron

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

Total Measurements: 80
Total Non-Detect: 7
Percent Non-Detects: 8.75%
Total Background Measurements: 9
There is 1 background location

Loc.	Meas.	ND	Date	Conc.	Original
BG-1	9	1 (11.1111%)	8/12/2015	8.5 J	8.5 J
			10/15/2015	6.1	6.1
			11/18/2015	5.9	5.9
			1/4/2016	7.5	7.5
			2/16/2016	5.5	5.5
			4/5/2016	6	6
			5/26/2016	6.1	6.1
			7/12/2016	7	7
			1/23/2017	ND<25 U	ND<25 U

There are 8 compliance locations

Loc.	Meas.	ND	Date	Conc.	Original
MW-1	9	1 (11.1111%)	8/12/2015	41	41
			10/15/2015	14.6	14.6
			11/20/2015	14.5	14.5
			1/6/2016	9.6	9.6
			2/17/2016	10	10
			4/6/2016	10.6	10.6
			5/27/2016	9.7	9.7
			7/12/2016	7.9	7.9
			1/25/2017	ND<25 U	ND<25 U
MW-2	9	0 (0%)	8/12/2015	51	51
			10/15/2015	25.7	25.7
			11/19/2015	40.9	40.9
			1/6/2016	37.8	37.8
			2/17/2016	37.4	37.4
			4/6/2016	47.3	47.3
			5/27/2016	40.5	40.5
			7/12/2016	39.4	39.4
			1/26/2017	52.1	52.1
MW-3	9	1 (11.1111%)	8/12/2015	49	49
			10/15/2015	38	38
			11/19/2015	49.4	49.4
			1/5/2016	42	42
			2/16/2016	35.8	35.8
			4/7/2016	42.7	42.7
			5/27/2016	39	39
			7/11/2016	41.9	41.9
			1/24/2017	ND<25 U	ND<25 U
MW-4	9	2 (22.2222%)	8/12/2015	12 J	12 J

			10/15/2015	6.2	6.2
			11/19/2015	6.2	6.2
			1/4/2016	7.2	7.2
			2/16/2016	5.7	5.7
			4/7/2016	6.8	6.8
			5/25/2016	6.4	6.4
			7/13/2016	ND<5 U	ND<5 U
			1/25/2017	ND<25 U	ND<25 U
MW-5	9	0 (0%)	8/12/2015	16 J	16 J
			10/15/2015	9	9
			11/18/2015	9.9	9.9
			1/4/2016	10.8	10.8
			2/16/2016	10.2	10.2
			4/5/2016	12.1	12.1
			5/25/2016	10.7	10.7
			7/11/2016	9.8	9.8
			1/23/2017	39.3	39.3
MW-6	9	1 (11.1111%)	8/12/2015	8.1 J	8.1 J
			10/19/2015	6.7	6.7
			11/20/2015	9.1	9.1
			1/5/2016	8.9	8.9
			2/17/2016	6.6	6.6
			4/5/2016	10.8	10.8
			5/26/2016	6.1	6.1
			7/11/2016	7.7	7.7
			1/24/2017	ND<25 U	ND<25 U
MW-7	8	0 (0%)	8/12/2015	110	110
			10/16/2015	53.1	53.1
			11/20/2015	69	69
			1/5/2016	48.3	48.3
			2/18/2016	35.3	35.3
			4/6/2016	32.1	32.1
			5/26/2016	21.2	21.2
			7/11/2016	22.7	22.7
MW-8	9	1 (11.1111%)	8/12/2015	9.9 J	9.9 J
			10/15/2015	6.3	6.3
			11/20/2015	9	9
			1/6/2016	9.2	9.2
			2/18/2016	8.7	8.7
			4/6/2016	8.9	8.9
			5/26/2016	9.3	9.3
			7/12/2016	9.6	9.6
			1/24/2017	ND<25 U	ND<25 U

There are 0 unused locations

Loc.	Meas.	ND	Date	Conc.	Original

Rosner's Test for Outliers

Parameter: Boron

All Locations

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

Data set mean = 21.7537

10 most extreme of 80 measurements

by order of magnitude difference from the mean

1	8/12/2015	MW-7	110	88.2463
2	11/20/2015	MW-7	69	47.2463
3	10/16/2015	MW-7	53.1	31.3463
4	1/26/2017	MW-2	52.1	30.3463
5	8/12/2015	MW-2	51	29.2463
6	11/19/2015	MW-3	49.4	27.6463
7	8/12/2015	MW-3	49	27.2463
8	1/5/2016	MW-7	48.3	26.5463
9	4/6/2016	MW-2	47.3	25.5463
10	4/7/2016	MW-3	42.7	20.9463

Iteration i = 9

Mean of 71 measurements = 17.0577
Std Dev = 12.7249
x(i+1) = 42.7 from measurement 4/7/2016 from location MW-3
Rosner Statistic R = |42.7 - 17.0577|/12.7249 = 2.01512
Lambda(80, 10, 0.05) = 3.26
2.01512 < 3.26 -- No outliers detected for i = 9

Iteration i = 8

Mean of 72 measurements = 17.4778
Std Dev = 13.1281
x(i+1) = 47.3 from measurement 4/6/2016 from location MW-2
Rosner Statistic R = |47.3 - 17.4778|/13.1281 = 2.27164
Lambda(80, 9, 0.05) = 3.266
2.27164 < 3.266 -- No outliers detected for i = 8

Iteration i = 7

Mean of 73 measurements = 17.9
Std Dev = 13.5265
x(i+1) = 48.3 from measurement 1/5/2016 from location MW-7
Rosner Statistic R = |48.3 - 17.9|/13.5265 = 2.24744
Lambda(80, 8, 0.05) = 3.272
2.24744 < 3.272 -- No outliers detected for i = 7

Iteration i = 6

Mean of 74 measurements = 18.3203
Std Dev = 13.9115
x(i+1) = 49 from measurement 8/12/2015 from location MW-3
Rosner Statistic R = |49 - 18.3203|/13.9115 = 2.20535
Lambda(80, 7, 0.05) = 3.278
2.20535 < 3.278 -- No outliers detected for i = 6

Iteration i = 5
Mean of 75 measurements = 18.7347
Std Dev = 14.2757
x(i+1) = 49.4 from measurement 11/19/2015 from location MW-3
Rosner Statistic R = |49.4 - 18.7347|/14.2757 = 2.14809
Lambda(80, 6, 0.05) = 3.284
2.14809 < 3.284 -- No outliers detected for i = 5

Iteration i = 4
Mean of 76 measurements = 19.1592
Std Dev = 14.6552
x(i+1) = 51 from measurement 8/12/2015 from location MW-2
Rosner Statistic R = |51 - 19.1592|/14.6552 = 2.17266
Lambda(80, 5, 0.05) = 3.29
2.17266 < 3.29 -- No outliers detected for i = 4

Iteration i = 3
Mean of 77 measurements = 19.587
Std Dev = 15.0347
x(i+1) = 52.1 from measurement 1/26/2017 from location MW-2
Rosner Statistic R = |52.1 - 19.587|/15.0347 = 2.16253
Lambda(80, 4, 0.05) = 3.29
2.16253 < 3.29 -- No outliers detected for i = 3

Iteration i = 2
Mean of 78 measurements = 20.0167
Std Dev = 15.4112
x(i+1) = 53.1 from measurement 10/16/2015 from location MW-7
Rosner Statistic R = |53.1 - 20.0167|/15.4112 = 2.14671
Lambda(80, 3, 0.05) = 3.3
2.14671 < 3.3 -- No outliers detected for i = 2

Iteration i = 1
Mean of 79 measurements = 20.6367
Std Dev = 16.2736
x(i+1) = 69 from measurement 11/20/2015 from location MW-7
Rosner Statistic R = |69 - 20.6367|/16.2736 = 2.97188
Lambda(80, 2, 0.05) = 3.3
2.97188 < 3.3 -- No outliers detected for i = 1

Iteration i = 0
Mean of 80 measurements = 21.7538
Std Dev = 19.0079
x(i+1) = 110 from measurement 8/12/2015 from location MW-7
Rosner Statistic R = |110 - 21.7538|/19.0079 = 4.6426
Lambda(80, 1, 0.05) = 3.31
4.6426 > 3.31 -- Measurement 8/12/2015 for location MW-7 is an outlier

Shapiro-Wilks Test of Normality

Parameter: Boron

All Locations

Normality Test of Parameter Concentrations

Natural Logarithm Transformation

Non-Detects Replaced with 1/2 DL

K = 4 for 9 measurements

i	x(i)	x(n-i+1)	x(n-1+1)-x(i)	a(n-i+1)	b(i)
1	1.70475	2.52573	0.820981	0.5888	0.483393
2	1.77495	2.14007	0.365114	0.3244	0.118443
3	1.79176	2.0149	0.223144	0.1976	0.0440932
4	1.80829	1.94591	0.137621	0.0947	0.0130327
5	1.80829	1.80829	0		
6	1.94591	1.80829	-0.137621		
7	2.0149	1.79176	-0.223144		
8	2.14007	1.77495	-0.365114		
9	2.52573	1.70475	-0.820981		

Sum of b values = 0.658962
Sample Standard Deviation = 0.256825
W Statistic = 0.822917

5% Critical value of 0.829 exceeds 0.822917
Evidence of non-normality at 95% level of significance

1% Critical value of 0.764 is less than 0.822917
Data is normally distributed at 99% level of significance

Parametric Prediction Interval Analysis

Inter-Well Comparison

Parameter: Boron

Natural Logarithm Transformation

Non-Detects Replaced with 1/2 DL

Inter-Well Unified Guid. Formula 95% One-Sided Comparison

Background Samples = 9
Background Mean = 1.94607
Background Std Dev = 0.256825

Number of comparisons = 7
Future Samples (k) = 7
Actual confidence level is 1.0 - (0.05/7) = 99.2857 %
t is Percentile of Student's T-Test (0.95/7) = 0.992857
Degrees of Freedom = 9 (background observations) - 1
t(0.992857, 9) = 3.1587

Well MW-1

Date	Samples	Mean	Interval	Significant
1/25/2017	1	2.52573	[0, 2.80119]	FALSE

Well MW-2

Date	Samples	Mean	Interval	Significant
1/26/2017	**1**	**3.95316**	**[0, 2.80119]**	**TRUE**

Well MW-3

Date	Samples	Mean	Interval	Significant
1/24/2017	1	2.52573	[0, 2.80119]	FALSE

Well MW-4

Date	Samples	Mean	Interval	Significant
1/25/2017	1	2.52573	[0, 2.80119]	FALSE

Well MW-5

Date	Samples	Mean	Interval	Significant
1/23/2017	**1**	**3.67122**	**[0, 2.80119]**	**TRUE**

Well MW-6

Date	Samples	Mean	Interval	Significant
1/24/2017	1	2.52573	[0, 2.80119]	FALSE

Well MW-8

Date	Samples	Mean	Interval	Significant
1/24/2017	1	2.52573	[0, 2.80119]	FALSE

Sen's Slope Analysis

Parameter: Boron

Location: MW-2

Original Data (Not Transformed)

Non-Detects Replaced with 1/2 DL

90% Confidence Level

Xj	Xk	(Xj - Xk)/(j-k)	Q
25.7 (10/15/2015)	51 (8/12/2015)	(25.7 - 51)/(2 - 1)	-25.3
40.9 (11/19/2015)	51 (8/12/2015)	(40.9 - 51)/(3 - 1)	-5.05
37.8 (1/6/2016)	51 (8/12/2015)	(37.8 - 51)/(4 - 1)	-4.4
37.4 (2/17/2016)	51 (8/12/2015)	(37.4 - 51)/(5 - 1)	-3.4
47.3 (4/6/2016)	51 (8/12/2015)	(47.3 - 51)/(6 - 1)	-0.74
40.5 (5/27/2016)	51 (8/12/2015)	(40.5 - 51)/(7 - 1)	-1.75
39.4 (7/12/2016)	51 (8/12/2015)	(39.4 - 51)/(8 - 1)	-1.65714
52.1 (1/26/2017)	51 (8/12/2015)	(52.1 - 51)/(9 - 1)	0.1375
40.9 (11/19/2015)	25.7 (10/15/2015)	(40.9 - 25.7)/(3 - 2)	15.2
37.8 (1/6/2016)	25.7 (10/15/2015)	(37.8 - 25.7)/(4 - 2)	6.05
37.4 (2/17/2016)	25.7 (10/15/2015)	(37.4 - 25.7)/(5 - 2)	3.9
47.3 (4/6/2016)	25.7 (10/15/2015)	(47.3 - 25.7)/(6 - 2)	5.4
40.5 (5/27/2016)	25.7 (10/15/2015)	(40.5 - 25.7)/(7 - 2)	2.96
39.4 (7/12/2016)	25.7 (10/15/2015)	(39.4 - 25.7)/(8 - 2)	2.28333
52.1 (1/26/2017)	25.7 (10/15/2015)	(52.1 - 25.7)/(9 - 2)	3.77143
37.8 (1/6/2016)	40.9 (11/19/2015)	(37.8 - 40.9)/(4 - 3)	-3.1
37.4 (2/17/2016)	40.9 (11/19/2015)	(37.4 - 40.9)/(5 - 3)	-1.75
47.3 (4/6/2016)	40.9 (11/19/2015)	(47.3 - 40.9)/(6 - 3)	2.13333
40.5 (5/27/2016)	40.9 (11/19/2015)	(40.5 - 40.9)/(7 - 3)	-0.1
39.4 (7/12/2016)	40.9 (11/19/2015)	(39.4 - 40.9)/(8 - 3)	-0.3
52.1 (1/26/2017)	40.9 (11/19/2015)	(52.1 - 40.9)/(9 - 3)	1.86667
37.4 (2/17/2016)	37.8 (1/6/2016)	(37.4 - 37.8)/(5 - 4)	-0.4
47.3 (4/6/2016)	37.8 (1/6/2016)	(47.3 - 37.8)/(6 - 4)	4.75
40.5 (5/27/2016)	37.8 (1/6/2016)	(40.5 - 37.8)/(7 - 4)	0.9
39.4 (7/12/2016)	37.8 (1/6/2016)	(39.4 - 37.8)/(8 - 4)	0.4
52.1 (1/26/2017)	37.8 (1/6/2016)	(52.1 - 37.8)/(9 - 4)	2.86
47.3 (4/6/2016)	37.4 (2/17/2016)	(47.3 - 37.4)/(6 - 5)	9.9
40.5 (5/27/2016)	37.4 (2/17/2016)	(40.5 - 37.4)/(7 - 5)	1.55
39.4 (7/12/2016)	37.4 (2/17/2016)	(39.4 - 37.4)/(8 - 5)	0.666667
52.1 (1/26/2017)	37.4 (2/17/2016)	(52.1 - 37.4)/(9 - 5)	3.675
40.5 (5/27/2016)	47.3 (4/6/2016)	(40.5 - 47.3)/(7 - 6)	-6.8
39.4 (7/12/2016)	47.3 (4/6/2016)	(39.4 - 47.3)/(8 - 6)	-3.95
52.1 (1/26/2017)	47.3 (4/6/2016)	(52.1 - 47.3)/(9 - 6)	1.6
39.4 (7/12/2016)	40.5 (5/27/2016)	(39.4 - 40.5)/(8 - 7)	-1.1
52.1 (1/26/2017)	40.5 (5/27/2016)	(52.1 - 40.5)/(9 - 7)	5.8
52.1 (1/26/2017)	39.4 (7/12/2016)	(52.1 - 39.4)/(9 - 8)	12.7

Number of Q values = 36

Ordered Q Values

n	Q
1	-25.3
2	-6.8
3	-5.05
4	-4.4
5	-3.95
6	-3.4
7	-3.1
8	-1.75
9	-1.75
10	-1.65714
11	-1.1
12	-0.74
13	-0.4
14	-0.3
15	-0.1
16	0.1375
17	0.4
18	0.666667
19	0.9
20	1.55
21	1.6
22	1.86667
23	2.13333
24	2.28333
25	2.86
26	2.96
27	3.675
28	3.77143
29	3.9
30	4.75
31	5.4
32	5.8
33	6.05
34	9.9
35	12.7
36	15.2

Sen's Estimator (Median Q) is 0.783333

Time Period	Observations
8/12/2015	1
10/15/2015	1
11/19/2015	1
1/6/2016	1
2/17/2016	1
4/6/2016	1
5/27/2016	1
7/12/2016	1
1/26/2017	1

There are 0 time periods with multiple data

A = 0
B = 0
C = 0
D = 0
E = 0
F = 0

a = 1656
b = 4536
c = 144
Group Variance = 92
For 90% confidence interval (two-tailed), Z at (1-0.9)/2 = 1.64485
C = 15.7769
M1 = (36 - 15.7769)/2.0 = 10.1116
M2 = (36 + 15.7769)/2.0 + 1 = 26.8884
Lower limit is -1.65714 = Q(10)
Upper limit is 3.675 = Q(27)
-1.65714 < 0 < 3.675 indicating no trend in data.

Sen's Slope Analysis

Parameter: Boron

Location: MW-5

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

90% Confidence Level

Xj	Xk	(Xj - Xk)/(j-k)	Q
9 (10/15/2015)	16 J (8/12/2015)	(9 - 16)/(2 - 1)	-7
9.9 (11/18/2015)	16 J (8/12/2015)	(9.9 - 16)/(3 - 1)	-3.05
10.8 (1/4/2016)	16 J (8/12/2015)	(10.8 - 16)/(4 - 1)	-1.73333
10.2 (2/16/2016)	16 J (8/12/2015)	(10.2 - 16)/(5 - 1)	-1.45
12.1 (4/5/2016)	16 J (8/12/2015)	(12.1 - 16)/(6 - 1)	-0.78
10.7 (5/25/2016)	16 J (8/12/2015)	(10.7 - 16)/(7 - 1)	-0.883333
9.8 (7/11/2016)	16 J (8/12/2015)	(9.8 - 16)/(8 - 1)	-0.885714
39.3 (1/23/2017)	16 J (8/12/2015)	(39.3 - 16)/(9 - 1)	2.9125
9.9 (11/18/2015)	9 (10/15/2015)	(9.9 - 9)/(3 - 2)	0.9
10.8 (1/4/2016)	9 (10/15/2015)	(10.8 - 9)/(4 - 2)	0.9
10.2 (2/16/2016)	9 (10/15/2015)	(10.2 - 9)/(5 - 2)	0.4
12.1 (4/5/2016)	9 (10/15/2015)	(12.1 - 9)/(6 - 2)	0.775
10.7 (5/25/2016)	9 (10/15/2015)	(10.7 - 9)/(7 - 2)	0.34
9.8 (7/11/2016)	9 (10/15/2015)	(9.8 - 9)/(8 - 2)	0.133333
39.3 (1/23/2017)	9 (10/15/2015)	(39.3 - 9)/(9 - 2)	4.32857
10.8 (1/4/2016)	9.9 (11/18/2015)	(10.8 - 9.9)/(4 - 3)	0.9
10.2 (2/16/2016)	9.9 (11/18/2015)	(10.2 - 9.9)/(5 - 3)	0.15
12.1 (4/5/2016)	9.9 (11/18/2015)	(12.1 - 9.9)/(6 - 3)	0.733333
10.7 (5/25/2016)	9.9 (11/18/2015)	(10.7 - 9.9)/(7 - 3)	0.2
9.8 (7/11/2016)	9.9 (11/18/2015)	(9.8 - 9.9)/(8 - 3)	-0.02
39.3 (1/23/2017)	9.9 (11/18/2015)	(39.3 - 9.9)/(9 - 3)	4.9
10.2 (2/16/2016)	10.8 (1/4/2016)	(10.2 - 10.8)/(5 - 4)	-0.6
12.1 (4/5/2016)	10.8 (1/4/2016)	(12.1 - 10.8)/(6 - 4)	0.65
10.7 (5/25/2016)	10.8 (1/4/2016)	(10.7 - 10.8)/(7 - 4)	-0.0333333
9.8 (7/11/2016)	10.8 (1/4/2016)	(9.8 - 10.8)/(8 - 4)	-0.25
39.3 (1/23/2017)	10.8 (1/4/2016)	(39.3 - 10.8)/(9 - 4)	5.7
12.1 (4/5/2016)	10.2 (2/16/2016)	(12.1 - 10.2)/(6 - 5)	1.9
10.7 (5/25/2016)	10.2 (2/16/2016)	(10.7 - 10.2)/(7 - 5)	0.25

9.8 (7/11/2016)	10.2 (2/16/2016)	(9.8 - 10.2)/(8 - 5)	-0.133333
39.3 (1/23/2017)	10.2 (2/16/2016)	(39.3 - 10.2)/(9 - 5)	7.275
10.7 (5/25/2016)	12.1 (4/5/2016)	(10.7 - 12.1)/(7 - 6)	-1.4
9.8 (7/11/2016)	12.1 (4/5/2016)	(9.8 - 12.1)/(8 - 6)	-1.15
39.3 (1/23/2017)	12.1 (4/5/2016)	(39.3 - 12.1)/(9 - 6)	9.06667
9.8 (7/11/2016)	10.7 (5/25/2016)	(9.8 - 10.7)/(8 - 7)	-0.9
39.3 (1/23/2017)	10.7 (5/25/2016)	(39.3 - 10.7)/(9 - 7)	14.3
39.3 (1/23/2017)	9.8 (7/11/2016)	(39.3 - 9.8)/(9 - 8)	29.5

Number of Q values = 36

Ordered Q Values

n	Q
1	-7
2	-3.05
3	-1.73333
4	-1.45
5	-1.4
6	-1.15
7	-0.9
8	-0.885714
9	-0.883333
10	-0.78
11	-0.6
12	-0.25
13	-0.133333
14	-0.0333333
15	-0.02
16	0.133333
17	0.15
18	0.2
19	0.25
20	0.34
21	0.4
22	0.65
23	0.733333
24	0.775

25	0.9
26	0.9
27	0.9
28	1.9
29	2.9125
30	4.32857
31	4.9
32	5.7
33	7.275
34	9.06667
35	14.3
36	29.5

Sen's Estimator (Median Q) is 0.225

Time Period	Observations
8/12/2015	1
10/15/2015	1
11/18/2015	1
1/4/2016	1
2/16/2016	1
4/5/2016	1
5/25/2016	1
7/11/2016	1
1/23/2017	1

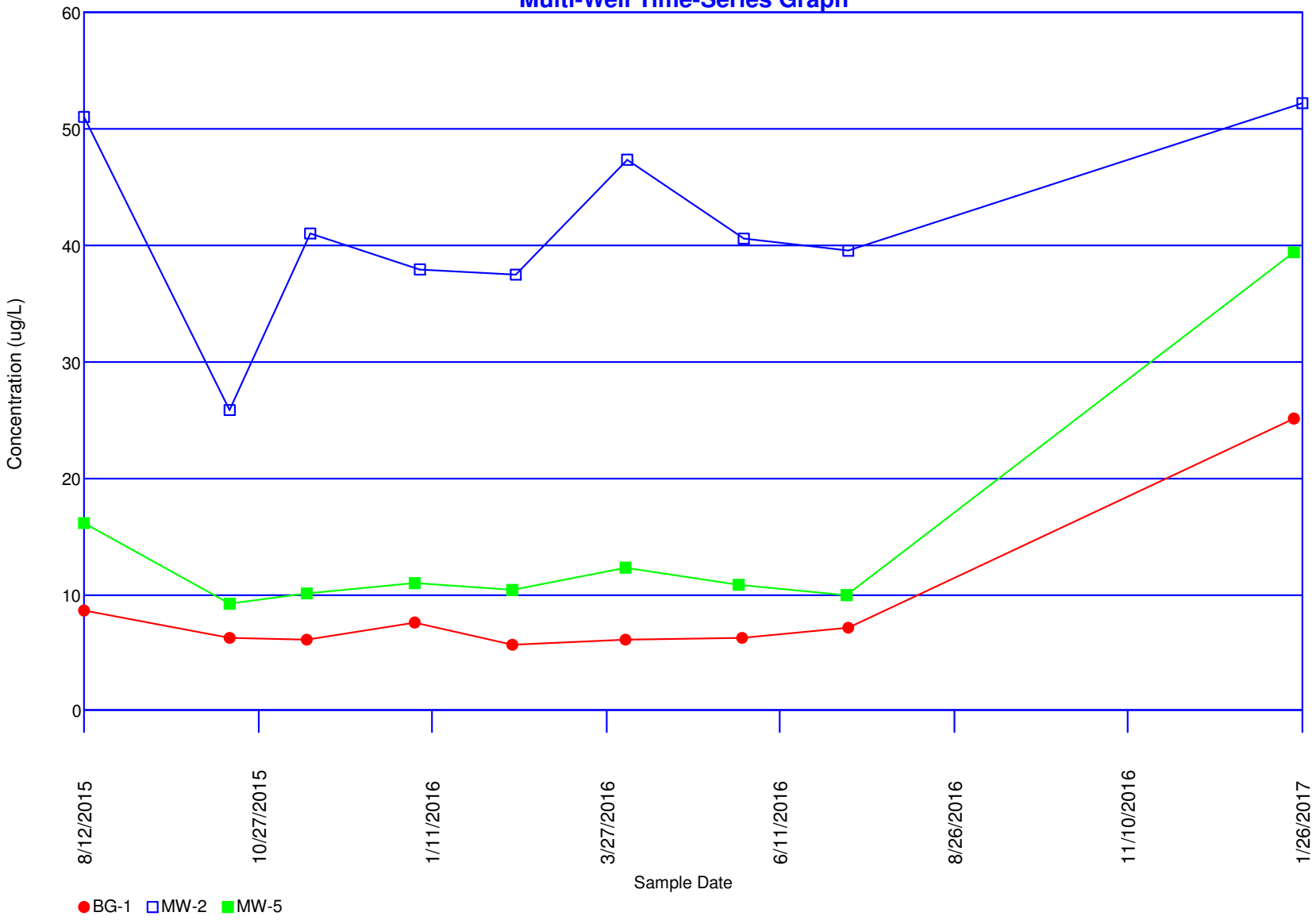
There are 0 time periods with multiple data

A = 0
B = 0
C = 0
D = 0
E = 0
F = 0
a = 1656
b = 4536
c = 144
Group Variance = 92
For 90% confidence interval (two-tailed), Z at (1-0.9)/2 = 1.64485
C = 15.7769
M1 = (36 - 15.7769)/2.0 = 10.1116
M2 = (36 + 15.7769)/2.0 + 1 = 26.8884
Lower limit is -0.78 = Q(10)

Upper limit is 0.9 = Q(27)
-0.78 < 0 < 0.9 indicating no trend in data.

Boron

Multi-Well Time-Series Graph



Concentrations (ug/L)

Parameter: Calcium

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

Total Measurements: 80
Total Non-Detect: 0
Percent Non-Detects: 0%
Total Background Measurements: 9
There is 1 background location

Loc.	Meas.	ND	Date	Conc.	Original
BG-1	9	0 (0%)	8/12/2015	32000 B	32000 B
			10/15/2015	38200	38200
			11/18/2015	31700	31700
			1/4/2016	28600	28600
			2/16/2016	29500	29500
			4/5/2016	27300	27300
			5/26/2016	29500	29500
			7/12/2016	31600	31600
			1/23/2017	28100	28100

There are 8 compliance locations

Loc.	Meas.	ND	Date	Conc.	Original
MW-1	9	0 (0%)	8/12/2015	150000 B	150000 B
			10/15/2015	36500	36500
			11/20/2015	58700	58700
			1/6/2016	108000	108000
			2/17/2016	57700	57700
			4/6/2016	79900	79900
			5/27/2016	87800	87800
			7/12/2016	127000	127000
			1/25/2017	112000	112000
MW-2	9	0 (0%)	8/12/2015	100000 B	100000 B
			10/15/2015	153000	153000
			11/19/2015	189000	189000
			1/6/2016	188000	188000
			2/17/2016	207000	207000
			4/6/2016	192000	192000
			5/27/2016	130000	130000
			7/12/2016	159000	159000
			1/26/2017	214000	214000
MW-3	9	0 (0%)	8/12/2015	180000 B	180000 B
			10/15/2015	185000	185000
			11/19/2015	157000	157000
			1/5/2016	188000	188000
			2/16/2016	174000	174000
			4/7/2016	181000	181000
			5/27/2016	161000	161000
			7/11/2016	182000	182000
			1/24/2017	160000	160000
MW-4	9	0 (0%)	8/12/2015	46000 B	46000 B

			10/15/2015	46200	46200
			11/19/2015	39200	39200
			1/4/2016	35200	35200
			2/16/2016	35200	35200
			4/7/2016	17900	17900
			5/25/2016	18600	18600
			7/13/2016	53500	53500
			1/25/2017	68200	68200
MW-5	9	0 (0%)	8/12/2015	18000 B	18000 B
			10/15/2015	16900	16900
			11/18/2015	12400	12400
			1/4/2016	13500	13500
			2/16/2016	16900	16900
			4/5/2016	10100	10100
			5/25/2016	11900	11900
			7/11/2016	9990	9990
			1/23/2017	9140	9140
MW-6	9	0 (0%)	8/12/2015	38000 B	38000 B
			10/19/2015	38100	38100
			11/20/2015	37600	37600
			1/5/2016	35600	35600
			2/17/2016	39200	39200
			4/5/2016	33600	33600
			5/26/2016	33200	33200
			7/11/2016	35400	35400
			1/24/2017	34500	34500
MW-7	8	0 (0%)	8/12/2015	37000 B	37000 B
			10/16/2015	34200	34200
			11/20/2015	44200	44200
			1/5/2016	45100	45100
			2/18/2016	47900	47900
			4/6/2016	40600	40600
			5/26/2016	51200	51200
			7/11/2016	53200	53200
MW-8	9	0 (0%)	8/12/2015	110000 B	110000 B
			10/15/2015	117000	117000
			11/20/2015	194000	194000
			1/6/2016	162000	162000
			2/18/2016	137000	137000
			4/6/2016	159000	159000
			5/26/2016	144000	144000
			7/12/2016	125000	125000
			1/24/2017	169000	169000

There are 0 unused locations

Loc.	Meas.	ND	Date	Conc.	Original

Rosner's Test for Outliers

Parameter: Calcium

All Locations

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

Data set mean = 83356.6

10 most extreme of 80 measurements

by order of magnitude difference from the mean

1	1/26/2017	MW-2	214000	130643
2	2/17/2016	MW-2	207000	123643
3	11/20/2015	MW-8	194000	110643
4	4/6/2016	MW-2	192000	108643
5	11/19/2015	MW-2	189000	105643
6	1/6/2016	MW-2	188000	104643
7	1/5/2016	MW-3	188000	104643
8	10/15/2015	MW-3	185000	101643
9	7/11/2016	MW-3	182000	98643.4
10	4/7/2016	MW-3	181000	97643.4

Iteration i = 9

Mean of 71 measurements = 69430
Std Dev = 54165.6
x(i+1) = 181000 from measurement 4/7/2016 from location MW-3
Rosner Statistic R = |181000 - 69430|/54165.6 = 2.05979
Lambda(80, 10, 0.05) = 3.26
2.05979 < 3.26 -- No outliers detected for i = 9

Iteration i = 8

Mean of 72 measurements = 70993.5
Std Dev = 55394.8
x(i+1) = 182000 from measurement 7/11/2016 from location MW-3
Rosner Statistic R = |182000 - 70993.5|/55394.8 = 2.00391
Lambda(80, 9, 0.05) = 3.266
2.00391 < 3.266 -- No outliers detected for i = 8

Iteration i = 7

Mean of 73 measurements = 72555.2
Std Dev = 56604
x(i+1) = 185000 from measurement 10/15/2015 from location MW-3
Rosner Statistic R = |185000 - 72555.2|/56604 = 1.98652
Lambda(80, 8, 0.05) = 3.272
1.98652 < 3.272 -- No outliers detected for i = 7

Iteration i = 6

Mean of 74 measurements = 74115.3
Std Dev = 57794.7
x(i+1) = 188000 from measurement 1/5/2016 from location MW-3
Rosner Statistic R = |188000 - 74115.3|/57794.7 = 1.9705
Lambda(80, 7, 0.05) = 3.278
1.9705 < 3.278 -- No outliers detected for i = 6

Iteration i = 5
Mean of 75 measurements = 75633.7
Std Dev = 58889.9
x(i+1) = 188000 from measurement 1/6/2016 from location MW-2
Rosner Statistic R = |188000 - 75633.7|/58889.9 = 1.90807
Lambda(80, 6, 0.05) = 3.284
1.90807 < 3.284 -- No outliers detected for i = 5

Iteration i = 4
Mean of 76 measurements = 77125.4
Std Dev = 59924
x(i+1) = 189000 from measurement 11/19/2015 from location MW-2
Rosner Statistic R = |189000 - 77125.4|/59924 = 1.86694
Lambda(80, 5, 0.05) = 3.29
1.86694 < 3.29 -- No outliers detected for i = 4

Iteration i = 3
Mean of 77 measurements = 78617.3
Std Dev = 60950.9
x(i+1) = 192000 from measurement 4/6/2016 from location MW-2
Rosner Statistic R = |192000 - 78617.3|/60950.9 = 1.86023
Lambda(80, 4, 0.05) = 3.29
1.86023 < 3.29 -- No outliers detected for i = 3

Iteration i = 2
Mean of 78 measurements = 80096.5
Std Dev = 61947.1
x(i+1) = 194000 from measurement 11/20/2015 from location MW-8
Rosner Statistic R = |194000 - 80096.5|/61947.1 = 1.83872
Lambda(80, 3, 0.05) = 3.3
1.83872 < 3.3 -- No outliers detected for i = 2

Iteration i = 1
Mean of 79 measurements = 81702.9
Std Dev = 63183.1
x(i+1) = 207000 from measurement 2/17/2016 from location MW-2
Rosner Statistic R = |207000 - 81702.9|/63183.1 = 1.98308
Lambda(80, 2, 0.05) = 3.3
1.98308 < 3.3 -- No outliers detected for i = 1

Iteration i = 0
Mean of 80 measurements = 83356.6
Std Dev = 64500.8
x(i+1) = 214000 from measurement 1/26/2017 from location MW-2
Rosner Statistic R = |214000 - 83356.6|/64500.8 = 2.02545
Lambda(80, 1, 0.05) = 3.31
2.02545 < 3.31 -- No outliers detected for i = 0

Shapiro-Wilks Test of Normality

Parameter: Calcium

All Locations

Normality Test of Parameter Concentrations

Original Data (Not Transformed)

Non-Detects Replaced with 1/2 DL

K = 4 for 9 measurements

i	x(i)	x(n-i+1)	x(n-1+1)-x(i)	a(n-i+1)	b(i)
1	27300	38200	10900	0.5888	6417.92
2	28100	32000	3900	0.3244	1265.16
3	28600	31700	3100	0.1976	612.56
4	29500	31600	2100	0.0947	198.87
5	29500	29500	0		
6	31600	29500	-2100		
7	31700	28600	-3100		
8	32000	28100	-3900		
9	38200	27300	-10900		

Sum of b values = 8494.51
Sample Standard Deviation = 3266.41
W Statistic = 0.845366

5% Critical value of 0.829 is less than 0.845366
Data is normally distributed at 95% level of significance

1% Critical value of 0.764 is less than 0.845366
Data is normally distributed at 99% level of significance

Parametric Prediction Interval Analysis

Inter-Well Comparison

Parameter: Calcium

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

Inter-Well Unified Guid. Formula 95% One-Sided Comparison

Background Samples = 9
Background Mean = 30722.2
Background Std Dev = 3266.41

Number of comparisons = 7
Future Samples (k) = 7
Actual confidence level is 1.0 - (0.05/7) = 99.2857 %
t is Percentile of Student's T-Test (0.95/7) = 0.992857
Degrees of Freedom = 9 (background observations) - 1
t(0.992857, 9) = 3.1587

Well MW-1

Date	Samples	Mean	Interval	Significant
1/25/2017	1	112000	[0, 41598]	TRUE

Well MW-2

Date	Samples	Mean	Interval	Significant
1/26/2017	1	214000	[0, 41598]	TRUE

Well MW-3

Date	Samples	Mean	Interval	Significant
1/24/2017	1	160000	[0, 41598]	TRUE

Well MW-4

Date	Samples	Mean	Interval	Significant
1/25/2017	1	68200	[0, 41598]	TRUE

Well MW-5

Date	Samples	Mean	Interval	Significant
1/23/2017	1	9140	[0, 41598]	FALSE

Well MW-6

Date	Samples	Mean	Interval	Significant
1/24/2017	1	34500	[0, 41598]	FALSE

Well MW-8

Date	Samples	Mean	Interval	Significant
1/24/2017	1	169000	[0, 41598]	TRUE

Sen's Slope Analysis

Parameter: Calcium

Location: MW-1

Original Data (Not Transformed)

Non-Detects Replaced with 1/2 DL

90% Confidence Level

Xj	Xk	(Xj - Xk)/(j-k)	Q
36500 (10/15/2015)	150000 B (8/12/2015)	(36500 - 150000)/(2 - 1)	-113500
58700 (11/20/2015)	150000 B (8/12/2015)	(58700 - 150000)/(3 - 1)	-45650
108000 (1/6/2016)	150000 B (8/12/2015)	(108000 - 150000)/(4 - 1)	-14000
57700 (2/17/2016)	150000 B (8/12/2015)	(57700 - 150000)/(5 - 1)	-23075
79900 (4/6/2016)	150000 B (8/12/2015)	(79900 - 150000)/(6 - 1)	-14020
87800 (5/27/2016)	150000 B (8/12/2015)	(87800 - 150000)/(7 - 1)	-10366.7
127000 (7/12/2016)	150000 B (8/12/2015)	(127000 - 150000)/(8 - 1)	-3285.71
112000 (1/25/2017)	150000 B (8/12/2015)	(112000 - 150000)/(9 - 1)	-4750
58700 (11/20/2015)	36500 (10/15/2015)	(58700 - 36500)/(3 - 2)	22200
108000 (1/6/2016)	36500 (10/15/2015)	(108000 - 36500)/(4 - 2)	35750
57700 (2/17/2016)	36500 (10/15/2015)	(57700 - 36500)/(5 - 2)	7066.67
79900 (4/6/2016)	36500 (10/15/2015)	(79900 - 36500)/(6 - 2)	10850
87800 (5/27/2016)	36500 (10/15/2015)	(87800 - 36500)/(7 - 2)	10260
127000 (7/12/2016)	36500 (10/15/2015)	(127000 - 36500)/(8 - 2)	15083.3
112000 (1/25/2017)	36500 (10/15/2015)	(112000 - 36500)/(9 - 2)	10785.7
108000 (1/6/2016)	58700 (11/20/2015)	(108000 - 58700)/(4 - 3)	49300
57700 (2/17/2016)	58700 (11/20/2015)	(57700 - 58700)/(5 - 3)	-500
79900 (4/6/2016)	58700 (11/20/2015)	(79900 - 58700)/(6 - 3)	7066.67
87800 (5/27/2016)	58700 (11/20/2015)	(87800 - 58700)/(7 - 3)	7275
127000 (7/12/2016)	58700 (11/20/2015)	(127000 - 58700)/(8 - 3)	13660
112000 (1/25/2017)	58700 (11/20/2015)	(112000 - 58700)/(9 - 3)	8883.33
57700 (2/17/2016)	108000 (1/6/2016)	(57700 - 108000)/(5 - 4)	-50300
79900 (4/6/2016)	108000 (1/6/2016)	(79900 - 108000)/(6 - 4)	-14050
87800 (5/27/2016)	108000 (1/6/2016)	(87800 - 108000)/(7 - 4)	-6733.33
127000 (7/12/2016)	108000 (1/6/2016)	(127000 - 108000)/(8 - 4)	4750
112000 (1/25/2017)	108000 (1/6/2016)	(112000 - 108000)/(9 - 4)	800
79900 (4/6/2016)	57700 (2/17/2016)	(79900 - 57700)/(6 - 5)	22200
87800 (5/27/2016)	57700 (2/17/2016)	(87800 - 57700)/(7 - 5)	15050
127000 (7/12/2016)	57700 (2/17/2016)	(127000 - 57700)/(8 - 5)	23100
112000 (1/25/2017)	57700 (2/17/2016)	(112000 - 57700)/(9 - 5)	13575
87800 (5/27/2016)	79900 (4/6/2016)	(87800 - 79900)/(7 - 6)	7900
127000 (7/12/2016)	79900 (4/6/2016)	(127000 - 79900)/(8 - 6)	23550
112000 (1/25/2017)	79900 (4/6/2016)	(112000 - 79900)/(9 - 6)	10700
127000 (7/12/2016)	87800 (5/27/2016)	(127000 - 87800)/(8 - 7)	39200
112000 (1/25/2017)	87800 (5/27/2016)	(112000 - 87800)/(9 - 7)	12100
112000 (1/25/2017)	127000 (7/12/2016)	(112000 - 127000)/(9 - 8)	-15000

Number of Q values = 36

Ordered Q Values

n	Q
1	-113500
2	-50300
3	-45650
4	-23075
5	-15000
6	-14050
7	-14020
8	-14000
9	-10366.7
10	-6733.33
11	-4750
12	-3285.71
13	-500
14	800
15	4750
16	7066.67
17	7066.67
18	7275
19	7900
20	8883.33
21	10260
22	10700
23	10785.7
24	10850
25	12100
26	13575
27	13660
28	15050
29	15083.3
30	22200
31	22200
32	23100
33	23550
34	35750
35	39200
36	49300

Sen's Estimator (Median Q) is 7587.5

Time Period	Observations
8/12/2015	1
10/15/2015	1
11/20/2015	1
1/6/2016	1
2/17/2016	1
4/6/2016	1
5/27/2016	1
7/12/2016	1
1/25/2017	1

There are 0 time periods with multiple data

A = 0
B = 0
C = 0
D = 0
E = 0
F = 0

a = 1656
b = 4536
c = 144
Group Variance = 92
For 90% confidence interval (two-tailed), Z at (1-0.9)/2 = 1.64485
C = 15.7769
M1 = (36 - 15.7769)/2.0 = 10.1116
M2 = (36 + 15.7769)/2.0 + 1 = 26.8884
Lower limit is -6733.33 = Q(10)
Upper limit is 13660 = Q(27)
-6733.33 < 0 < 13660 indicating no trend in data.

Sen's Slope Analysis

Parameter: Calcium

Location: MW-2

Original Data (Not Transformed)

Non-Detects Replaced with 1/2 DL

90% Confidence Level

Xj	Xk	(Xj - Xk)/(j-k)	Q
153000 (10/15/2015)	100000 B (8/12/2015)	(153000 - 100000)/(2 - 1)	53000
189000 (11/19/2015)	100000 B (8/12/2015)	(189000 - 100000)/(3 - 1)	44500
188000 (1/6/2016)	100000 B (8/12/2015)	(188000 - 100000)/(4 - 1)	29333.3
207000 (2/17/2016)	100000 B (8/12/2015)	(207000 - 100000)/(5 - 1)	26750
192000 (4/6/2016)	100000 B (8/12/2015)	(192000 - 100000)/(6 - 1)	18400
130000 (5/27/2016)	100000 B (8/12/2015)	(130000 - 100000)/(7 - 1)	5000
159000 (7/12/2016)	100000 B (8/12/2015)	(159000 - 100000)/(8 - 1)	8428.57
214000 (1/26/2017)	100000 B (8/12/2015)	(214000 - 100000)/(9 - 1)	14250
189000 (11/19/2015)	153000 (10/15/2015)	(189000 - 153000)/(3 - 2)	36000
188000 (1/6/2016)	153000 (10/15/2015)	(188000 - 153000)/(4 - 2)	17500
207000 (2/17/2016)	153000 (10/15/2015)	(207000 - 153000)/(5 - 2)	18000
192000 (4/6/2016)	153000 (10/15/2015)	(192000 - 153000)/(6 - 2)	9750
130000 (5/27/2016)	153000 (10/15/2015)	(130000 - 153000)/(7 - 2)	-4600
159000 (7/12/2016)	153000 (10/15/2015)	(159000 - 153000)/(8 - 2)	1000
214000 (1/26/2017)	153000 (10/15/2015)	(214000 - 153000)/(9 - 2)	8714.29
188000 (1/6/2016)	189000 (11/19/2015)	(188000 - 189000)/(4 - 3)	-1000
207000 (2/17/2016)	189000 (11/19/2015)	(207000 - 189000)/(5 - 3)	9000
192000 (4/6/2016)	189000 (11/19/2015)	(192000 - 189000)/(6 - 3)	1000
130000 (5/27/2016)	189000 (11/19/2015)	(130000 - 189000)/(7 - 3)	-14750
159000 (7/12/2016)	189000 (11/19/2015)	(159000 - 189000)/(8 - 3)	-6000
214000 (1/26/2017)	189000 (11/19/2015)	(214000 - 189000)/(9 - 3)	4166.67
207000 (2/17/2016)	188000 (1/6/2016)	(207000 - 188000)/(5 - 4)	19000
192000 (4/6/2016)	188000 (1/6/2016)	(192000 - 188000)/(6 - 4)	2000
130000 (5/27/2016)	188000 (1/6/2016)	(130000 - 188000)/(7 - 4)	-19333.3
159000 (7/12/2016)	188000 (1/6/2016)	(159000 - 188000)/(8 - 4)	-7250
214000 (1/26/2017)	188000 (1/6/2016)	(214000 - 188000)/(9 - 4)	5200
192000 (4/6/2016)	207000 (2/17/2016)	(192000 - 207000)/(6 - 5)	-15000
130000 (5/27/2016)	207000 (2/17/2016)	(130000 - 207000)/(7 - 5)	-38500
159000 (7/12/2016)	207000 (2/17/2016)	(159000 - 207000)/(8 - 5)	-16000
214000 (1/26/2017)	207000 (2/17/2016)	(214000 - 207000)/(9 - 5)	1750
130000 (5/27/2016)	192000 (4/6/2016)	(130000 - 192000)/(7 - 6)	-62000
159000 (7/12/2016)	192000 (4/6/2016)	(159000 - 192000)/(8 - 6)	-16500
214000 (1/26/2017)	192000 (4/6/2016)	(214000 - 192000)/(9 - 6)	7333.33
159000 (7/12/2016)	130000 (5/27/2016)	(159000 - 130000)/(8 - 7)	29000
214000 (1/26/2017)	130000 (5/27/2016)	(214000 - 130000)/(9 - 7)	42000
214000 (1/26/2017)	159000 (7/12/2016)	(214000 - 159000)/(9 - 8)	55000

Number of Q values = 36

Ordered Q Values

n	Q
1	-62000
2	-38500
3	-19333.3
4	-16500
5	-16000
6	-15000
7	-14750
8	-7250
9	-6000
10	-4600
11	-1000
12	1000
13	1000
14	1750
15	2000
16	4166.67
17	5000
18	5200
19	7333.33
20	8428.57
21	8714.29
22	9000
23	9750
24	14250
25	17500
26	18000
27	18400
28	19000
29	26750
30	29000
31	29333.3
32	36000
33	42000
34	44500
35	53000
36	55000

Sen's Estimator (Median Q) is 6266.67

Time Period	Observations
8/12/2015	1
10/15/2015	1
11/19/2015	1
1/6/2016	1
2/17/2016	1
4/6/2016	1
5/27/2016	1
7/12/2016	1
1/26/2017	1

There are 0 time periods with multiple data

A = 0
B = 0
C = 0
D = 0
E = 0
F = 0

a = 1656
b = 4536
c = 144
Group Variance = 92
For 90% confidence interval (two-tailed), Z at (1-0.9)/2 = 1.64485
C = 15.7769
M1 = (36 - 15.7769)/2.0 = 10.1116
M2 = (36 + 15.7769)/2.0 + 1 = 26.8884
Lower limit is -4600 = Q(10)
Upper limit is 18400 = Q(27)
-4600 < 0 < 18400 indicating no trend in data.

Sen's Slope Analysis

Parameter: Calcium

Location: MW-3

Original Data (Not Transformed)

Non-Detects Replaced with 1/2 DL

90% Confidence Level

Xj	Xk	(Xj - Xk)/(j-k)	Q
185000 (10/15/2015)	180000 B (8/12/2015)	(185000 - 180000)/(2 - 1)	5000
157000 (11/19/2015)	180000 B (8/12/2015)	(157000 - 180000)/(3 - 1)	-11500
188000 (1/5/2016)	180000 B (8/12/2015)	(188000 - 180000)/(4 - 1)	2666.67
174000 (2/16/2016)	180000 B (8/12/2015)	(174000 - 180000)/(5 - 1)	-1500
181000 (4/7/2016)	180000 B (8/12/2015)	(181000 - 180000)/(6 - 1)	200
161000 (5/27/2016)	180000 B (8/12/2015)	(161000 - 180000)/(7 - 1)	-3166.67
182000 (7/11/2016)	180000 B (8/12/2015)	(182000 - 180000)/(8 - 1)	285.714
160000 (1/24/2017)	180000 B (8/12/2015)	(160000 - 180000)/(9 - 1)	-2500
157000 (11/19/2015)	185000 (10/15/2015)	(157000 - 185000)/(3 - 2)	-28000
188000 (1/5/2016)	185000 (10/15/2015)	(188000 - 185000)/(4 - 2)	1500
174000 (2/16/2016)	185000 (10/15/2015)	(174000 - 185000)/(5 - 2)	-3666.67
181000 (4/7/2016)	185000 (10/15/2015)	(181000 - 185000)/(6 - 2)	-1000
161000 (5/27/2016)	185000 (10/15/2015)	(161000 - 185000)/(7 - 2)	-4800
182000 (7/11/2016)	185000 (10/15/2015)	(182000 - 185000)/(8 - 2)	-500
160000 (1/24/2017)	185000 (10/15/2015)	(160000 - 185000)/(9 - 2)	-3571.43
188000 (1/5/2016)	157000 (11/19/2015)	(188000 - 157000)/(4 - 3)	31000
174000 (2/16/2016)	157000 (11/19/2015)	(174000 - 157000)/(5 - 3)	8500
181000 (4/7/2016)	157000 (11/19/2015)	(181000 - 157000)/(6 - 3)	8000
161000 (5/27/2016)	157000 (11/19/2015)	(161000 - 157000)/(7 - 3)	1000
182000 (7/11/2016)	157000 (11/19/2015)	(182000 - 157000)/(8 - 3)	5000
160000 (1/24/2017)	157000 (11/19/2015)	(160000 - 157000)/(9 - 3)	500
174000 (2/16/2016)	188000 (1/5/2016)	(174000 - 188000)/(5 - 4)	-14000
181000 (4/7/2016)	188000 (1/5/2016)	(181000 - 188000)/(6 - 4)	-3500
161000 (5/27/2016)	188000 (1/5/2016)	(161000 - 188000)/(7 - 4)	-9000
182000 (7/11/2016)	188000 (1/5/2016)	(182000 - 188000)/(8 - 4)	-1500
160000 (1/24/2017)	188000 (1/5/2016)	(160000 - 188000)/(9 - 4)	-5600
181000 (4/7/2016)	174000 (2/16/2016)	(181000 - 174000)/(6 - 5)	7000
161000 (5/27/2016)	174000 (2/16/2016)	(161000 - 174000)/(7 - 5)	-6500
182000 (7/11/2016)	174000 (2/16/2016)	(182000 - 174000)/(8 - 5)	2666.67
160000 (1/24/2017)	174000 (2/16/2016)	(160000 - 174000)/(9 - 5)	-3500
161000 (5/27/2016)	181000 (4/7/2016)	(161000 - 181000)/(7 - 6)	-20000
182000 (7/11/2016)	181000 (4/7/2016)	(182000 - 181000)/(8 - 6)	500
160000 (1/24/2017)	181000 (4/7/2016)	(160000 - 181000)/(9 - 6)	-7000
182000 (7/11/2016)	161000 (5/27/2016)	(182000 - 161000)/(8 - 7)	21000
160000 (1/24/2017)	161000 (5/27/2016)	(160000 - 161000)/(9 - 7)	-500
160000 (1/24/2017)	182000 (7/11/2016)	(160000 - 182000)/(9 - 8)	-22000

Number of Q values = 36

Ordered Q Values

n	Q
1	-28000
2	-22000
3	-20000
4	-14000
5	-11500
6	-9000
7	-7000
8	-6500
9	-5600
10	-4800
11	-3666.67
12	-3571.43
13	-3500
14	-3500
15	-3166.67
16	-2500
17	-1500
18	-1500
19	-1000
20	-500
21	-500
22	200
23	285.714
24	500
25	500
26	1000
27	1500
28	2666.67
29	2666.67
30	5000
31	5000
32	7000
33	8000
34	8500
35	21000
36	31000

Sen's Estimator (Median Q) is -1250

Time Period	Observations
8/12/2015	1
10/15/2015	1
11/19/2015	1
1/5/2016	1
2/16/2016	1
4/7/2016	1
5/27/2016	1
7/11/2016	1
1/24/2017	1

There are 0 time periods with multiple data

A = 0
B = 0
C = 0
D = 0
E = 0
F = 0

a = 1656
b = 4536
c = 144
Group Variance = 92
For 90% confidence interval (two-tailed), Z at (1-0.9)/2 = 1.64485
C = 15.7769
M1 = (36 - 15.7769)/2.0 = 10.1116
M2 = (36 + 15.7769)/2.0 + 1 = 26.8884
Lower limit is -4800 = Q(10)
Upper limit is 1500 = Q(27)
-4800 < 0 < 1500 indicating no trend in data.

Sen's Slope Analysis

Parameter: Calcium

Location: MW-4

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

90% Confidence Level

Xj	Xk	(Xj - Xk)/(j-k)	Q
46200 (10/15/2015)	46000 B (8/12/2015)	(46200 - 46000)/(2 - 1)	200
39200 (11/19/2015)	46000 B (8/12/2015)	(39200 - 46000)/(3 - 1)	-3400
35200 (1/4/2016)	46000 B (8/12/2015)	(35200 - 46000)/(4 - 1)	-3600
35200 (2/16/2016)	46000 B (8/12/2015)	(35200 - 46000)/(5 - 1)	-2700
17900 (4/7/2016)	46000 B (8/12/2015)	(17900 - 46000)/(6 - 1)	-5620
18600 (5/25/2016)	46000 B (8/12/2015)	(18600 - 46000)/(7 - 1)	-4566.67
53500 (7/13/2016)	46000 B (8/12/2015)	(53500 - 46000)/(8 - 1)	1071.43
68200 (1/25/2017)	46000 B (8/12/2015)	(68200 - 46000)/(9 - 1)	2775
39200 (11/19/2015)	46200 (10/15/2015)	(39200 - 46200)/(3 - 2)	-7000
35200 (1/4/2016)	46200 (10/15/2015)	(35200 - 46200)/(4 - 2)	-5500
35200 (2/16/2016)	46200 (10/15/2015)	(35200 - 46200)/(5 - 2)	-3666.67
17900 (4/7/2016)	46200 (10/15/2015)	(17900 - 46200)/(6 - 2)	-7075
18600 (5/25/2016)	46200 (10/15/2015)	(18600 - 46200)/(7 - 2)	-5520
53500 (7/13/2016)	46200 (10/15/2015)	(53500 - 46200)/(8 - 2)	1216.67
68200 (1/25/2017)	46200 (10/15/2015)	(68200 - 46200)/(9 - 2)	3142.86
35200 (1/4/2016)	39200 (11/19/2015)	(35200 - 39200)/(4 - 3)	-4000
35200 (2/16/2016)	39200 (11/19/2015)	(35200 - 39200)/(5 - 3)	-2000
17900 (4/7/2016)	39200 (11/19/2015)	(17900 - 39200)/(6 - 3)	-7100
18600 (5/25/2016)	39200 (11/19/2015)	(18600 - 39200)/(7 - 3)	-5150
53500 (7/13/2016)	39200 (11/19/2015)	(53500 - 39200)/(8 - 3)	2860
68200 (1/25/2017)	39200 (11/19/2015)	(68200 - 39200)/(9 - 3)	4833.33
35200 (2/16/2016)	35200 (1/4/2016)	(35200 - 35200)/(5 - 4)	0
17900 (4/7/2016)	35200 (1/4/2016)	(17900 - 35200)/(6 - 4)	-8650
18600 (5/25/2016)	35200 (1/4/2016)	(18600 - 35200)/(7 - 4)	-5533.33
53500 (7/13/2016)	35200 (1/4/2016)	(53500 - 35200)/(8 - 4)	4575
68200 (1/25/2017)	35200 (1/4/2016)	(68200 - 35200)/(9 - 4)	6600
17900 (4/7/2016)	35200 (2/16/2016)	(17900 - 35200)/(6 - 5)	-17300
18600 (5/25/2016)	35200 (2/16/2016)	(18600 - 35200)/(7 - 5)	-8300

53500 (7/13/2016)	35200 (2/16/2016)	(53500 - 35200)/(8 - 5)	6100
68200 (1/25/2017)	35200 (2/16/2016)	(68200 - 35200)/(9 - 5)	8250
18600 (5/25/2016)	17900 (4/7/2016)	(18600 - 17900)/(7 - 6)	700
53500 (7/13/2016)	17900 (4/7/2016)	(53500 - 17900)/(8 - 6)	17800
68200 (1/25/2017)	17900 (4/7/2016)	(68200 - 17900)/(9 - 6)	16766.7
53500 (7/13/2016)	18600 (5/25/2016)	(53500 - 18600)/(8 - 7)	34900
68200 (1/25/2017)	18600 (5/25/2016)	(68200 - 18600)/(9 - 7)	24800
68200 (1/25/2017)	53500 (7/13/2016)	(68200 - 53500)/(9 - 8)	14700

Number of Q values = 36

Ordered Q Values

n	Q
1	-17300
2	-8650
3	-8300
4	-7100
5	-7075
6	-7000
7	-5620
8	-5533.33
9	-5520
10	-5500
11	-5150
12	-4566.67
13	-4000
14	-3666.67
15	-3600
16	-3400
17	-2700
18	-2000
19	0
20	200
21	700
22	1071.43
23	1216.67
24	2775

25	2860
26	3142.86
27	4575
28	4833.33
29	6100
30	6600
31	8250
32	14700
33	16766.7
34	17800
35	24800
36	34900

Sen's Estimator (Median Q) is -1000

Tied Group	Value	Members
1	35200	2

Time Period	Observations
8/12/2015	1
10/15/2015	1
11/19/2015	1
1/4/2016	1
2/16/2016	1
4/7/2016	1
5/25/2016	1
7/13/2016	1
1/25/2017	1

There are 0 time periods with multiple data

A = 18
B = 0
C = 0
D = 0
E = 2
F = 0
a = 1656
b = 4536
c = 144
Group Variance = 91
For 90% confidence interval (two-tailed), Z at (1-0.9)/2 = 1.64485
C = 15.6909

M1 = (36 - 15.6909)/2.0 = 10.1546
M2 = (36 + 15.6909)/2.0 + 1 = 26.8454
Lower limit is -5500 = Q(10)
Upper limit is 4575 = Q(27)
-5500 < 0 < 4575 indicating no trend in data.

Sen's Slope Analysis

Parameter: Calcium

Location: MW-8

Original Data (Not Transformed)

Non-Detects Replaced with 1/2 DL

90% Confidence Level

Xj	Xk	(Xj - Xk)/(j-k)	Q
117000 (10/15/2015)	110000 B (8/12/2015)	(117000 - 110000)/(2 - 1)	7000
194000 (11/20/2015)	110000 B (8/12/2015)	(194000 - 110000)/(3 - 1)	42000
162000 (1/6/2016)	110000 B (8/12/2015)	(162000 - 110000)/(4 - 1)	17333.3
137000 (2/18/2016)	110000 B (8/12/2015)	(137000 - 110000)/(5 - 1)	6750
159000 (4/6/2016)	110000 B (8/12/2015)	(159000 - 110000)/(6 - 1)	9800
144000 (5/26/2016)	110000 B (8/12/2015)	(144000 - 110000)/(7 - 1)	5666.67
125000 (7/12/2016)	110000 B (8/12/2015)	(125000 - 110000)/(8 - 1)	2142.86
169000 (1/24/2017)	110000 B (8/12/2015)	(169000 - 110000)/(9 - 1)	7375
194000 (11/20/2015)	117000 (10/15/2015)	(194000 - 117000)/(3 - 2)	77000
162000 (1/6/2016)	117000 (10/15/2015)	(162000 - 117000)/(4 - 2)	22500
137000 (2/18/2016)	117000 (10/15/2015)	(137000 - 117000)/(5 - 2)	6666.67
159000 (4/6/2016)	117000 (10/15/2015)	(159000 - 117000)/(6 - 2)	10500
144000 (5/26/2016)	117000 (10/15/2015)	(144000 - 117000)/(7 - 2)	5400
125000 (7/12/2016)	117000 (10/15/2015)	(125000 - 117000)/(8 - 2)	1333.33
169000 (1/24/2017)	117000 (10/15/2015)	(169000 - 117000)/(9 - 2)	7428.57
162000 (1/6/2016)	194000 (11/20/2015)	(162000 - 194000)/(4 - 3)	-32000
137000 (2/18/2016)	194000 (11/20/2015)	(137000 - 194000)/(5 - 3)	-28500
159000 (4/6/2016)	194000 (11/20/2015)	(159000 - 194000)/(6 - 3)	-11666.7
144000 (5/26/2016)	194000 (11/20/2015)	(144000 - 194000)/(7 - 3)	-12500
125000 (7/12/2016)	194000 (11/20/2015)	(125000 - 194000)/(8 - 3)	-13800
169000 (1/24/2017)	194000 (11/20/2015)	(169000 - 194000)/(9 - 3)	-4166.67
137000 (2/18/2016)	162000 (1/6/2016)	(137000 - 162000)/(5 - 4)	-25000
159000 (4/6/2016)	162000 (1/6/2016)	(159000 - 162000)/(6 - 4)	-1500
144000 (5/26/2016)	162000 (1/6/2016)	(144000 - 162000)/(7 - 4)	-6000
125000 (7/12/2016)	162000 (1/6/2016)	(125000 - 162000)/(8 - 4)	-9250
169000 (1/24/2017)	162000 (1/6/2016)	(169000 - 162000)/(9 - 4)	1400
159000 (4/6/2016)	137000 (2/18/2016)	(159000 - 137000)/(6 - 5)	22000
144000 (5/26/2016)	137000 (2/18/2016)	(144000 - 137000)/(7 - 5)	3500
125000 (7/12/2016)	137000 (2/18/2016)	(125000 - 137000)/(8 - 5)	-4000
169000 (1/24/2017)	137000 (2/18/2016)	(169000 - 137000)/(9 - 5)	8000
144000 (5/26/2016)	159000 (4/6/2016)	(144000 - 159000)/(7 - 6)	-15000
125000 (7/12/2016)	159000 (4/6/2016)	(125000 - 159000)/(8 - 6)	-17000
169000 (1/24/2017)	159000 (4/6/2016)	(169000 - 159000)/(9 - 6)	3333.33
125000 (7/12/2016)	144000 (5/26/2016)	(125000 - 144000)/(8 - 7)	-19000
169000 (1/24/2017)	144000 (5/26/2016)	(169000 - 144000)/(9 - 7)	12500
169000 (1/24/2017)	125000 (7/12/2016)	(169000 - 125000)/(9 - 8)	44000

Number of Q values = 36

Ordered Q Values

n	Q
1	-32000
2	-28500
3	-25000
4	-19000
5	-17000
6	-15000
7	-13800
8	-12500
9	-11666.7
10	-9250
11	-6000
12	-4166.67
13	-4000
14	-1500
15	1333.33
16	1400
17	2142.86
18	3333.33
19	3500
20	5400
21	5666.67
22	6666.67
23	6750
24	7000
25	7375
26	7428.57
27	8000
28	9800
29	10500
30	12500
31	17333.3
32	22000
33	22500
34	42000
35	44000
36	77000

Sen's Estimator (Median Q) is 3416.67

Time Period	Observations
8/12/2015	1
10/15/2015	1
11/20/2015	1
1/6/2016	1
2/18/2016	1
4/6/2016	1
5/26/2016	1
7/12/2016	1
1/24/2017	1

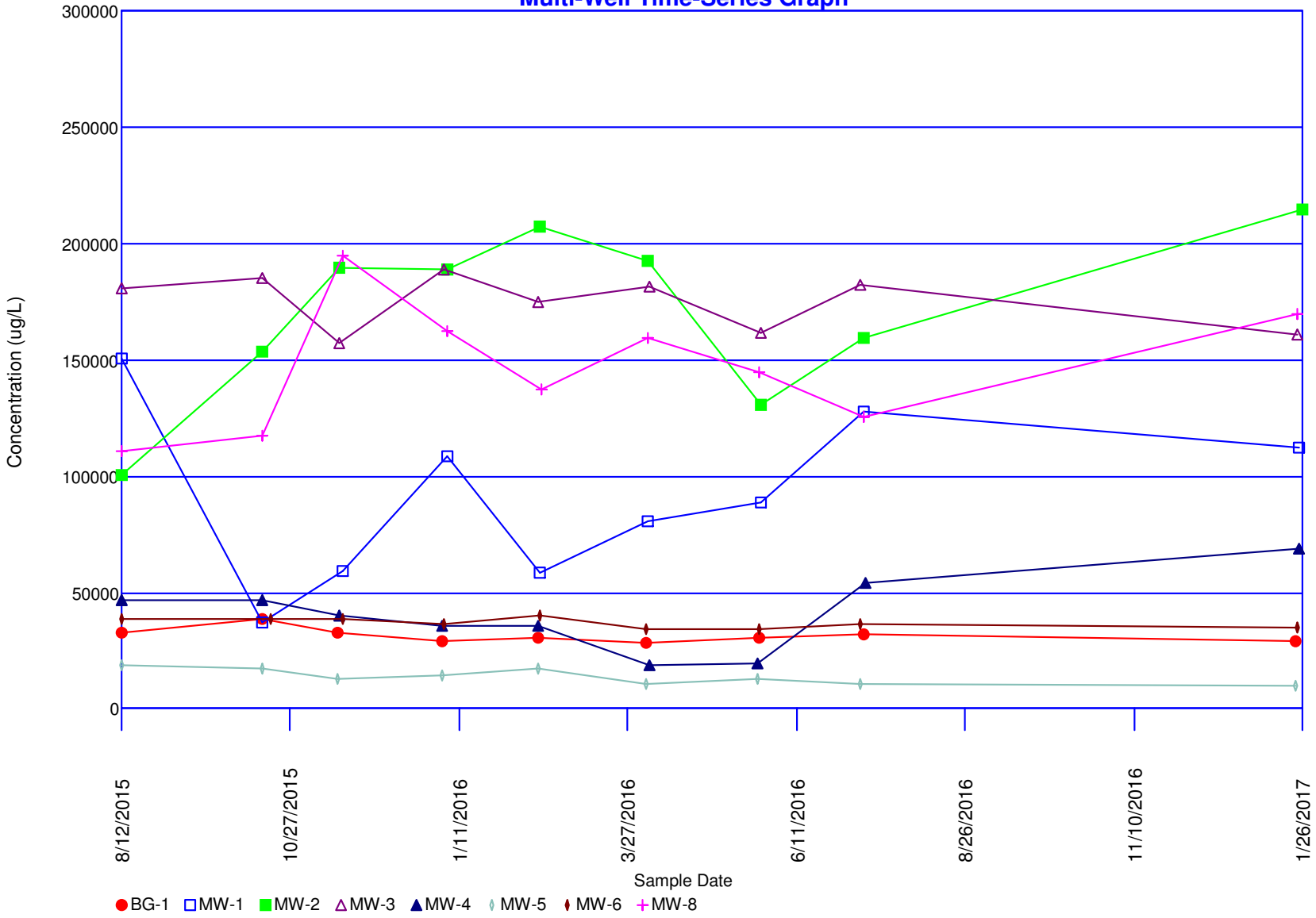
There are 0 time periods with multiple data

A = 0
B = 0
C = 0
D = 0
E = 0
F = 0

a = 1656
b = 4536
c = 144
Group Variance = 92
For 90% confidence interval (two-tailed), Z at (1-0.9)/2 = 1.64485
C = 15.7769
M1 = (36 - 15.7769)/2.0 = 10.1116
M2 = (36 + 15.7769)/2.0 + 1 = 26.8884
Lower limit is -9250 = Q(10)
Upper limit is 8000 = Q(27)
-9250 < 0 < 8000 indicating no trend in data.

Calcium

Multi-Well Time-Series Graph



Concentrations (mg/L)

Parameter: Chloride

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

Total Measurements: 80
Total Non-Detect: 0
Percent Non-Detects: 0%
Total Background Measurements: 9
There is 1 background location

Loc.	Meas.	ND	Date	Conc.	Original
BG-1	9	0 (0%)	8/12/2015	270	270
			10/15/2015	311	311
			11/18/2015	283	283
			1/4/2016	285	285
			2/16/2016	277	277
			4/5/2016	264	264
			5/26/2016	250	250
			7/12/2016	292	292
			1/23/2017	303	303

There are 8 compliance locations

Loc.	Meas.	ND	Date	Conc.	Original
MW-1	9	0 (0%)	8/12/2015	580	580
			10/15/2015	72	72
			11/20/2015	172	172
			1/6/2016	446	446
			2/17/2016	167	167
			4/6/2016	342	342
			5/27/2016	307	307
			7/12/2016	547	547
			1/25/2017	401	401
MW-2	9	0 (0%)	8/12/2015	790	790
			10/15/2015	972	972
			11/19/2015	1050	1050
			1/6/2016	910	910
			2/17/2016	1190	1190
			4/6/2016	1230	1230
			5/27/2016	933	933
			7/12/2016	1160	1160
			1/26/2017	1320	1320
MW-3	9	0 (0%)	8/12/2015	990	990
			10/15/2015	1160	1160
			11/19/2015	1230	1230
			1/5/2016	1270	1270
			2/16/2016	1280	1280
			4/7/2016	1270	1270
			5/27/2016	1130	1130
			7/11/2016	1190	1190
			1/24/2017	1060	1060
MW-4	8	0 (0%)	10/15/2015	344	344

			11/19/2015	294	294
			1/4/2016	307	307
			2/16/2016	188	188
			4/7/2016	174	174
			5/25/2016	144	144
			7/13/2016	423	423
			1/25/2017	513	513
MW-5	10	0 (0%)	8/12/2015	20 J	20 J
			8/12/2015	22	22
			10/15/2015	22.2	22.2
			11/18/2015	21.7	21.7
			1/4/2016	21.9	21.9
			2/16/2016	21.3	21.3
			4/5/2016	18	18
			5/25/2016	19.3	19.3
			7/11/2016	17.6	17.6
			1/23/2017	18.2	18.2
MW-6	9	0 (0%)	8/12/2015	230	230
			10/19/2015	241	241
			11/20/2015	242	242
			1/5/2016	252	252
			2/17/2016	242	242
			4/5/2016	15.3	15.3
			5/26/2016	243	243
			7/11/2016	239	239
			1/24/2017	263	263
MW-7	8	0 (0%)	8/12/2015	440	440
			10/16/2015	422	422
			11/20/2015	552	552
			1/5/2016	403	403
			2/18/2016	330	330
			4/6/2016	411	411
			5/26/2016	327	327
			7/11/2016	382	382
MW-8	9	0 (0%)	8/12/2015	480	480
			10/15/2015	515	515
			11/20/2015	939	939
			1/6/2016	755	755
			2/18/2016	663	663
			4/6/2016	685	685
			5/26/2016	396	396
			7/12/2016	504	504
			1/24/2017	660	660

There are 0 unused locations

Loc.	Meas.	ND	Date	Conc.	Original

Rosner's Test for Outliers

Parameter: Chloride

All Locations

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

Data set mean = 489.056

10 most extreme of 80 measurements

by order of magnitude difference from the mean

1	1/26/2017	MW-2	1320	830.944
2	2/16/2016	MW-3	1280	790.944
3	4/7/2016	MW-3	1270	780.944
4	1/5/2016	MW-3	1270	780.944
5	11/19/2015	MW-3	1230	740.944
6	4/6/2016	MW-2	1230	740.944
7	2/17/2016	MW-2	1190	700.944
8	7/11/2016	MW-3	1190	700.944
9	7/12/2016	MW-2	1160	670.944
10	10/15/2015	MW-3	1160	670.944

Iteration i = 9

Mean of 71 measurements = 394.148
Std Dev = 303.153
x(i+1) = 1160 from measurement 10/15/2015 from location MW-3
Rosner Statistic R = |1160 - 394.148|/303.153 = 2.52629
Lambda(80, 10, 0.05) = 3.26
2.52629 < 3.26 -- No outliers detected for i = 9

Iteration i = 8

Mean of 72 measurements = 404.785
Std Dev = 314.251
x(i+1) = 1160 from measurement 7/12/2016 from location MW-2
Rosner Statistic R = |1160 - 404.785|/314.251 = 2.40322
Lambda(80, 9, 0.05) = 3.266
2.40322 < 3.266 -- No outliers detected for i = 8

Iteration i = 7

Mean of 73 measurements = 415.541
Std Dev = 325.312
x(i+1) = 1190 from measurement 7/11/2016 from location MW-3
Rosner Statistic R = |1190 - 415.541|/325.312 = 2.38066
Lambda(80, 8, 0.05) = 3.272
2.38066 < 3.272 -- No outliers detected for i = 7

Iteration i = 6

Mean of 74 measurements = 426.007
Std Dev = 335.386
x(i+1) = 1190 from measurement 2/17/2016 from location MW-2
Rosner Statistic R = |1190 - 426.007|/335.386 = 2.27795
Lambda(80, 7, 0.05) = 3.278
2.27795 < 3.278 -- No outliers detected for i = 6

Iteration i = 5
Mean of 75 measurements = 436.727
Std Dev = 345.807
x(i+1) = 1230 from measurement 4/6/2016 from location MW-2
Rosner Statistic R = |1230 - 436.727|/345.807 = 2.29398
Lambda(80, 6, 0.05) = 3.284
2.29398 < 3.284 -- No outliers detected for i = 5

Iteration i = 4
Mean of 76 measurements = 447.164
Std Dev = 355.342
x(i+1) = 1230 from measurement 11/19/2015 from location MW-3
Rosner Statistic R = |1230 - 447.164|/355.342 = 2.20305
Lambda(80, 5, 0.05) = 3.29
2.20305 < 3.29 -- No outliers detected for i = 4

Iteration i = 3
Mean of 77 measurements = 457.851
Std Dev = 365.239
x(i+1) = 1270 from measurement 1/5/2016 from location MW-3
Rosner Statistic R = |1270 - 457.851|/365.239 = 2.22361
Lambda(80, 4, 0.05) = 3.29
2.22361 < 3.29 -- No outliers detected for i = 3

Iteration i = 2
Mean of 78 measurements = 468.263
Std Dev = 374.33
x(i+1) = 1270 from measurement 4/7/2016 from location MW-3
Rosner Statistic R = |1270 - 468.263|/374.33 = 2.14179
Lambda(80, 3, 0.05) = 3.3
2.14179 < 3.3 -- No outliers detected for i = 2

Iteration i = 1
Mean of 79 measurements = 478.538
Std Dev = 382.972
x(i+1) = 1280 from measurement 2/16/2016 from location MW-3
Rosner Statistic R = |1280 - 478.538|/382.972 = 2.09274
Lambda(80, 2, 0.05) = 3.3
2.09274 < 3.3 -- No outliers detected for i = 1

Iteration i = 0
Mean of 80 measurements = 489.056
Std Dev = 391.997
x(i+1) = 1320 from measurement 1/26/2017 from location MW-2
Rosner Statistic R = |1320 - 489.056|/391.997 = 2.11977
Lambda(80, 1, 0.05) = 3.31
2.11977 < 3.31 -- No outliers detected for i = 0

Shapiro-Wilks Test of Normality

Parameter: Chloride

All Locations

Normality Test of Parameter Concentrations

Original Data (Not Transformed)

Non-Detects Replaced with 1/2 DL

K = 4 for 9 measurements

i	x(i)	x(n-i+1)	x(n-1+1)-x(i)	a(n-i+1)	b(i)
1	250	311	61	0.5888	35.9168
2	264	303	39	0.3244	12.6516
3	270	292	22	0.1976	4.3472
4	277	285	8	0.0947	0.7576
5	283	283	0		
6	285	277	-8		
7	292	270	-22		
8	303	264	-39		
9	311	250	-61		

Sum of b values = 53.6732
Sample Standard Deviation = 19.0657
W Statistic = 0.990651

5% Critical value of 0.829 is less than 0.990651
Data is normally distributed at 95% level of significance

1% Critical value of 0.764 is less than 0.990651
Data is normally distributed at 99% level of significance

Parametric Prediction Interval Analysis

Inter-Well Comparison

Parameter: Chloride

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

Inter-Well Unified Guid. Formula 95% One-Sided Comparison

Background Samples = 9
Background Mean = 281.667
Background Std Dev = 19.0657

Number of comparisons = 7
Future Samples (k) = 7
Actual confidence level is 1.0 - (0.05/7) = 99.2857 %
t is Percentile of Student's T-Test (0.95/7) = 0.992857
Degrees of Freedom = 9 (background observations) - 1
t(0.992857, 9) = 3.1587

Well MW-1

Date	Samples	Mean	Interval	Significant
1/25/2017	1	401	[0, 345.147]	TRUE

Well MW-2

Date	Samples	Mean	Interval	Significant
1/26/2017	1	1320	[0, 345.147]	TRUE

Well MW-3

Date	Samples	Mean	Interval	Significant
1/24/2017	1	1060	[0, 345.147]	TRUE

Well MW-4

Date	Samples	Mean	Interval	Significant
1/25/2017	1	513	[0, 345.147]	TRUE

Well MW-5

Date	Samples	Mean	Interval	Significant
1/23/2017	1	18.2	[0, 345.147]	FALSE

Well MW-6

Date	Samples	Mean	Interval	Significant
1/24/2017	1	263	[0, 345.147]	FALSE

Well MW-8

Date	Samples	Mean	Interval	Significant
1/24/2017	1	660	[0, 345.147]	TRUE

Sen's Slope Analysis

Parameter: Chloride

Location: MW-1

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

90% Confidence Level

Xj	Xk	(Xj - Xk)/(j-k)	Q
72 (10/15/2015)	580 (8/12/2015)	(72 - 580)/(2 - 1)	-508
172 (11/20/2015)	580 (8/12/2015)	(172 - 580)/(3 - 1)	-204
446 (1/6/2016)	580 (8/12/2015)	(446 - 580)/(4 - 1)	-44.6667
167 (2/17/2016)	580 (8/12/2015)	(167 - 580)/(5 - 1)	-103.25
342 (4/6/2016)	580 (8/12/2015)	(342 - 580)/(6 - 1)	-47.6
307 (5/27/2016)	580 (8/12/2015)	(307 - 580)/(7 - 1)	-45.5
547 (7/12/2016)	580 (8/12/2015)	(547 - 580)/(8 - 1)	-4.71429
401 (1/25/2017)	580 (8/12/2015)	(401 - 580)/(9 - 1)	-22.375
172 (11/20/2015)	72 (10/15/2015)	(172 - 72)/(3 - 2)	100
446 (1/6/2016)	72 (10/15/2015)	(446 - 72)/(4 - 2)	187
167 (2/17/2016)	72 (10/15/2015)	(167 - 72)/(5 - 2)	31.6667
342 (4/6/2016)	72 (10/15/2015)	(342 - 72)/(6 - 2)	67.5
307 (5/27/2016)	72 (10/15/2015)	(307 - 72)/(7 - 2)	47
547 (7/12/2016)	72 (10/15/2015)	(547 - 72)/(8 - 2)	79.1667
401 (1/25/2017)	72 (10/15/2015)	(401 - 72)/(9 - 2)	47
446 (1/6/2016)	172 (11/20/2015)	(446 - 172)/(4 - 3)	274
167 (2/17/2016)	172 (11/20/2015)	(167 - 172)/(5 - 3)	-2.5
342 (4/6/2016)	172 (11/20/2015)	(342 - 172)/(6 - 3)	56.6667
307 (5/27/2016)	172 (11/20/2015)	(307 - 172)/(7 - 3)	33.75
547 (7/12/2016)	172 (11/20/2015)	(547 - 172)/(8 - 3)	75
401 (1/25/2017)	172 (11/20/2015)	(401 - 172)/(9 - 3)	38.1667
167 (2/17/2016)	446 (1/6/2016)	(167 - 446)/(5 - 4)	-279
342 (4/6/2016)	446 (1/6/2016)	(342 - 446)/(6 - 4)	-52
307 (5/27/2016)	446 (1/6/2016)	(307 - 446)/(7 - 4)	-46.3333
547 (7/12/2016)	446 (1/6/2016)	(547 - 446)/(8 - 4)	25.25
401 (1/25/2017)	446 (1/6/2016)	(401 - 446)/(9 - 4)	-9
342 (4/6/2016)	167 (2/17/2016)	(342 - 167)/(6 - 5)	175
307 (5/27/2016)	167 (2/17/2016)	(307 - 167)/(7 - 5)	70

547 (7/12/2016)	167 (2/17/2016)	(547 - 167)/(8 - 5)	126.667
401 (1/25/2017)	167 (2/17/2016)	(401 - 167)/(9 - 5)	58.5
307 (5/27/2016)	342 (4/6/2016)	(307 - 342)/(7 - 6)	-35
547 (7/12/2016)	342 (4/6/2016)	(547 - 342)/(8 - 6)	102.5
401 (1/25/2017)	342 (4/6/2016)	(401 - 342)/(9 - 6)	19.6667
547 (7/12/2016)	307 (5/27/2016)	(547 - 307)/(8 - 7)	240
401 (1/25/2017)	307 (5/27/2016)	(401 - 307)/(9 - 7)	47
401 (1/25/2017)	547 (7/12/2016)	(401 - 547)/(9 - 8)	-146

Number of Q values = 36

Ordered Q Values

n	Q
1	-508
2	-279
3	-204
4	-146
5	-103.25
6	-52
7	-47.6
8	-46.3333
9	-45.5
10	-44.6667
11	-35
12	-22.375
13	-9
14	-4.71429
15	-2.5
16	19.6667
17	25.25
18	31.6667
19	33.75
20	38.1667
21	47
22	47
23	47
24	56.6667

25	58.5
26	67.5
27	70
28	75
29	79.1667
30	100
31	102.5
32	126.667
33	175
34	187
35	240
36	274

Sen's Estimator (Median Q) is 32.7083

Time Period	Observations
8/12/2015	1
10/15/2015	1
11/20/2015	1
1/6/2016	1
2/17/2016	1
4/6/2016	1
5/27/2016	1
7/12/2016	1
1/25/2017	1

There are 0 time periods with multiple data

A = 0
B = 0
C = 0
D = 0
E = 0
F = 0
a = 1656
b = 4536
c = 144
Group Variance = 92
For 90% confidence interval (two-tailed), Z at (1-0.9)/2 = 1.64485
C = 15.7769
M1 = (36 - 15.7769)/2.0 = 10.1116
M2 = (36 + 15.7769)/2.0 + 1 = 26.8884
Lower limit is -44.6667 = Q(10)

Upper limit is 70 = Q(27)
-44.6667 < 0 < 70 indicating no trend in data.

Sen's Slope Analysis

Parameter: Chloride

Location: MW-2

Original Data (Not Transformed)

Non-Detects Replaced with 1/2 DL

90% Confidence Level

Xj	Xk	(Xj - Xk)/(j-k)	Q
972 (10/15/2015)	790 (8/12/2015)	(972 - 790)/(2 - 1)	182
1050 (11/19/2015)	790 (8/12/2015)	(1050 - 790)/(3 - 1)	130
910 (1/6/2016)	790 (8/12/2015)	(910 - 790)/(4 - 1)	40
1190 (2/17/2016)	790 (8/12/2015)	(1190 - 790)/(5 - 1)	100
1230 (4/6/2016)	790 (8/12/2015)	(1230 - 790)/(6 - 1)	88
933 (5/27/2016)	790 (8/12/2015)	(933 - 790)/(7 - 1)	23.8333
1160 (7/12/2016)	790 (8/12/2015)	(1160 - 790)/(8 - 1)	52.8571
1320 (1/26/2017)	790 (8/12/2015)	(1320 - 790)/(9 - 1)	66.25
1050 (11/19/2015)	972 (10/15/2015)	(1050 - 972)/(3 - 2)	78
910 (1/6/2016)	972 (10/15/2015)	(910 - 972)/(4 - 2)	-31
1190 (2/17/2016)	972 (10/15/2015)	(1190 - 972)/(5 - 2)	72.6667
1230 (4/6/2016)	972 (10/15/2015)	(1230 - 972)/(6 - 2)	64.5
933 (5/27/2016)	972 (10/15/2015)	(933 - 972)/(7 - 2)	-7.8
1160 (7/12/2016)	972 (10/15/2015)	(1160 - 972)/(8 - 2)	31.3333
1320 (1/26/2017)	972 (10/15/2015)	(1320 - 972)/(9 - 2)	49.7143
910 (1/6/2016)	1050 (11/19/2015)	(910 - 1050)/(4 - 3)	-140
1190 (2/17/2016)	1050 (11/19/2015)	(1190 - 1050)/(5 - 3)	70
1230 (4/6/2016)	1050 (11/19/2015)	(1230 - 1050)/(6 - 3)	60
933 (5/27/2016)	1050 (11/19/2015)	(933 - 1050)/(7 - 3)	-29.25
1160 (7/12/2016)	1050 (11/19/2015)	(1160 - 1050)/(8 - 3)	22
1320 (1/26/2017)	1050 (11/19/2015)	(1320 - 1050)/(9 - 3)	45
1190 (2/17/2016)	910 (1/6/2016)	(1190 - 910)/(5 - 4)	280
1230 (4/6/2016)	910 (1/6/2016)	(1230 - 910)/(6 - 4)	160
933 (5/27/2016)	910 (1/6/2016)	(933 - 910)/(7 - 4)	7.66667
1160 (7/12/2016)	910 (1/6/2016)	(1160 - 910)/(8 - 4)	62.5
1320 (1/26/2017)	910 (1/6/2016)	(1320 - 910)/(9 - 4)	82
1230 (4/6/2016)	1190 (2/17/2016)	(1230 - 1190)/(6 - 5)	40
933 (5/27/2016)	1190 (2/17/2016)	(933 - 1190)/(7 - 5)	-128.5
1160 (7/12/2016)	1190 (2/17/2016)	(1160 - 1190)/(8 - 5)	-10
1320 (1/26/2017)	1190 (2/17/2016)	(1320 - 1190)/(9 - 5)	32.5
933 (5/27/2016)	1230 (4/6/2016)	(933 - 1230)/(7 - 6)	-297
1160 (7/12/2016)	1230 (4/6/2016)	(1160 - 1230)/(8 - 6)	-35
1320 (1/26/2017)	1230 (4/6/2016)	(1320 - 1230)/(9 - 6)	30
1160 (7/12/2016)	933 (5/27/2016)	(1160 - 933)/(8 - 7)	227
1320 (1/26/2017)	933 (5/27/2016)	(1320 - 933)/(9 - 7)	193.5
1320 (1/26/2017)	1160 (7/12/2016)	(1320 - 1160)/(9 - 8)	160

Number of Q values = 36

Ordered Q Values

n	Q
1	-297
2	-140
3	-128.5
4	-35
5	-31
6	-29.25
7	-10
8	-7.8
9	7.66667
10	22
11	23.8333
12	30
13	31.3333
14	32.5
15	40
16	40
17	45
18	49.7143
19	52.8571
20	60
21	62.5
22	64.5
23	66.25
24	70
25	72.6667
26	78
27	82
28	88
29	100
30	130
31	160
32	160
33	182
34	193.5
35	227
36	280

Sen's Estimator (Median Q) is 51.2857

Time Period	Observations
8/12/2015	1
10/15/2015	1
11/19/2015	1
1/6/2016	1
2/17/2016	1
4/6/2016	1
5/27/2016	1
7/12/2016	1
1/26/2017	1

There are 0 time periods with multiple data

A = 0
B = 0
C = 0
D = 0
E = 0
F = 0

a = 1656
b = 4536
c = 144
Group Variance = 92
For 90% confidence interval (two-tailed), Z at (1-0.9)/2 = 1.64485
C = 15.7769
M1 = (36 - 15.7769)/2.0 = 10.1116
M2 = (36 + 15.7769)/2.0 + 1 = 26.8884
Lower limit is 22 = Q(10)
Upper limit is 82 = Q(27)
22 > 0 indicating an upward trend in data.

Sen's Slope Analysis

Parameter: Chloride

Location: MW-3

Original Data (Not Transformed)

Non-Detects Replaced with 1/2 DL

90% Confidence Level

Xj	Xk	(Xj - Xk)/(j-k)	Q
1160 (10/15/2015)	990 (8/12/2015)	(1160 - 990)/(2 - 1)	170
1230 (11/19/2015)	990 (8/12/2015)	(1230 - 990)/(3 - 1)	120
1270 (1/5/2016)	990 (8/12/2015)	(1270 - 990)/(4 - 1)	93.3333
1280 (2/16/2016)	990 (8/12/2015)	(1280 - 990)/(5 - 1)	72.5
1270 (4/7/2016)	990 (8/12/2015)	(1270 - 990)/(6 - 1)	56
1130 (5/27/2016)	990 (8/12/2015)	(1130 - 990)/(7 - 1)	23.3333
1190 (7/11/2016)	990 (8/12/2015)	(1190 - 990)/(8 - 1)	28.5714
1060 (1/24/2017)	990 (8/12/2015)	(1060 - 990)/(9 - 1)	8.75
1230 (11/19/2015)	1160 (10/15/2015)	(1230 - 1160)/(3 - 2)	70
1270 (1/5/2016)	1160 (10/15/2015)	(1270 - 1160)/(4 - 2)	55
1280 (2/16/2016)	1160 (10/15/2015)	(1280 - 1160)/(5 - 2)	40
1270 (4/7/2016)	1160 (10/15/2015)	(1270 - 1160)/(6 - 2)	27.5
1130 (5/27/2016)	1160 (10/15/2015)	(1130 - 1160)/(7 - 2)	-6
1190 (7/11/2016)	1160 (10/15/2015)	(1190 - 1160)/(8 - 2)	5
1060 (1/24/2017)	1160 (10/15/2015)	(1060 - 1160)/(9 - 2)	-14.2857
1270 (1/5/2016)	1230 (11/19/2015)	(1270 - 1230)/(4 - 3)	40
1280 (2/16/2016)	1230 (11/19/2015)	(1280 - 1230)/(5 - 3)	25
1270 (4/7/2016)	1230 (11/19/2015)	(1270 - 1230)/(6 - 3)	13.3333
1130 (5/27/2016)	1230 (11/19/2015)	(1130 - 1230)/(7 - 3)	-25
1190 (7/11/2016)	1230 (11/19/2015)	(1190 - 1230)/(8 - 3)	-8
1060 (1/24/2017)	1230 (11/19/2015)	(1060 - 1230)/(9 - 3)	-28.3333
1280 (2/16/2016)	1270 (1/5/2016)	(1280 - 1270)/(5 - 4)	10
1270 (4/7/2016)	1270 (1/5/2016)	(1270 - 1270)/(6 - 4)	0
1130 (5/27/2016)	1270 (1/5/2016)	(1130 - 1270)/(7 - 4)	-46.6667
1190 (7/11/2016)	1270 (1/5/2016)	(1190 - 1270)/(8 - 4)	-20
1060 (1/24/2017)	1270 (1/5/2016)	(1060 - 1270)/(9 - 4)	-42
1270 (4/7/2016)	1280 (2/16/2016)	(1270 - 1280)/(6 - 5)	-10
1130 (5/27/2016)	1280 (2/16/2016)	(1130 - 1280)/(7 - 5)	-75
1190 (7/11/2016)	1280 (2/16/2016)	(1190 - 1280)/(8 - 5)	-30
1060 (1/24/2017)	1280 (2/16/2016)	(1060 - 1280)/(9 - 5)	-55
1130 (5/27/2016)	1270 (4/7/2016)	(1130 - 1270)/(7 - 6)	-140
1190 (7/11/2016)	1270 (4/7/2016)	(1190 - 1270)/(8 - 6)	-40
1060 (1/24/2017)	1270 (4/7/2016)	(1060 - 1270)/(9 - 6)	-70
1190 (7/11/2016)	1130 (5/27/2016)	(1190 - 1130)/(8 - 7)	60
1060 (1/24/2017)	1130 (5/27/2016)	(1060 - 1130)/(9 - 7)	-35
1060 (1/24/2017)	1190 (7/11/2016)	(1060 - 1190)/(9 - 8)	-130

Number of Q values = 36

Ordered Q Values

n	Q
1	-140
2	-130
3	-75
4	-70
5	-55
6	-46.6667
7	-42
8	-40
9	-35
10	-30
11	-28.3333
12	-25
13	-20
14	-14.2857
15	-10
16	-8
17	-6
18	0
19	5
20	8.75
21	10
22	13.3333
23	23.3333
24	25
25	27.5
26	28.5714
27	40
28	40
29	55
30	56
31	60
32	70
33	72.5
34	93.3333
35	120
36	170

Sen's Estimator (Median Q) is 2.5

Tied Group	Value	Members
1	1270	2

Time Period	Observations
8/12/2015	1
10/15/2015	1
11/19/2015	1
1/5/2016	1
2/16/2016	1
4/7/2016	1
5/27/2016	1
7/11/2016	1
1/24/2017	1

There are 0 time periods with multiple data

A = 18
B = 0
C = 0

D = 0
E = 2
F = 0
a = 1656
b = 4536
c = 144
Group Variance = 91
For 90% confidence interval (two-tailed), Z at (1-0.9)/2 = 1.64485
C = 15.6909
M1 = (36 - 15.6909)/2.0 = 10.1546
M2 = (36 + 15.6909)/2.0 + 1 = 26.8454
Lower limit is -30 = Q(10)
Upper limit is 40 = Q(27)
-30 < 0 < 40 indicating no trend in data.

Sen's Slope Analysis

Parameter: Chloride

Location: MW-4

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

90% Confidence Level

Xj	Xk	(Xj - Xk)/(j-k)	Q
294 (11/19/2015)	344 (10/15/2015)	(294 - 344)/(2 - 1)	-50
307 (1/4/2016)	344 (10/15/2015)	(307 - 344)/(3 - 1)	-18.5
188 (2/16/2016)	344 (10/15/2015)	(188 - 344)/(4 - 1)	-52
174 (4/7/2016)	344 (10/15/2015)	(174 - 344)/(5 - 1)	-42.5
144 (5/25/2016)	344 (10/15/2015)	(144 - 344)/(6 - 1)	-40
423 (7/13/2016)	344 (10/15/2015)	(423 - 344)/(7 - 1)	13.1667
513 (1/25/2017)	344 (10/15/2015)	(513 - 344)/(8 - 1)	24.1429
307 (1/4/2016)	294 (11/19/2015)	(307 - 294)/(3 - 2)	13
188 (2/16/2016)	294 (11/19/2015)	(188 - 294)/(4 - 2)	-53
174 (4/7/2016)	294 (11/19/2015)	(174 - 294)/(5 - 2)	-40
144 (5/25/2016)	294 (11/19/2015)	(144 - 294)/(6 - 2)	-37.5
423 (7/13/2016)	294 (11/19/2015)	(423 - 294)/(7 - 2)	25.8
513 (1/25/2017)	294 (11/19/2015)	(513 - 294)/(8 - 2)	36.5
188 (2/16/2016)	307 (1/4/2016)	(188 - 307)/(4 - 3)	-119
174 (4/7/2016)	307 (1/4/2016)	(174 - 307)/(5 - 3)	-66.5
144 (5/25/2016)	307 (1/4/2016)	(144 - 307)/(6 - 3)	-54.3333
423 (7/13/2016)	307 (1/4/2016)	(423 - 307)/(7 - 3)	29
513 (1/25/2017)	307 (1/4/2016)	(513 - 307)/(8 - 3)	41.2
174 (4/7/2016)	188 (2/16/2016)	(174 - 188)/(5 - 4)	-14
144 (5/25/2016)	188 (2/16/2016)	(144 - 188)/(6 - 4)	-22
423 (7/13/2016)	188 (2/16/2016)	(423 - 188)/(7 - 4)	78.3333
513 (1/25/2017)	188 (2/16/2016)	(513 - 188)/(8 - 4)	81.25
144 (5/25/2016)	174 (4/7/2016)	(144 - 174)/(6 - 5)	-30
423 (7/13/2016)	174 (4/7/2016)	(423 - 174)/(7 - 5)	124.5
513 (1/25/2017)	174 (4/7/2016)	(513 - 174)/(8 - 5)	113
423 (7/13/2016)	144 (5/25/2016)	(423 - 144)/(7 - 6)	279
513 (1/25/2017)	144 (5/25/2016)	(513 - 144)/(8 - 6)	184.5

513 (1/25/2017) 423 (7/13/2016) (513 - 423)/(8 - 7) 90

Number of Q values = 28

Ordered Q Values

n	Q
1	-119
2	-66.5
3	-54.3333
4	-53
5	-52
6	-50
7	-42.5
8	-40
9	-40
10	-37.5
11	-30
12	-22
13	-18.5
14	-14
15	13
16	13.1667
17	24.1429
18	25.8
19	29
20	36.5
21	41.2
22	78.3333
23	81.25
24	90
25	113
26	124.5
27	184.5
28	279

Sen's Estimator (Median Q) is -0.5

Time Period	Observations
10/15/2015	1
11/19/2015	1

1/4/2016	1
2/16/2016	1
4/7/2016	1
5/25/2016	1
7/13/2016	1
1/25/2017	1

There are 0 time periods with multiple data

A = 0
B = 0
C = 0
D = 0
E = 0
F = 0
a = 1176
b = 3024
c = 112
Group Variance = 65.3333
For 90% confidence interval (two-tailed), Z at (1-0.9)/2 = 1.64485
C = 13.2952
M1 = (28 - 13.2952)/2.0 = 7.35241
M2 = (28 + 13.2952)/2.0 + 1 = 21.6476
Lower limit is -42.5 = Q(7)
Upper limit is 78.3333 = Q(22)
-42.5 < 0 < 78.3333 indicating no trend in data.

Sen's Slope Analysis

Parameter: Chloride

Location: MW-8

Original Data (Not Transformed)

Non-Detects Replaced with 1/2 DL

90% Confidence Level

Xj	Xk	(Xj - Xk)/(j-k)	Q
515 (10/15/2015)	480 (8/12/2015)	(515 - 480)/(2 - 1)	35
939 (11/20/2015)	480 (8/12/2015)	(939 - 480)/(3 - 1)	229.5
755 (1/6/2016)	480 (8/12/2015)	(755 - 480)/(4 - 1)	91.6667
663 (2/18/2016)	480 (8/12/2015)	(663 - 480)/(5 - 1)	45.75
685 (4/6/2016)	480 (8/12/2015)	(685 - 480)/(6 - 1)	41
396 (5/26/2016)	480 (8/12/2015)	(396 - 480)/(7 - 1)	-14
504 (7/12/2016)	480 (8/12/2015)	(504 - 480)/(8 - 1)	3.42857
660 (1/24/2017)	480 (8/12/2015)	(660 - 480)/(9 - 1)	22.5
939 (11/20/2015)	515 (10/15/2015)	(939 - 515)/(3 - 2)	424
755 (1/6/2016)	515 (10/15/2015)	(755 - 515)/(4 - 2)	120
663 (2/18/2016)	515 (10/15/2015)	(663 - 515)/(5 - 2)	49.3333
685 (4/6/2016)	515 (10/15/2015)	(685 - 515)/(6 - 2)	42.5
396 (5/26/2016)	515 (10/15/2015)	(396 - 515)/(7 - 2)	-23.8
504 (7/12/2016)	515 (10/15/2015)	(504 - 515)/(8 - 2)	-1.83333
660 (1/24/2017)	515 (10/15/2015)	(660 - 515)/(9 - 2)	20.7143
755 (1/6/2016)	939 (11/20/2015)	(755 - 939)/(4 - 3)	-184
663 (2/18/2016)	939 (11/20/2015)	(663 - 939)/(5 - 3)	-138
685 (4/6/2016)	939 (11/20/2015)	(685 - 939)/(6 - 3)	-84.6667
396 (5/26/2016)	939 (11/20/2015)	(396 - 939)/(7 - 3)	-135.75
504 (7/12/2016)	939 (11/20/2015)	(504 - 939)/(8 - 3)	-87
660 (1/24/2017)	939 (11/20/2015)	(660 - 939)/(9 - 3)	-46.5
663 (2/18/2016)	755 (1/6/2016)	(663 - 755)/(5 - 4)	-92
685 (4/6/2016)	755 (1/6/2016)	(685 - 755)/(6 - 4)	-35
396 (5/26/2016)	755 (1/6/2016)	(396 - 755)/(7 - 4)	-119.667
504 (7/12/2016)	755 (1/6/2016)	(504 - 755)/(8 - 4)	-62.75
660 (1/24/2017)	755 (1/6/2016)	(660 - 755)/(9 - 4)	-19
685 (4/6/2016)	663 (2/18/2016)	(685 - 663)/(6 - 5)	22
396 (5/26/2016)	663 (2/18/2016)	(396 - 663)/(7 - 5)	-133.5
504 (7/12/2016)	663 (2/18/2016)	(504 - 663)/(8 - 5)	-53
660 (1/24/2017)	663 (2/18/2016)	(660 - 663)/(9 - 5)	-0.75
396 (5/26/2016)	685 (4/6/2016)	(396 - 685)/(7 - 6)	-289
504 (7/12/2016)	685 (4/6/2016)	(504 - 685)/(8 - 6)	-90.5
660 (1/24/2017)	685 (4/6/2016)	(660 - 685)/(9 - 6)	-8.33333
504 (7/12/2016)	396 (5/26/2016)	(504 - 396)/(8 - 7)	108
660 (1/24/2017)	396 (5/26/2016)	(660 - 396)/(9 - 7)	132
660 (1/24/2017)	504 (7/12/2016)	(660 - 504)/(9 - 8)	156

Number of Q values = 36

Ordered Q Values

n	Q
1	-289
2	-184
3	-138
4	-135.75
5	-133.5
6	-119.667
7	-92
8	-90.5
9	-87
10	-84.6667
11	-62.75
12	-53
13	-46.5
14	-35
15	-23.8
16	-19
17	-14
18	-8.33333
19	-1.83333
20	-0.75
21	3.42857
22	20.7143
23	22
24	22.5
25	35
26	41
27	42.5
28	45.75
29	49.3333
30	91.6667
31	108
32	120
33	132
34	156
35	229.5
36	424

Sen's Estimator (Median Q) is -5.08333

Time Period	Observations
8/12/2015	1
10/15/2015	1
11/20/2015	1
1/6/2016	1
2/18/2016	1
4/6/2016	1
5/26/2016	1
7/12/2016	1
1/24/2017	1

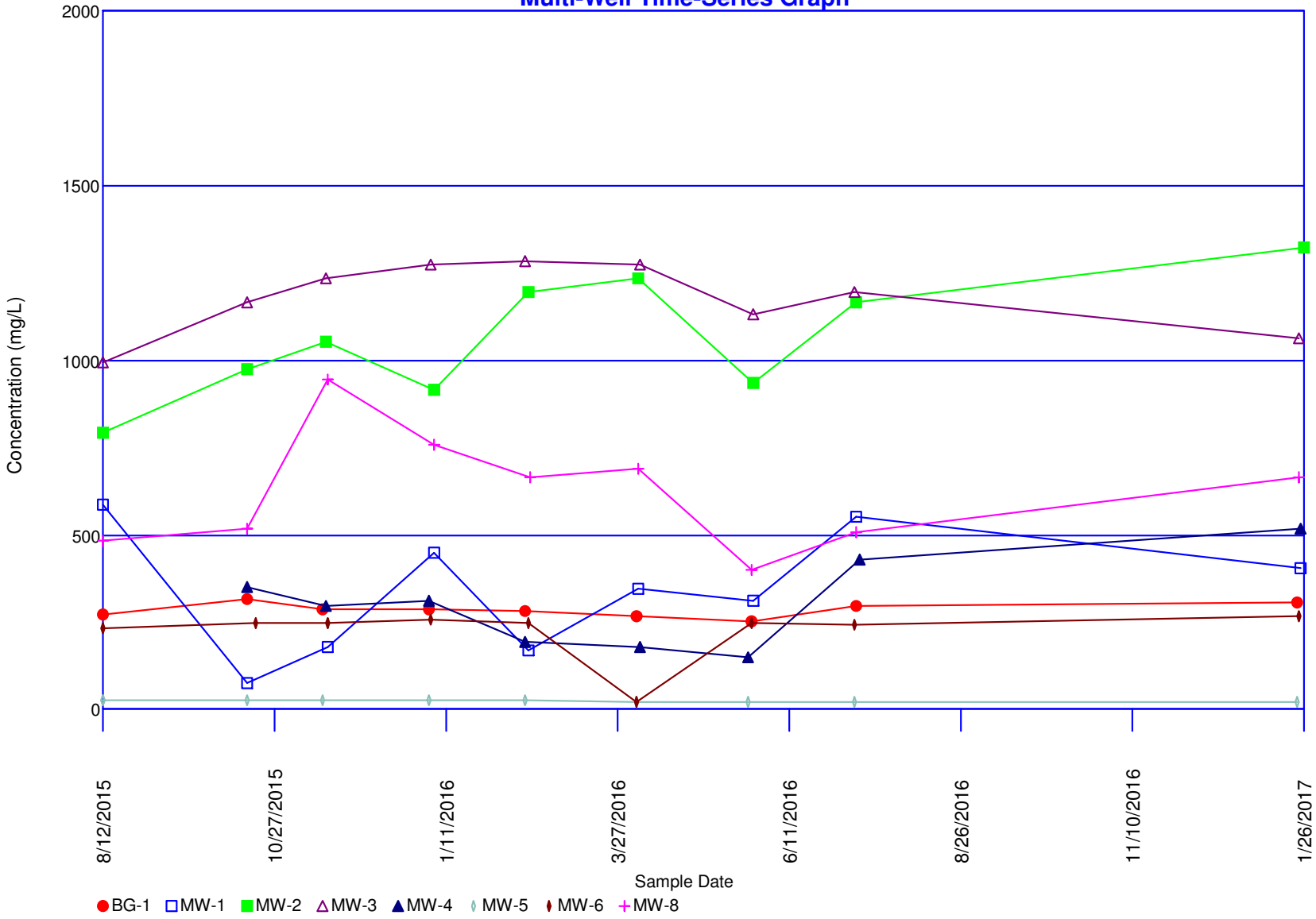
There are 0 time periods with multiple data

A = 0
B = 0
C = 0
D = 0
E = 0
F = 0

a = 1656
b = 4536
c = 144
Group Variance = 92
For 90% confidence interval (two-tailed), Z at (1-0.9)/2 = 1.64485
C = 15.7769
M1 = (36 - 15.7769)/2.0 = 10.1116
M2 = (36 + 15.7769)/2.0 + 1 = 26.8884
Lower limit is -84.6667 = Q(10)
Upper limit is 42.5 = Q(27)
-84.6667 < 0 < 42.5 indicating no trend in data.

Chloride

Multi-Well Time-Series Graph



Concentrations (ug/L)

Parameter: Chromium

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

Total Measurements: 81
Total Non-Detect: 59
Percent Non-Detects: 72.8395%
Total Background Measurements: 9
There is 1 background location

Loc.	Meas.	ND	Date	Conc.	Original
BG-1	9	9 (100%)	8/12/2015	ND<5 U	ND<5 U
			10/15/2015	ND<5 U	ND<5 U
			11/18/2015	ND<5 U	ND<5 U
			1/4/2016	ND<5 U	ND<5 U
			2/16/2016	ND<5 U	ND<5 U
			4/5/2016	ND<5 U	ND<5 U
			5/26/2016	ND<5 U	ND<5 U
			7/12/2016	ND<5 U	ND<5 U
			1/23/2017	ND<5 U	ND<5 U

There are 8 compliance locations

Loc.	Meas.	ND	Date	Conc.	Original
MW-1	9	7 (77.7778%)	8/12/2015	1.1 J	1.1 J
			10/15/2015	ND<5 U	ND<5 U
			11/20/2015	ND<5 U	ND<5 U
			1/6/2016	ND<5 U	ND<5 U
			2/17/2016	ND<5 U	ND<5 U
			4/6/2016	ND<5 U	ND<5 U
			5/27/2016	ND<5 U	ND<5 U
			7/12/2016	ND<5 U	ND<5 U
			1/25/2017	6.6	6.6
MW-2	9	1 (11.1111%)	8/12/2015	6	6
			10/15/2015	13	13
			11/19/2015	7.2	7.2
			1/6/2016	15.8	15.8
			2/17/2016	23.3	23.3
			4/6/2016	5.7	5.7
			5/27/2016	ND<5 U	ND<5 U
			7/12/2016	5.2	5.2
			1/26/2017	29.5	29.5
MW-3	10	8 (80%)	8/12/2015	1.1 J	1.1 J
			8/12/2015	1.2 J	1.2 J
			10/15/2015	ND<5 U	ND<5 U
			11/19/2015	ND<5 U	ND<5 U
			1/5/2016	ND<5 U	ND<5 U
			2/16/2016	ND<5 U	ND<5 U
			4/7/2016	ND<5 U	ND<5 U
			5/27/2016	ND<5 U	ND<5 U
			7/11/2016	ND<5 U	ND<5 U
			1/24/2017	ND<5 U	ND<5 U

MW-4	9	8 (88.8889%)	8/12/2015	2.5 J	2.5 J
			10/15/2015	ND<5 U	ND<5 U
			11/19/2015	ND<5 U	ND<5 U
			1/4/2016	ND<5 U	ND<5 U
			2/16/2016	ND<5 U	ND<5 U
			4/7/2016	ND<5 U	ND<5 U
			5/25/2016	ND<5 U	ND<5 U
			7/13/2016	ND<5 U	ND<5 U
			1/25/2017	ND<5 U	ND<5 U
MW-5	9	7 (77.7778%)	8/12/2015	1.8 J	1.8 J
			10/15/2015	10.8	10.8
			11/18/2015	ND<5 U	ND<5 U
			1/4/2016	ND<5 U	ND<5 U
			2/16/2016	ND<5 U	ND<5 U
			4/5/2016	ND<5 U	ND<5 U
			5/25/2016	ND<5 U	ND<5 U
			7/11/2016	ND<5 U	ND<5 U
			1/23/2017	ND<5 U	ND<5 U
MW-6	9	8 (88.8889%)	8/12/2015	0.75 J	0.75 J
			10/19/2015	ND<5 U	ND<5 U
			11/20/2015	ND<5 U	ND<5 U
			1/5/2016	ND<5 U	ND<5 U
			2/17/2016	ND<5 U	ND<5 U
			4/5/2016	ND<5 U	ND<5 U
			5/26/2016	ND<5 U	ND<5 U
			7/11/2016	ND<5 U	ND<5 U
			1/24/2017	ND<5 U	ND<5 U
MW-7	8	5 (62.5%)	8/12/2015	0.93 J	0.93 J
			10/16/2015	10.7	10.7
			11/20/2015	ND<5 U	ND<5 U
			1/5/2016	ND<5 U	ND<5 U
			2/18/2016	23.7	23.7
			4/6/2016	ND<5 U	ND<5 U
			5/26/2016	ND<5 U	ND<5 U
			7/11/2016	ND<5 U	ND<5 U
MW-8	9	6 (66.6667%)	8/12/2015	1.7 J	1.7 J
			10/15/2015	33.9	33.9
			11/20/2015	ND<5 U	ND<5 U
			1/6/2016	ND<5 U	ND<5 U
			2/18/2016	ND<5 U	ND<5 U
			4/6/2016	ND<5 U	ND<5 U
			5/26/2016	ND<5 U	ND<5 U
			7/12/2016	ND<5 U	ND<5 U
			1/24/2017	82	82

There are 0 unused locations

Loc.	Meas.	ND	Date	Conc.	Original

Rosner's Test for Outliers

Parameter: Chromium

All Locations

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

Data set mean = 7.15407

10 most extreme of 81 measurements

by order of magnitude difference from the mean

1	1/24/2017	MW-8	82	74.8459
2	10/15/2015	MW-8	33.9	26.7459
3	1/26/2017	MW-2	29.5	22.3459
4	2/18/2016	MW-7	23.7	16.5459
5	2/17/2016	MW-2	23.3	16.1459
6	1/6/2016	MW-2	15.8	8.64593
7	8/12/2015	MW-6	0.75 J	-6.40407
8	8/12/2015	MW-7	0.93 J	-6.22407
9	8/12/2015	MW-1	1.1 J	-6.05407
10	8/12/2015	MW-3	1.1 J	-6.05407

Iteration i = 9

Mean of 72 measurements = 5.11806
Std Dev = 1.65762
x(i+1) = 1.1 from measurement 8/12/2015 from location MW-3
Rosner Statistic R = |1.1 - 5.11806|/1.65762 = 2.42399
Lambda(81, 10, 0.05) = 3.265
2.42399 < 3.265 -- No outliers detected for i = 9

Iteration i = 8

Mean of 73 measurements = 5.06301
Std Dev = 1.71193
x(i+1) = 1.1 from measurement 8/12/2015 from location MW-1
Rosner Statistic R = |1.1 - 5.06301|/1.71193 = 2.31494
Lambda(81, 9, 0.05) = 3.2708
2.31494 < 3.2708 -- No outliers detected for i = 8

Iteration i = 7

Mean of 74 measurements = 5.00716
Std Dev = 1.76674
x(i+1) = 0.93 from measurement 8/12/2015 from location MW-7
Rosner Statistic R = |0.93 - 5.00716|/1.76674 = 2.30773
Lambda(81, 8, 0.05) = 3.2766
2.30773 < 3.2766 -- No outliers detected for i = 7

Iteration i = 6

Mean of 75 measurements = 4.9504
Std Dev = 1.82232
x(i+1) = 0.75 from measurement 8/12/2015 from location MW-6
Rosner Statistic R = |0.75 - 4.9504|/1.82232 = 2.30497
Lambda(81, 7, 0.05) = 3.2824
2.30497 < 3.2824 -- No outliers detected for i = 6

Iteration i = 5
Mean of 76 measurements = 5.09316
Std Dev = 2.19669
x(i+1) = 15.8 from measurement 1/6/2016 from location MW-2
Rosner Statistic R = |15.8 - 5.09316|/2.19669 = 4.87408
Lambda(81, 6, 0.05) = 3.2882
4.87408 > 3.2882 -- Measurement 1/6/2016 for location MW-2 is an outlier

Iteration i = 4
Mean of 77 measurements = 5.32961
Std Dev = 3.01115
x(i+1) = 23.3 from measurement 2/17/2016 from location MW-2
Rosner Statistic R = |23.3 - 5.32961|/3.01115 = 5.96796
Lambda(81, 5, 0.05) = 3.294
Measurement 2/17/2016 for location MW-2 is an outlier

Iteration i = 3
Mean of 78 measurements = 5.56513
Std Dev = 3.6436
x(i+1) = 23.7 from measurement 2/18/2016 from location MW-7
Rosner Statistic R = |23.7 - 5.56513|/3.6436 = 4.97719
Lambda(81, 4, 0.05) = 3.295
Measurement 2/18/2016 for location MW-7 is an outlier

Iteration i = 2
Mean of 79 measurements = 5.8681
Std Dev = 4.5119
x(i+1) = 29.5 from measurement 1/26/2017 from location MW-2
Rosner Statistic R = |29.5 - 5.8681|/4.5119 = 5.23769
Lambda(81, 3, 0.05) = 3.304
Measurement 1/26/2017 for location MW-2 is an outlier

Iteration i = 1
Mean of 80 measurements = 6.2185
Std Dev = 5.47009
x(i+1) = 33.9 from measurement 10/15/2015 from location MW-8
Rosner Statistic R = |33.9 - 6.2185|/5.47009 = 5.06052
Lambda(81, 2, 0.05) = 3.304
Measurement 10/15/2015 for location MW-8 is an outlier

Iteration i = 0
Mean of 81 measurements = 7.15407
Std Dev = 10.0223
x(i+1) = 82 from measurement 1/24/2017 from location MW-8
Rosner Statistic R = |82 - 7.15407|/10.0223 = 7.46792
Lambda(81, 1, 0.05) = 3.314
Measurement 1/24/2017 for location MW-8 is an outlier

Non-Parametric Prediction Interval

Inter-Well Comparison

Parameter: Chromium

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

Total Percent Non-Detects = 73.9726%
Number of comparisons = 7
Future Samples (k) = 7
Recent Dates = 1
Background Measurements (n) = 9
Maximum Background Value = 5
Confidence Level = 56.3%
False Positive Rate = 43.7%

Location	Date	Count	Mean	Significant
MW-1	**1/25/2017**	**1**	**6.6**	**TRUE**
MW-2	**1/26/2017**	**1**	**29.5**	**TRUE**
MW-3	1/24/2017	1	5	FALSE
MW-4	1/25/2017	1	5	FALSE
MW-5	1/23/2017	1	5	FALSE
MW-6	1/24/2017	1	5	FALSE
MW-8	**1/24/2017**	**1**	**82**	**TRUE**

Sen's Slope Analysis

Parameter: Chromium

Location: MW-1

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

90% Confidence Level

Xj	Xk	(Xj - Xk)/(j-k)	Q
ND<5 U (10/15/2015)	1.1 J (8/12/2015)	(5 - 1.1)/(2 - 1)	3.9
ND<5 U (11/20/2015)	1.1 J (8/12/2015)	(5 - 1.1)/(3 - 1)	1.95
ND<5 U (1/6/2016)	1.1 J (8/12/2015)	(5 - 1.1)/(4 - 1)	1.3
ND<5 U (2/17/2016)	1.1 J (8/12/2015)	(5 - 1.1)/(5 - 1)	0.975
ND<5 U (4/6/2016)	1.1 J (8/12/2015)	(5 - 1.1)/(6 - 1)	0.78
ND<5 U (5/27/2016)	1.1 J (8/12/2015)	(5 - 1.1)/(7 - 1)	0.65
ND<5 U (7/12/2016)	1.1 J (8/12/2015)	(5 - 1.1)/(8 - 1)	0.557143
6.6 (1/25/2017)	1.1 J (8/12/2015)	(6.6 - 1.1)/(9 - 1)	0.6875
ND<5 U (11/20/2015)	ND<5 U (10/15/2015)	(5 - 5)/(3 - 2)	0
ND<5 U (1/6/2016)	ND<5 U (10/15/2015)	(5 - 5)/(4 - 2)	0
ND<5 U (2/17/2016)	ND<5 U (10/15/2015)	(5 - 5)/(5 - 2)	0
ND<5 U (4/6/2016)	ND<5 U (10/15/2015)	(5 - 5)/(6 - 2)	0
ND<5 U (5/27/2016)	ND<5 U (10/15/2015)	(5 - 5)/(7 - 2)	0
ND<5 U (7/12/2016)	ND<5 U (10/15/2015)	(5 - 5)/(8 - 2)	0
6.6 (1/25/2017)	ND<5 U (10/15/2015)	(6.6 - 5)/(9 - 2)	0.228571
ND<5 U (1/6/2016)	ND<5 U (11/20/2015)	(5 - 5)/(4 - 3)	0
ND<5 U (2/17/2016)	ND<5 U (11/20/2015)	(5 - 5)/(5 - 3)	0
ND<5 U (4/6/2016)	ND<5 U (11/20/2015)	(5 - 5)/(6 - 3)	0
ND<5 U (5/27/2016)	ND<5 U (11/20/2015)	(5 - 5)/(7 - 3)	0
ND<5 U (7/12/2016)	ND<5 U (11/20/2015)	(5 - 5)/(8 - 3)	0
6.6 (1/25/2017)	ND<5 U (11/20/2015)	(6.6 - 5)/(9 - 3)	0.266667
ND<5 U (2/17/2016)	ND<5 U (1/6/2016)	(5 - 5)/(5 - 4)	0
ND<5 U (4/6/2016)	ND<5 U (1/6/2016)	(5 - 5)/(6 - 4)	0
ND<5 U (5/27/2016)	ND<5 U (1/6/2016)	(5 - 5)/(7 - 4)	0
ND<5 U (7/12/2016)	ND<5 U (1/6/2016)	(5 - 5)/(8 - 4)	0
6.6 (1/25/2017)	ND<5 U (1/6/2016)	(6.6 - 5)/(9 - 4)	0.32
ND<5 U (4/6/2016)	ND<5 U (2/17/2016)	(5 - 5)/(6 - 5)	0
ND<5 U (5/27/2016)	ND<5 U (2/17/2016)	(5 - 5)/(7 - 5)	0
ND<5 U (7/12/2016)	ND<5 U (2/17/2016)	(5 - 5)/(8 - 5)	0
6.6 (1/25/2017)	ND<5 U (2/17/2016)	(6.6 - 5)/(9 - 5)	0.4
ND<5 U (5/27/2016)	ND<5 U (4/6/2016)	(5 - 5)/(7 - 6)	0
ND<5 U (7/12/2016)	ND<5 U (4/6/2016)	(5 - 5)/(8 - 6)	0
6.6 (1/25/2017)	ND<5 U (4/6/2016)	(6.6 - 5)/(9 - 6)	0.533333
ND<5 U (7/12/2016)	ND<5 U (5/27/2016)	(5 - 5)/(8 - 7)	0
6.6 (1/25/2017)	ND<5 U (5/27/2016)	(6.6 - 5)/(9 - 7)	0.8
6.6 (1/25/2017)	ND<5 U (7/12/2016)	(6.6 - 5)/(9 - 8)	1.6

Number of Q values = 36

Ordered Q Values

n	Q
1	0
2	0
3	0
4	0
5	0
6	0
7	0
8	0
9	0
10	0
11	0
12	0
13	0
14	0
15	0
16	0
17	0
18	0
19	0
20	0
21	0
22	0.228571
23	0.266667
24	0.32
25	0.4
26	0.533333
27	0.557143
28	0.65
29	0.6875
30	0.78
31	0.8
32	0.975
33	1.3
34	1.6
35	1.95
36	3.9

Sen's Estimator (Median Q) is 0

Tied Group	Value	Members
1	5	7

Time Period	Observations
8/12/2015	1
10/15/2015	1
11/20/2015	1
1/6/2016	1
2/17/2016	1
4/6/2016	1
5/27/2016	1
7/12/2016	1
1/25/2017	1

There are 0 time periods with multiple data

A = 798
B = 0
C = 210

D = 0
E = 42
F = 0
a = 1656
b = 4536
c = 144
Group Variance = 47.6667
For 90% confidence interval (two-tailed), Z at (1-0.9)/2 = 1.64485
C = 11.3562
M1 = (36 - 11.3562)/2.0 = 12.3219
M2 = (36 + 11.3562)/2.0 + 1 = 24.6781
Lower limit is 0 = Q(12)
Upper limit is 0.4 = Q(25)
0 < 0 < 0.4 indicating no trend in data.

Sen's Slope Analysis

Parameter: Chromium

Location: MW-2

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

90% Confidence Level

Xj	Xk	(Xj - Xk)/(j-k)	Q
13 (10/15/2015)	6 (8/12/2015)	(13 - 6)/(2 - 1)	7
7.2 (11/19/2015)	6 (8/12/2015)	(7.2 - 6)/(3 - 1)	0.6
15.8 (1/6/2016)	6 (8/12/2015)	(15.8 - 6)/(4 - 1)	3.26667
23.3 (2/17/2016)	6 (8/12/2015)	(23.3 - 6)/(5 - 1)	4.325
5.7 (4/6/2016)	6 (8/12/2015)	(5.7 - 6)/(6 - 1)	-0.06
ND<5 U (5/27/2016)	6 (8/12/2015)	(5 - 6)/(7 - 1)	-0.166667
5.2 (7/12/2016)	6 (8/12/2015)	(5.2 - 6)/(8 - 1)	-0.114286
29.5 (1/26/2017)	6 (8/12/2015)	(29.5 - 6)/(9 - 1)	2.9375
7.2 (11/19/2015)	13 (10/15/2015)	(7.2 - 13)/(3 - 2)	-5.8
15.8 (1/6/2016)	13 (10/15/2015)	(15.8 - 13)/(4 - 2)	1.4
23.3 (2/17/2016)	13 (10/15/2015)	(23.3 - 13)/(5 - 2)	3.43333
5.7 (4/6/2016)	13 (10/15/2015)	(5.7 - 13)/(6 - 2)	-1.825
ND<5 U (5/27/2016)	13 (10/15/2015)	(5 - 13)/(7 - 2)	-1.6
5.2 (7/12/2016)	13 (10/15/2015)	(5.2 - 13)/(8 - 2)	-1.3
29.5 (1/26/2017)	13 (10/15/2015)	(29.5 - 13)/(9 - 2)	2.35714
15.8 (1/6/2016)	7.2 (11/19/2015)	(15.8 - 7.2)/(4 - 3)	8.6
23.3 (2/17/2016)	7.2 (11/19/2015)	(23.3 - 7.2)/(5 - 3)	8.05
5.7 (4/6/2016)	7.2 (11/19/2015)	(5.7 - 7.2)/(6 - 3)	-0.5
ND<5 U (5/27/2016)	7.2 (11/19/2015)	(5 - 7.2)/(7 - 3)	-0.55
5.2 (7/12/2016)	7.2 (11/19/2015)	(5.2 - 7.2)/(8 - 3)	-0.4
29.5 (1/26/2017)	7.2 (11/19/2015)	(29.5 - 7.2)/(9 - 3)	3.71667
23.3 (2/17/2016)	15.8 (1/6/2016)	(23.3 - 15.8)/(5 - 4)	7.5
5.7 (4/6/2016)	15.8 (1/6/2016)	(5.7 - 15.8)/(6 - 4)	-5.05
ND<5 U (5/27/2016)	15.8 (1/6/2016)	(5 - 15.8)/(7 - 4)	-3.6
5.2 (7/12/2016)	15.8 (1/6/2016)	(5.2 - 15.8)/(8 - 4)	-2.65
29.5 (1/26/2017)	15.8 (1/6/2016)	(29.5 - 15.8)/(9 - 4)	2.74
5.7 (4/6/2016)	23.3 (2/17/2016)	(5.7 - 23.3)/(6 - 5)	-17.6
ND<5 U (5/27/2016)	23.3 (2/17/2016)	(5 - 23.3)/(7 - 5)	-9.15
5.2 (7/12/2016)	23.3 (2/17/2016)	(5.2 - 23.3)/(8 - 5)	-6.03333
29.5 (1/26/2017)	23.3 (2/17/2016)	(29.5 - 23.3)/(9 - 5)	1.55
ND<5 U (5/27/2016)	5.7 (4/6/2016)	(5 - 5.7)/(7 - 6)	-0.7
5.2 (7/12/2016)	5.7 (4/6/2016)	(5.2 - 5.7)/(8 - 6)	-0.25
29.5 (1/26/2017)	5.7 (4/6/2016)	(29.5 - 5.7)/(9 - 6)	7.93333
5.2 (7/12/2016)	ND<5 U (5/27/2016)	(5.2 - 5)/(8 - 7)	0.2
29.5 (1/26/2017)	ND<5 U (5/27/2016)	(29.5 - 5)/(9 - 7)	12.25
29.5 (1/26/2017)	5.2 (7/12/2016)	(29.5 - 5.2)/(9 - 8)	24.3

Number of Q values = 36

Ordered Q Values

n	Q
1	-17.6
2	-9.15
3	-6.03333
4	-5.8
5	-5.05
6	-3.6
7	-2.65
8	-1.825
9	-1.6
10	-1.3
11	-0.7
12	-0.55
13	-0.5
14	-0.4
15	-0.25
16	-0.166667
17	-0.114286
18	-0.06
19	0.2
20	0.6
21	1.4
22	1.55
23	2.35714
24	2.74
25	2.9375
26	3.26667
27	3.43333
28	3.71667
29	4.325
30	7
31	7.5
32	7.93333
33	8.05
34	8.6
35	12.25
36	24.3

Sen's Estimator (Median Q) is 0.07

Time Period	Observations
8/12/2015	1
10/15/2015	1
11/19/2015	1
1/6/2016	1
2/17/2016	1
4/6/2016	1
5/27/2016	1
7/12/2016	1
1/26/2017	1

There are 0 time periods with multiple data

A = 0
B = 0
C = 0
D = 0
E = 0
F = 0

a = 1656
b = 4536
c = 144
Group Variance = 92
For 90% confidence interval (two-tailed), Z at (1-0.9)/2 = 1.64485
C = 15.7769
M1 = (36 - 15.7769)/2.0 = 10.1116
M2 = (36 + 15.7769)/2.0 + 1 = 26.8884
Lower limit is -1.3 = Q(10)
Upper limit is 3.43333 = Q(27)
-1.3 < 0 < 3.43333 indicating no trend in data.

Sen's Slope Analysis

Parameter: Chromium

Location: MW-8

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

90% Confidence Level

Xj	Xk	(Xj - Xk)/(j-k)	Q
33.9 (10/15/2015)	1.7 J (8/12/2015)	(33.9 - 1.7)/(2 - 1)	32.2
ND<5 U (11/20/2015)	1.7 J (8/12/2015)	(5 - 1.7)/(3 - 1)	1.65
ND<5 U (1/6/2016)	1.7 J (8/12/2015)	(5 - 1.7)/(4 - 1)	1.1
ND<5 U (2/18/2016)	1.7 J (8/12/2015)	(5 - 1.7)/(5 - 1)	0.825
ND<5 U (4/6/2016)	1.7 J (8/12/2015)	(5 - 1.7)/(6 - 1)	0.66
ND<5 U (5/26/2016)	1.7 J (8/12/2015)	(5 - 1.7)/(7 - 1)	0.55
ND<5 U (7/12/2016)	1.7 J (8/12/2015)	(5 - 1.7)/(8 - 1)	0.471429
82 (1/24/2017)	1.7 J (8/12/2015)	(82 - 1.7)/(9 - 1)	10.0375
ND<5 U (11/20/2015)	33.9 (10/15/2015)	(5 - 33.9)/(3 - 2)	-28.9
ND<5 U (1/6/2016)	33.9 (10/15/2015)	(5 - 33.9)/(4 - 2)	-14.45
ND<5 U (2/18/2016)	33.9 (10/15/2015)	(5 - 33.9)/(5 - 2)	-9.63333
ND<5 U (4/6/2016)	33.9 (10/15/2015)	(5 - 33.9)/(6 - 2)	-7.225
ND<5 U (5/26/2016)	33.9 (10/15/2015)	(5 - 33.9)/(7 - 2)	-5.78
ND<5 U (7/12/2016)	33.9 (10/15/2015)	(5 - 33.9)/(8 - 2)	-4.81667
82 (1/24/2017)	33.9 (10/15/2015)	(82 - 33.9)/(9 - 2)	6.87143
ND<5 U (1/6/2016)	ND<5 U (11/20/2015)	(5 - 5)/(4 - 3)	0
ND<5 U (2/18/2016)	ND<5 U (11/20/2015)	(5 - 5)/(5 - 3)	0
ND<5 U (4/6/2016)	ND<5 U (11/20/2015)	(5 - 5)/(6 - 3)	0
ND<5 U (5/26/2016)	ND<5 U (11/20/2015)	(5 - 5)/(7 - 3)	0
ND<5 U (7/12/2016)	ND<5 U (11/20/2015)	(5 - 5)/(8 - 3)	0
82 (1/24/2017)	ND<5 U (11/20/2015)	(82 - 5)/(9 - 3)	12.8333
ND<5 U (2/18/2016)	ND<5 U (1/6/2016)	(5 - 5)/(5 - 4)	0
ND<5 U (4/6/2016)	ND<5 U (1/6/2016)	(5 - 5)/(6 - 4)	0
ND<5 U (5/26/2016)	ND<5 U (1/6/2016)	(5 - 5)/(7 - 4)	0
ND<5 U (7/12/2016)	ND<5 U (1/6/2016)	(5 - 5)/(8 - 4)	0
82 (1/24/2017)	ND<5 U (1/6/2016)	(82 - 5)/(9 - 4)	15.4
ND<5 U (4/6/2016)	ND<5 U (2/18/2016)	(5 - 5)/(6 - 5)	0
ND<5 U (5/26/2016)	ND<5 U (2/18/2016)	(5 - 5)/(7 - 5)	0
ND<5 U (7/12/2016)	ND<5 U (2/18/2016)	(5 - 5)/(8 - 5)	0
82 (1/24/2017)	ND<5 U (2/18/2016)	(82 - 5)/(9 - 5)	19.25
ND<5 U (5/26/2016)	ND<5 U (4/6/2016)	(5 - 5)/(7 - 6)	0
ND<5 U (7/12/2016)	ND<5 U (4/6/2016)	(5 - 5)/(8 - 6)	0
82 (1/24/2017)	ND<5 U (4/6/2016)	(82 - 5)/(9 - 6)	25.6667
ND<5 U (7/12/2016)	ND<5 U (5/26/2016)	(5 - 5)/(8 - 7)	0
82 (1/24/2017)	ND<5 U (5/26/2016)	(82 - 5)/(9 - 7)	38.5
82 (1/24/2017)	ND<5 U (7/12/2016)	(82 - 5)/(9 - 8)	77

Number of Q values = 36

Ordered Q Values

n	Q
1	-28.9
2	-14.45
3	-9.63333
4	-7.225
5	-5.78
6	-4.81667
7	0
8	0
9	0
10	0
11	0
12	0
13	0
14	0
15	0
16	0
17	0
18	0
19	0
20	0
21	0
22	0.471429
23	0.55
24	0.66
25	0.825
26	1.1
27	1.65
28	6.87143
29	10.0375
30	12.8333
31	15.4
32	19.25
33	25.6667
34	32.2
35	38.5
36	77

Sen's Estimator (Median Q) is 0

Tied Group	Value	Members
1	5	6

Time Period	Observations
8/12/2015	1
10/15/2015	1
11/20/2015	1
1/6/2016	1
2/18/2016	1
4/6/2016	1
5/26/2016	1
7/12/2016	1
1/24/2017	1

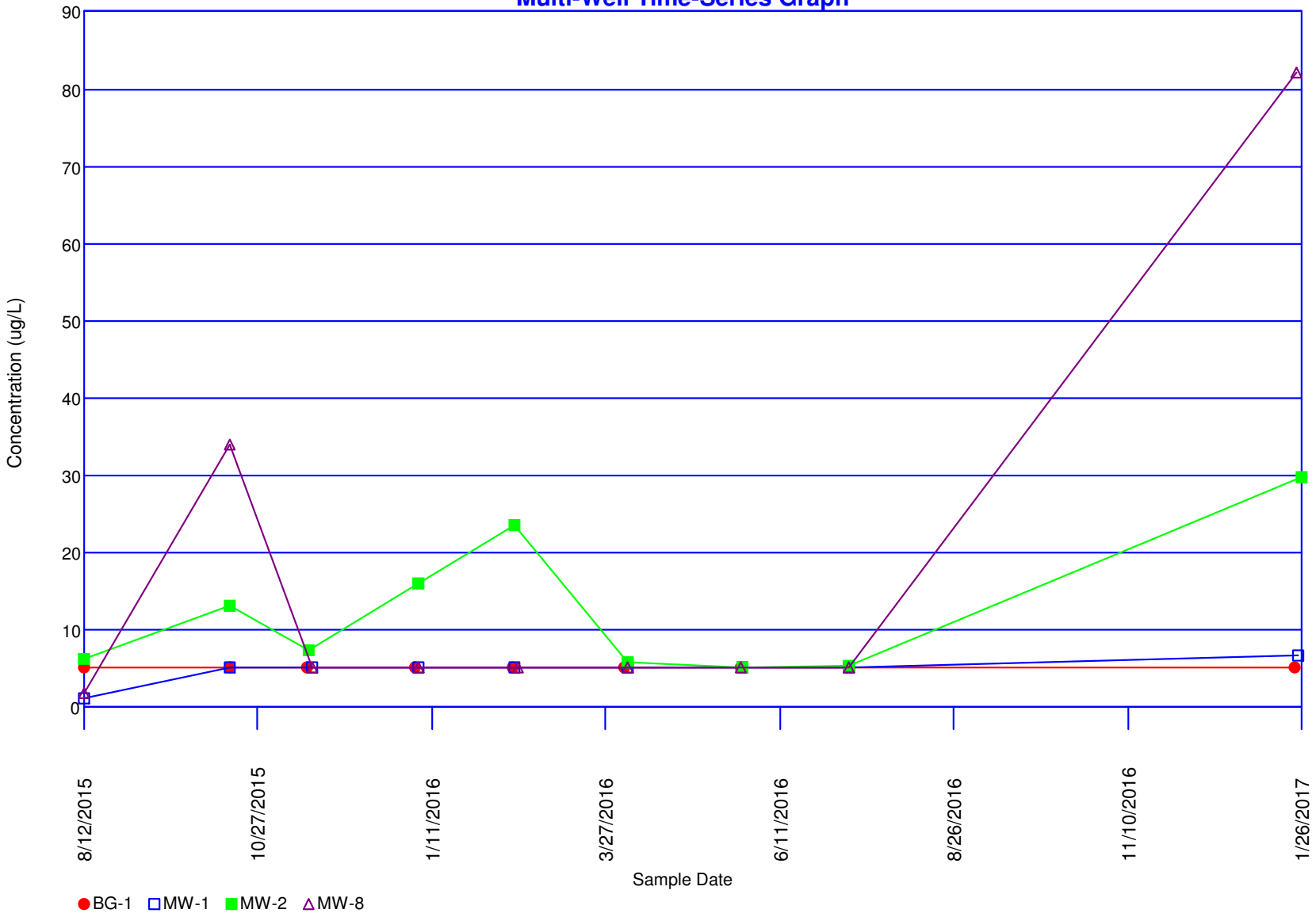
There are 0 time periods with multiple data

A = 510
B = 0
C = 120

D = 0
E = 30
F = 0
a = 1656
b = 4536
c = 144
Group Variance = 63.6667
For 90% confidence interval (two-tailed), Z at (1-0.9)/2 = 1.64485
C = 13.1245
M1 = (36 - 13.1245)/2.0 = 11.4377
M2 = (36 + 13.1245)/2.0 + 1 = 25.5623
Lower limit is 0 = Q(11)
Upper limit is 1.1 = Q(26)
0 < 0 < 1.1 indicating no trend in data.

Chromium

Multi-Well Time-Series Graph



Concentrations (mg/L)

Parameter: Fluoride

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

Total Measurements: 80
Total Non-Detect: 13
Percent Non-Detects: 16.25%
Total Background Measurements: 9
There is 1 background location

Loc.	Meas.	ND	Date	Conc.	Original
BG-1	9	0 (0%)	8/12/2015	0.22 J	0.22 J
			10/15/2015	0.1	0.1
			11/18/2015	0.12	0.12
			1/4/2016	0.13	0.13
			2/16/2016	0.13	0.13
			4/5/2016	0.13	0.13
			5/26/2016	0.12	0.12
			7/12/2016	0.11	0.11
			1/23/2017	0.14	0.14

There are 8 compliance locations

Loc.	Meas.	ND	Date	Conc.	Original
MW-1	9	0 (0%)	8/12/2015	0.23 J	0.23 J
			10/15/2015	0.16	0.16
			11/20/2015	0.16	0.16
			1/6/2016	0.14	0.14
			2/17/2016	0.16	0.16
			4/6/2016	0.13	0.13
			5/27/2016	0.11	0.11
			7/12/2016	0.12	0.12
			1/25/2017	0.12	0.12
MW-2	9	2 (22.2222%)	8/12/2015	ND<2.5 U	ND<2.5 U
			10/15/2015	0.34	0.34
			11/19/2015	0.3	0.3
			1/6/2016	0.29	0.29
			2/17/2016	0.22	0.22
			4/6/2016	0.22	0.22
			5/27/2016	0.13	0.13
			7/12/2016	0.14	0.14
			1/26/2017	ND<0.1 U	ND<0.1 U
MW-3	9	2 (22.2222%)	8/12/2015	ND<2.5 U	ND<2.5 U
			10/15/2015	0.22	0.22
			11/19/2015	0.22	0.22
			1/5/2016	0.26	0.26
			2/16/2016	0.21	0.21
			4/7/2016	0.22	0.22
			5/27/2016	0.21	0.21
			7/11/2016	0.26	0.26
			1/24/2017	ND<0.1 U	ND<0.1 U
MW-4	9	0 (0%)	8/12/2015	0.51	0.51

			10/15/2015	0.28	0.28
			11/19/2015	0.34	0.34
			1/4/2016	0.35	0.35
			2/16/2016	0.36	0.36
			4/7/2016	0.42	0.42
			5/25/2016	0.42	0.42
			7/13/2016	0.34	0.34
			1/25/2017	0.21	0.21
MW-5	9	0 (0%)	8/12/2015	0.74	0.74
			10/15/2015	0.59	0.59
			11/18/2015	0.59	0.59
			1/4/2016	0.56	0.56
			2/16/2016	0.55	0.55
			4/5/2016	0.52	0.52
			5/25/2016	0.5	0.5
			7/11/2016	0.5	0.5
			1/23/2017	0.52	0.52
MW-6	9	0 (0%)	8/12/2015	0.49 J	0.49 J
			10/19/2015	0.45	0.45
			11/20/2015	0.39	0.39
			1/5/2016	0.41	0.41
			2/17/2016	0.34	0.34
			4/5/2016	0.18	0.18
			5/26/2016	0.46	0.46
			7/11/2016	0.31	0.31
			1/24/2017	0.38	0.38
MW-7	8	0 (0%)	8/12/2015	0.45 J	0.45 J
			10/16/2015	0.38	0.38
			11/20/2015	0.37	0.37
			1/5/2016	0.35	0.35
			2/18/2016	0.27	0.27
			4/6/2016	0.26	0.26
			5/26/2016	0.22	0.22
			7/11/2016	0.21	0.21
MW-8	9	9 (100%)	8/12/2015	ND<0.5 U	ND<0.5 U
			10/15/2015	ND<0.1 U	ND<0.1 U
			11/20/2015	ND<0.1 U	ND<0.1 U
			1/6/2016	ND<0.1 U	ND<0.1 U
			2/18/2016	ND<0.1 U	ND<0.1 U
			4/6/2016	ND<0.1 U	ND<0.1 U
			5/26/2016	ND<0.1 U	ND<0.1 U
			7/12/2016	ND<0.1 U	ND<0.1 U
			1/24/2017	ND<0.1 U	ND<0.1 U

There are 0 unused locations

Loc.	Meas.	ND	Date	Conc.	Original

Rosner's Test for Outliers

Parameter: Fluoride

All Locations

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

Data set mean = 0.331125

10 most extreme of 80 measurements

by order of magnitude difference from the mean

1	8/12/2015	MW-2	ND<2.5 U	2.16887
2	8/12/2015	MW-3	ND<2.5 U	2.16887
3	8/12/2015	MW-5	0.74	0.408875
4	11/18/2015	MW-5	0.59	0.258875
5	10/15/2015	MW-5	0.59	0.258875
6	1/24/2017	MW-8	ND<0.1 U	-0.231125
7	7/12/2016	MW-8	ND<0.1 U	-0.231125
8	10/15/2015	BG-1	0.1	-0.231125
9	2/18/2016	MW-8	ND<0.1 U	-0.231125
10	1/6/2016	MW-8	ND<0.1 U	-0.231125

Iteration i = 9

Mean of 71 measurements = 0.27
Std Dev = 0.140418
x(i+1) = 0.1 from measurement 1/6/2016 from location MW-8
Rosner Statistic R = |0.1 - 0.27|/0.140418 = 1.21067
Lambda(80, 10, 0.05) = 3.26
1.21067 < 3.26 -- No outliers detected for i = 9

Iteration i = 8

Mean of 72 measurements = 0.267639
Std Dev = 0.140857
x(i+1) = 0.1 from measurement 2/18/2016 from location MW-8
Rosner Statistic R = |0.1 - 0.267639|/0.140857 = 1.19013
Lambda(80, 9, 0.05) = 3.266
1.19013 < 3.266 -- No outliers detected for i = 8

Iteration i = 7

Mean of 73 measurements = 0.265342
Std Dev = 0.141245
x(i+1) = 0.1 from measurement 10/15/2015 from location BG-1
Rosner Statistic R = |0.1 - 0.265342|/0.141245 = 1.17061
Lambda(80, 8, 0.05) = 3.272
1.17061 < 3.272 -- No outliers detected for i = 7

Iteration i = 6

Mean of 74 measurements = 0.263108
Std Dev = 0.141585
x(i+1) = 0.1 from measurement 7/12/2016 from location MW-8
Rosner Statistic R = |0.1 - 0.263108|/0.141585 = 1.15201
Lambda(80, 7, 0.05) = 3.278
1.15201 < 3.278 -- No outliers detected for i = 6

Iteration i = 5
Mean of 75 measurements = 0.260933
Std Dev = 0.141881
x(i+1) = 0.1 from measurement 1/24/2017 from location MW-8
Rosner Statistic R = |0.1 - 0.260933|/0.141881 = 1.13428
Lambda(80, 6, 0.05) = 3.284
1.13428 < 3.284 -- No outliers detected for i = 5

Iteration i = 4
Mean of 76 measurements = 0.265263
Std Dev = 0.145899
x(i+1) = 0.59 from measurement 10/15/2015 from location MW-5
Rosner Statistic R = |0.59 - 0.265263|/0.145899 = 2.22576
Lambda(80, 5, 0.05) = 3.29
2.22576 < 3.29 -- No outliers detected for i = 4

Iteration i = 3
Mean of 77 measurements = 0.269481
Std Dev = 0.149586
x(i+1) = 0.59 from measurement 11/18/2015 from location MW-5
Rosner Statistic R = |0.59 - 0.269481|/0.149586 = 2.14271
Lambda(80, 4, 0.05) = 3.29
2.14271 < 3.29 -- No outliers detected for i = 3

Iteration i = 2
Mean of 78 measurements = 0.275513
Std Dev = 0.157873
x(i+1) = 0.74 from measurement 8/12/2015 from location MW-5
Rosner Statistic R = |0.74 - 0.275513|/0.157873 = 2.94216
Lambda(80, 3, 0.05) = 3.3
2.94216 < 3.3 -- No outliers detected for i = 2

Iteration i = 1
Mean of 79 measurements = 0.303671
Std Dev = 0.295367
x(i+1) = 2.5 from measurement 8/12/2015 from location MW-3
Rosner Statistic R = |2.5 - 0.303671|/0.295367 = 7.43594
Lambda(80, 2, 0.05) = 3.3
7.43594 > 3.3 -- Measurement 8/12/2015 for location MW-3 is an outlier

Iteration i = 0
Mean of 80 measurements = 0.331125
Std Dev = 0.382669
x(i+1) = 2.5 from measurement 8/12/2015 from location MW-2
Rosner Statistic R = |2.5 - 0.331125|/0.382669 = 5.66776
Lambda(80, 1, 0.05) = 3.31
Measurement 8/12/2015 for location MW-2 is an outlier

Shapiro-Wilks Test of Normality

Parameter: Fluoride

All Locations

Normality Test of Parameter Concentrations

Natural Logarithm Transformation

Non-Detects Replaced with Detection Limit

K = 4 for 9 measurements

i	x(i)	x(n-i+1)	x(n-1+1)-x(i)	a(n-i+1)	b(i)
1	-2.30259	-1.51413	0.788457	0.5888	0.464244
2	-2.20727	-1.96611	0.241162	0.3244	0.078233
3	-2.12026	-2.04022	0.0800427	0.1976	0.0158164
4	-2.12026	-2.04022	0.0800427	0.0947	0.00758004
5	-2.04022	-2.04022	0		
6	-2.04022	-2.12026	-0.0800427		
7	-2.04022	-2.12026	-0.0800427		
8	-1.96611	-2.20727	-0.241162		
9	-1.51413	-2.30259	-0.788457		

Sum of b values = 0.565873
Sample Standard Deviation = 0.221305
W Statistic = 0.817267

5% Critical value of 0.829 exceeds 0.817267
Evidence of non-normality at 95% level of significance

1% Critical value of 0.764 is less than 0.817267
Data is normally distributed at 99% level of significance

Parametric Prediction Interval Analysis

Inter-Well Comparison

Parameter: Fluoride

Natural Logarithm Transformation

Non-Detects Replaced with Detection Limit

Inter-Well Unified Guid. Formula 95% One-Sided Comparison

Background Samples = 9
Background Mean = -2.03903
Background Std Dev = 0.221305

Number of comparisons = 7
Future Samples (k) = 7
Actual confidence level is 1.0 - (0.05/7) = 99.2857 %
t is Percentile of Student's T-Test (0.95/7) = 0.992857
Degrees of Freedom = 9 (background observations) - 1
t(0.992857, 9) = 3.1587

Well MW-1

Date	Samples	Mean	Interval	Significant
1/25/2017	1	-2.12026	[0, -1.30218]	FALSE

Well MW-2

Date	Samples	Mean	Interval	Significant
1/26/2017	1	-2.30259	[0, -1.30218]	FALSE

Well MW-3

Date	Samples	Mean	Interval	Significant
1/24/2017	1	-2.30259	[0, -1.30218]	FALSE

Well MW-4

Date	Samples	Mean	Interval	Significant
1/25/2017	1	-1.56065	[0, -1.30218]	FALSE

Well MW-5

Date	Samples	Mean	Interval	Significant
1/23/2017	**1**	**-0.653926**	**[0, -1.30218]**	**TRUE**

Well MW-6

Date	Samples	Mean	Interval	Significant
1/24/2017	**1**	**-0.967584**	**[0, -1.30218]**	**TRUE**

Well MW-8

Date	Samples	Mean	Interval	Significant
1/24/2017	1	-2.30259	[0, -1.30218]	FALSE

Sen's Slope Analysis

Parameter: Fluoride

Location: MW-5

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

90% Confidence Level

Xj	Xk	(Xj - Xk)/(j-k)	Q
0.59 (10/15/2015)	0.74 (8/12/2015)	(0.59 - 0.74)/(2 - 1)	-0.15
0.59 (11/18/2015)	0.74 (8/12/2015)	(0.59 - 0.74)/(3 - 1)	-0.075
0.56 (1/4/2016)	0.74 (8/12/2015)	(0.56 - 0.74)/(4 - 1)	-0.06
0.55 (2/16/2016)	0.74 (8/12/2015)	(0.55 - 0.74)/(5 - 1)	-0.0475
0.52 (4/5/2016)	0.74 (8/12/2015)	(0.52 - 0.74)/(6 - 1)	-0.044
0.5 (5/25/2016)	0.74 (8/12/2015)	(0.5 - 0.74)/(7 - 1)	-0.04
0.5 (7/11/2016)	0.74 (8/12/2015)	(0.5 - 0.74)/(8 - 1)	-0.0342857
0.52 (1/23/2017)	0.74 (8/12/2015)	(0.52 - 0.74)/(9 - 1)	-0.0275
0.59 (11/18/2015)	0.59 (10/15/2015)	(0.59 - 0.59)/(3 - 2)	0
0.56 (1/4/2016)	0.59 (10/15/2015)	(0.56 - 0.59)/(4 - 2)	-0.015
0.55 (2/16/2016)	0.59 (10/15/2015)	(0.55 - 0.59)/(5 - 2)	-0.0133333
0.52 (4/5/2016)	0.59 (10/15/2015)	(0.52 - 0.59)/(6 - 2)	-0.0175
0.5 (5/25/2016)	0.59 (10/15/2015)	(0.5 - 0.59)/(7 - 2)	-0.018
0.5 (7/11/2016)	0.59 (10/15/2015)	(0.5 - 0.59)/(8 - 2)	-0.015
0.52 (1/23/2017)	0.59 (10/15/2015)	(0.52 - 0.59)/(9 - 2)	-0.01
0.56 (1/4/2016)	0.59 (11/18/2015)	(0.56 - 0.59)/(4 - 3)	-0.03
0.55 (2/16/2016)	0.59 (11/18/2015)	(0.55 - 0.59)/(5 - 3)	-0.02
0.52 (4/5/2016)	0.59 (11/18/2015)	(0.52 - 0.59)/(6 - 3)	-0.0233333
0.5 (5/25/2016)	0.59 (11/18/2015)	(0.5 - 0.59)/(7 - 3)	-0.0225
0.5 (7/11/2016)	0.59 (11/18/2015)	(0.5 - 0.59)/(8 - 3)	-0.018
0.52 (1/23/2017)	0.59 (11/18/2015)	(0.52 - 0.59)/(9 - 3)	-0.0116667
0.55 (2/16/2016)	0.56 (1/4/2016)	(0.55 - 0.56)/(5 - 4)	-0.01
0.52 (4/5/2016)	0.56 (1/4/2016)	(0.52 - 0.56)/(6 - 4)	-0.02
0.5 (5/25/2016)	0.56 (1/4/2016)	(0.5 - 0.56)/(7 - 4)	-0.02
0.5 (7/11/2016)	0.56 (1/4/2016)	(0.5 - 0.56)/(8 - 4)	-0.015
0.52 (1/23/2017)	0.56 (1/4/2016)	(0.52 - 0.56)/(9 - 4)	-0.008
0.52 (4/5/2016)	0.55 (2/16/2016)	(0.52 - 0.55)/(6 - 5)	-0.03
0.5 (5/25/2016)	0.55 (2/16/2016)	(0.5 - 0.55)/(7 - 5)	-0.025

0.5 (7/11/2016)	0.55 (2/16/2016)	(0.5 - 0.55)/(8 - 5)	-0.0166667
0.52 (1/23/2017)	0.55 (2/16/2016)	(0.52 - 0.55)/(9 - 5)	-0.0075
0.5 (5/25/2016)	0.52 (4/5/2016)	(0.5 - 0.52)/(7 - 6)	-0.02
0.5 (7/11/2016)	0.52 (4/5/2016)	(0.5 - 0.52)/(8 - 6)	-0.01
0.52 (1/23/2017)	0.52 (4/5/2016)	(0.52 - 0.52)/(9 - 6)	0
0.5 (7/11/2016)	0.5 (5/25/2016)	(0.5 - 0.5)/(8 - 7)	0
0.52 (1/23/2017)	0.5 (5/25/2016)	(0.52 - 0.5)/(9 - 7)	0.01
0.52 (1/23/2017)	0.5 (7/11/2016)	(0.52 - 0.5)/(9 - 8)	0.02

Number of Q values = 36

Ordered Q Values

n	Q
1	-0.15
2	-0.075
3	-0.06
4	-0.0475
5	-0.044
6	-0.04
7	-0.0342857
8	-0.03
9	-0.03
10	-0.0275
11	-0.025
12	-0.0233333
13	-0.0225
14	-0.02
15	-0.02
16	-0.02
17	-0.02
18	-0.018
19	-0.018
20	-0.0175
21	-0.0166667
22	-0.015
23	-0.015
24	-0.015

25	-0.0133333
26	-0.0116667
27	-0.01
28	-0.01
29	-0.01
30	-0.008
31	-0.0075
32	0
33	0
34	0
35	0.01
36	0.02

Sen's Estimator (Median Q) is -0.018

Tied Group	Value	Members
1	0.59	2
2	0.52	2
3	0.5	2

Time Period	Observations
8/12/2015	1
10/15/2015	1
11/18/2015	1
1/4/2016	1
2/16/2016	1
4/5/2016	1
5/25/2016	1
7/11/2016	1
1/23/2017	1

There are 0 time periods with multiple data

A = 54
B = 0
C = 0
D = 0
E = 6
F = 0
a = 1656
b = 4536
c = 144
Group Variance = 89

For 90% confidence interval (two-tailed), Z at (1-0.9)/2 = 1.64485
C = 15.5175
M1 = (36 - 15.5175)/2.0 = 10.2412
M2 = (36 + 15.5175)/2.0 + 1 = 26.7588
Lower limit is -0.0275 = Q(10)
Upper limit is -0.01 = Q(27)
-0.01 < 0 indicating a downward trend in data.

Sen's Slope Analysis

Parameter: Fluoride

Location: MW-6

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

90% Confidence Level

Xj	Xk	(Xj - Xk)/(j-k)	Q
0.45 (10/19/2015)	0.49 J (8/12/2015)	(0.45 - 0.49)/(2 - 1)	-0.04
0.39 (11/20/2015)	0.49 J (8/12/2015)	(0.39 - 0.49)/(3 - 1)	-0.05
0.41 (1/5/2016)	0.49 J (8/12/2015)	(0.41 - 0.49)/(4 - 1)	-0.0266667
0.34 (2/17/2016)	0.49 J (8/12/2015)	(0.34 - 0.49)/(5 - 1)	-0.0375
0.18 (4/5/2016)	0.49 J (8/12/2015)	(0.18 - 0.49)/(6 - 1)	-0.062
0.46 (5/26/2016)	0.49 J (8/12/2015)	(0.46 - 0.49)/(7 - 1)	-0.005
0.31 (7/11/2016)	0.49 J (8/12/2015)	(0.31 - 0.49)/(8 - 1)	-0.0257143
0.38 (1/24/2017)	0.49 J (8/12/2015)	(0.38 - 0.49)/(9 - 1)	-0.01375
0.39 (11/20/2015)	0.45 (10/19/2015)	(0.39 - 0.45)/(3 - 2)	-0.06
0.41 (1/5/2016)	0.45 (10/19/2015)	(0.41 - 0.45)/(4 - 2)	-0.02
0.34 (2/17/2016)	0.45 (10/19/2015)	(0.34 - 0.45)/(5 - 2)	-0.0366667
0.18 (4/5/2016)	0.45 (10/19/2015)	(0.18 - 0.45)/(6 - 2)	-0.0675
0.46 (5/26/2016)	0.45 (10/19/2015)	(0.46 - 0.45)/(7 - 2)	0.002
0.31 (7/11/2016)	0.45 (10/19/2015)	(0.31 - 0.45)/(8 - 2)	-0.0233333
0.38 (1/24/2017)	0.45 (10/19/2015)	(0.38 - 0.45)/(9 - 2)	-0.01
0.41 (1/5/2016)	0.39 (11/20/2015)	(0.41 - 0.39)/(4 - 3)	0.02
0.34 (2/17/2016)	0.39 (11/20/2015)	(0.34 - 0.39)/(5 - 3)	-0.025
0.18 (4/5/2016)	0.39 (11/20/2015)	(0.18 - 0.39)/(6 - 3)	-0.07
0.46 (5/26/2016)	0.39 (11/20/2015)	(0.46 - 0.39)/(7 - 3)	0.0175
0.31 (7/11/2016)	0.39 (11/20/2015)	(0.31 - 0.39)/(8 - 3)	-0.016
0.38 (1/24/2017)	0.39 (11/20/2015)	(0.38 - 0.39)/(9 - 3)	-0.00166667
0.34 (2/17/2016)	0.41 (1/5/2016)	(0.34 - 0.41)/(5 - 4)	-0.07
0.18 (4/5/2016)	0.41 (1/5/2016)	(0.18 - 0.41)/(6 - 4)	-0.115
0.46 (5/26/2016)	0.41 (1/5/2016)	(0.46 - 0.41)/(7 - 4)	0.0166667
0.31 (7/11/2016)	0.41 (1/5/2016)	(0.31 - 0.41)/(8 - 4)	-0.025
0.38 (1/24/2017)	0.41 (1/5/2016)	(0.38 - 0.41)/(9 - 4)	-0.006
0.18 (4/5/2016)	0.34 (2/17/2016)	(0.18 - 0.34)/(6 - 5)	-0.16
0.46 (5/26/2016)	0.34 (2/17/2016)	(0.46 - 0.34)/(7 - 5)	0.06
0.31 (7/11/2016)	0.34 (2/17/2016)	(0.31 - 0.34)/(8 - 5)	-0.01
0.38 (1/24/2017)	0.34 (2/17/2016)	(0.38 - 0.34)/(9 - 5)	0.01
0.46 (5/26/2016)	0.18 (4/5/2016)	(0.46 - 0.18)/(7 - 6)	0.28
0.31 (7/11/2016)	0.18 (4/5/2016)	(0.31 - 0.18)/(8 - 6)	0.065
0.38 (1/24/2017)	0.18 (4/5/2016)	(0.38 - 0.18)/(9 - 6)	0.0666667
0.31 (7/11/2016)	0.46 (5/26/2016)	(0.31 - 0.46)/(8 - 7)	-0.15
0.38 (1/24/2017)	0.46 (5/26/2016)	(0.38 - 0.46)/(9 - 7)	-0.04
0.38 (1/24/2017)	0.31 (7/11/2016)	(0.38 - 0.31)/(9 - 8)	0.07

Number of Q values = 36

Ordered Q Values

n	Q
1	-0.16
2	-0.15
3	-0.115
4	-0.07
5	-0.07
6	-0.0675
7	-0.062
8	-0.06
9	-0.05
10	-0.04
11	-0.04
12	-0.0375
13	-0.0366667
14	-0.0266667
15	-0.0257143
16	-0.025
17	-0.025
18	-0.0233333
19	-0.02
20	-0.016
21	-0.01375
22	-0.01
23	-0.01
24	-0.006
25	-0.005
26	-0.00166667
27	0.002
28	0.01
29	0.0166667
30	0.0175
31	0.02
32	0.06
33	0.065
34	0.0666667
35	0.07
36	0.28

Sen's Estimator (Median Q) is -0.0216667

Time Period	Observations
8/12/2015	1
10/19/2015	1
11/20/2015	1
1/5/2016	1
2/17/2016	1
4/5/2016	1
5/26/2016	1
7/11/2016	1
1/24/2017	1

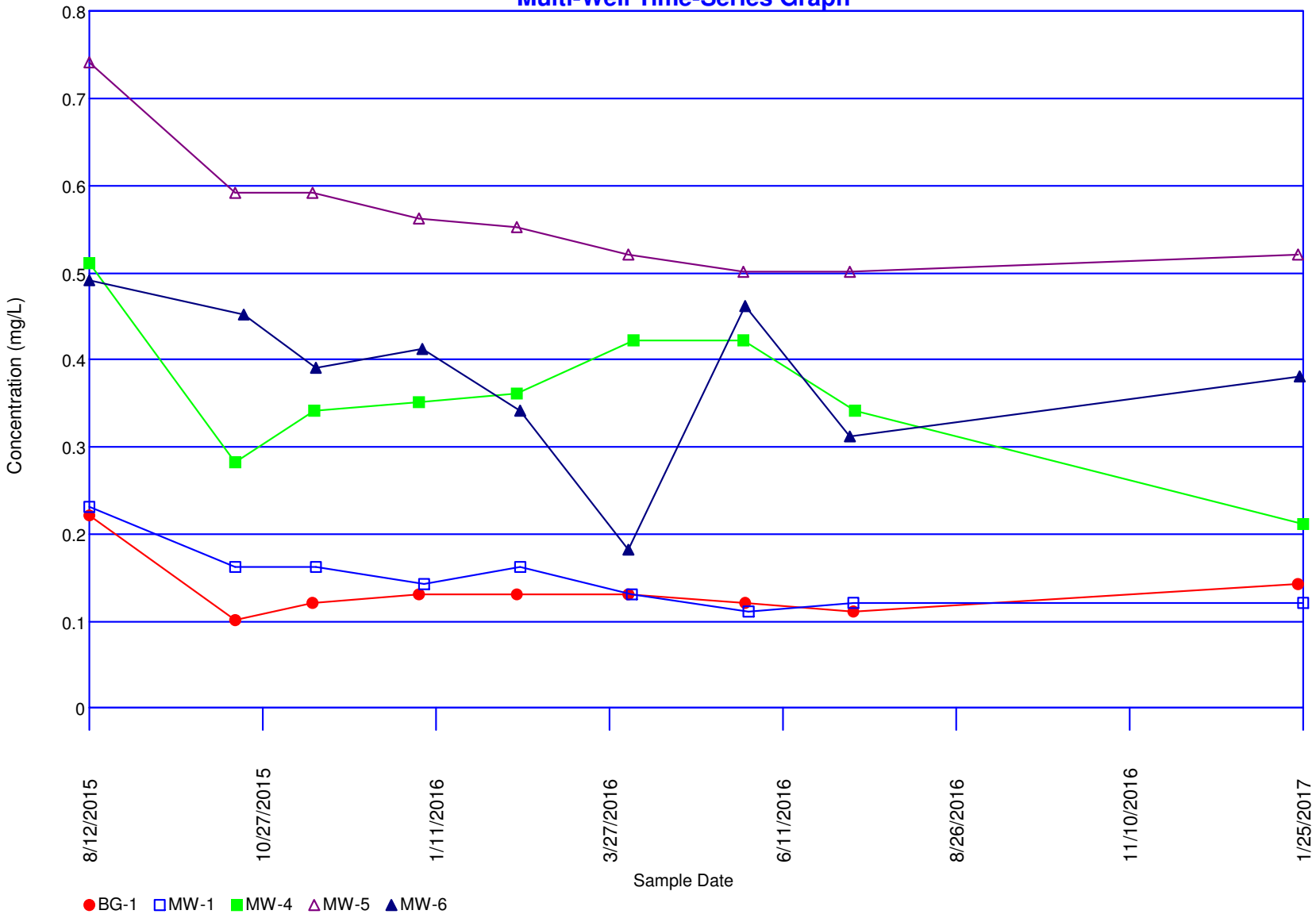
There are 0 time periods with multiple data

A = 0
B = 0
C = 0
D = 0
E = 0
F = 0

a = 1656
b = 4536
c = 144
Group Variance = 92
For 90% confidence interval (two-tailed), Z at (1-0.9)/2 = 1.64485
C = 15.7769
M1 = (36 - 15.7769)/2.0 = 10.1116
M2 = (36 + 15.7769)/2.0 + 1 = 26.8884
Lower limit is -0.04 = Q(10)
Upper limit is 0.002 = Q(27)
-0.04 < 0 < 0.002 indicating no trend in data.

Fluoride

Multi-Well Time-Series Graph



Concentrations (ug/L)

Parameter: Lithium

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

Total Measurements: 71
Total Non-Detect: 1
Percent Non-Detects: 1.40845%
Total Background Measurements: 8
There is 1 background location

Loc.	Meas.	ND	Date	Conc.	Original
BG-1	8	0 (0%)	10/15/2015	14.9	14.9
			11/18/2015	12.1	12.1
			1/4/2016	15	15
			2/16/2016	17.1	17.1
			4/5/2016	36.8	36.8
			5/26/2016	23.5	23.5
			7/12/2016	23.8	23.8
			1/23/2017	24.5	24.5

There are 8 compliance locations

Loc.	Meas.	ND	Date	Conc.	Original
MW-1	8	0 (0%)	10/15/2015	20.9	20.9
			11/20/2015	23.7	23.7
			1/6/2016	30.1	30.1
			2/17/2016	19.2	19.2
			4/6/2016	28.4	28.4
			5/27/2016	27.5	27.5
			7/12/2016	32.8	32.8
			1/25/2017	31.2	31.2
MW-2	8	0 (0%)	10/15/2015	34	34
			11/19/2015	53.1	53.1
			1/6/2016	144	144
			2/17/2016	88.4	88.4
			4/6/2016	117	117
			5/27/2016	350	350
			7/12/2016	356	356
			1/26/2017	195	195
MW-3	8	0 (0%)	10/15/2015	70.4	70.4
			11/19/2015	128	128
			1/5/2016	65.4	65.4
			2/16/2016	75.5	75.5
			4/7/2016	217	217
			5/27/2016	102	102
			7/11/2016	73.2	73.2
			1/24/2017	103	103
MW-4	8	1 (12.5%)	10/15/2015	20.1	20.1
			11/19/2015	20	20
			1/4/2016	23.2	23.2
			2/16/2016	22.8	22.8
			4/7/2016	18.3	18.3

			5/25/2016	15.8	15.8
			7/13/2016	ND<0.5 U	ND<0.5 U
			1/25/2017	28.3	28.3
MW-5	8	0 (0%)	10/15/2015	7.5	7.5
			11/18/2015	7.4	7.4
			1/4/2016	6.4	6.4
			2/16/2016	6.3	6.3
			4/5/2016	9.7	9.7
			5/25/2016	8.9	8.9
			7/11/2016	9.3	9.3
			1/23/2017	9.4	9.4
MW-6	8	0 (0%)	10/19/2015	43.1	43.1
			11/20/2015	60.5	60.5
			1/5/2016	55.8	55.8
			2/17/2016	37.1	37.1
			4/5/2016	41.2	41.2
			5/26/2016	30.6	30.6
			7/11/2016	31.7	31.7
			1/24/2017	48.5	48.5
MW-7	7	0 (0%)	10/16/2015	23.5	23.5
			11/20/2015	31.1	31.1
			1/5/2016	21.7	21.7
			2/18/2016	17.7	17.7
			4/6/2016	20.7	20.7
			5/26/2016	21.5	21.5
			7/11/2016	23	23
MW-8	8	0 (0%)	10/15/2015	27.4	27.4
			11/20/2015	50.1	50.1
			1/6/2016	39.6	39.6
			2/18/2016	33.4	33.4
			4/6/2016	37.6	37.6
			5/26/2016	29.7	29.7
			7/12/2016	31.2	31.2
			1/24/2017	38.3	38.3

There are 0 unused locations

Loc.	Meas.	ND	Date	Conc.	Original

Rosner's Test for Outliers

Parameter: Lithium

All Locations

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

Data set mean = 50.1746

10 most extreme of 71 measurements

by order of magnitude difference from the mean

1	7/12/2016	MW-2	356	305.825
2	5/27/2016	MW-2	350	299.825
3	4/7/2016	MW-3	217	166.825
4	1/26/2017	MW-2	195	144.825
5	1/6/2016	MW-2	144	93.8254
6	11/19/2015	MW-3	128	77.8254
7	4/6/2016	MW-2	117	66.8254
8	1/24/2017	MW-3	103	52.8254
9	5/27/2016	MW-3	102	51.8254
10	7/13/2016	MW-4	ND<0.5 U	-49.6746

Iteration i = 9

Mean of 62 measurements = 29.8452
Std Dev = 18.5062
x(i+1) = 0.5 from measurement 7/13/2016 from location MW-4
Rosner Statistic R = |0.5 - 29.8452|/18.5062 = 1.58569
Lambda(71, 10, 0.05) = 3.215
1.58569 < 3.215 -- No outliers detected for i = 9

Iteration i = 8

Mean of 63 measurements = 30.9905
Std Dev = 20.484
x(i+1) = 102 from measurement 5/27/2016 from location MW-3
Rosner Statistic R = |102 - 30.9905|/20.484 = 3.46658
Lambda(71, 9, 0.05) = 3.221
3.46658 > 3.221 -- Measurement 5/27/2016 for location MW-3 is an outlier

---

Iteration i = 7

Mean of 64 measurements = 32.1156
Std Dev = 22.2251
x(i+1) = 103 from measurement 1/24/2017 from location MW-3
Rosner Statistic R = |103 - 32.1156|/22.2251 = 3.18938
Lambda(71, 8, 0.05) = 3.227
Measurement 1/24/2017 for location MW-3 is an outlier

Iteration i = 6

Mean of 65 measurements = 33.4215
Std Dev = 24.4354
x(i+1) = 117 from measurement 4/6/2016 from location MW-2
Rosner Statistic R = |117 - 33.4215|/24.4354 = 3.42038
Lambda(71, 7, 0.05) = 3.233
Measurement 4/6/2016 for location MW-2 is an outlier

Iteration i = 5
Mean of 66 measurements = 34.8545
Std Dev = 26.8968
x(i+1) = 128 from measurement 11/19/2015 from location MW-3
Rosner Statistic R = |128 - 34.8545|/26.8968 = 3.46307
Lambda(71, 6, 0.05) = 3.239
Measurement 11/19/2015 for location MW-3 is an outlier

Iteration i = 4
Mean of 67 measurements = 36.4836
Std Dev = 29.8375
x(i+1) = 144 from measurement 1/6/2016 from location MW-2
Rosner Statistic R = |144 - 36.4836|/29.8375 = 3.6034
Lambda(71, 5, 0.05) = 3.245
Measurement 1/6/2016 for location MW-2 is an outlier

Iteration i = 3
Mean of 68 measurements = 38.8147
Std Dev = 35.3059
x(i+1) = 195 from measurement 1/26/2017 from location MW-2
Rosner Statistic R = |195 - 38.8147|/35.3059 = 4.42377
Lambda(71, 4, 0.05) = 3.245
Measurement 1/26/2017 for location MW-2 is an outlier

Iteration i = 2
Mean of 69 measurements = 41.3971
Std Dev = 41.0892
x(i+1) = 217 from measurement 4/7/2016 from location MW-3
Rosner Statistic R = |217 - 41.3971|/41.0892 = 4.2737
Lambda(71, 3, 0.05) = 3.255
Measurement 4/7/2016 for location MW-3 is an outlier

Iteration i = 1
Mean of 70 measurements = 45.8057
Std Dev = 54.9942
x(i+1) = 350 from measurement 5/27/2016 from location MW-2
Rosner Statistic R = |350 - 45.8057|/54.9942 = 5.53138
Lambda(71, 2, 0.05) = 3.255
Measurement 5/27/2016 for location MW-2 is an outlier

Iteration i = 0
Mean of 71 measurements = 50.1746
Std Dev = 65.8512
x(i+1) = 356 from measurement 7/12/2016 from location MW-2
Rosner Statistic R = |356 - 50.1746|/65.8512 = 4.64419
Lambda(71, 1, 0.05) = 3.265
Measurement 7/12/2016 for location MW-2 is an outlier

Shapiro-Wilks Test of Normality

Parameter: Lithium

All Locations

Normality Test of Parameter Concentrations

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

K = 4 for 8 measurements

i	x(i)	x(n-i+1)	x(n-1+1)-x(i)	a(n-i+1)	b(i)
1	12.1	36.8	24.7	0.6052	14.9484
2	14.9	24.5	9.6	0.3164	3.03744
3	15	23.8	8.8	0.1743	1.53384
4	17.1	23.5	6.4	0.0561	0.35904
5	23.5	17.1	-6.4		
6	23.8	15	-8.8		
7	24.5	14.9	-9.6		
8	36.8	12.1	-24.7		

Sum of b values = 19.8788
Sample Standard Deviation = 7.96061
W Statistic = 0.890817

5% Critical value of 0.818 is less than 0.890817
Data is normally distributed at 95% level of significance

1% Critical value of 0.749 is less than 0.890817
Data is normally distributed at 99% level of significance

Parametric Prediction Interval Analysis

Inter-Well Comparison

Parameter: Lithium

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

Inter-Well Unified Guid. Formula 95% One-Sided Comparison

Background Samples = 8
Background Mean = 20.9625
Background Std Dev = 7.96061

Number of comparisons = 7
Future Samples (k) = 7
Actual confidence level is 1.0 - (0.05/7) = 99.2857 %
t is Percentile of Student's T-Test (0.95/7) = 0.992857
Degrees of Freedom = 8 (background observations) - 1
t(0.992857, 8) = 3.28454

Well MW-1

Date	Samples	Mean	Interval	Significant
1/25/2017	1	31.2	[0, 48.6955]	FALSE

Well MW-2

Date	Samples	Mean	Interval	Significant
1/26/2017	**1**	**195**	**[0, 48.6955]**	**TRUE**

Well MW-3

Date	Samples	Mean	Interval	Significant
1/24/2017	**1**	**103**	**[0, 48.6955]**	**TRUE**

Well MW-4

Date	Samples	Mean	Interval	Significant
1/25/2017	1	28.3	[0, 48.6955]	FALSE

Well MW-5

Date	Samples	Mean	Interval	Significant
1/23/2017	1	9.4	[0, 48.6955]	FALSE

Well MW-6

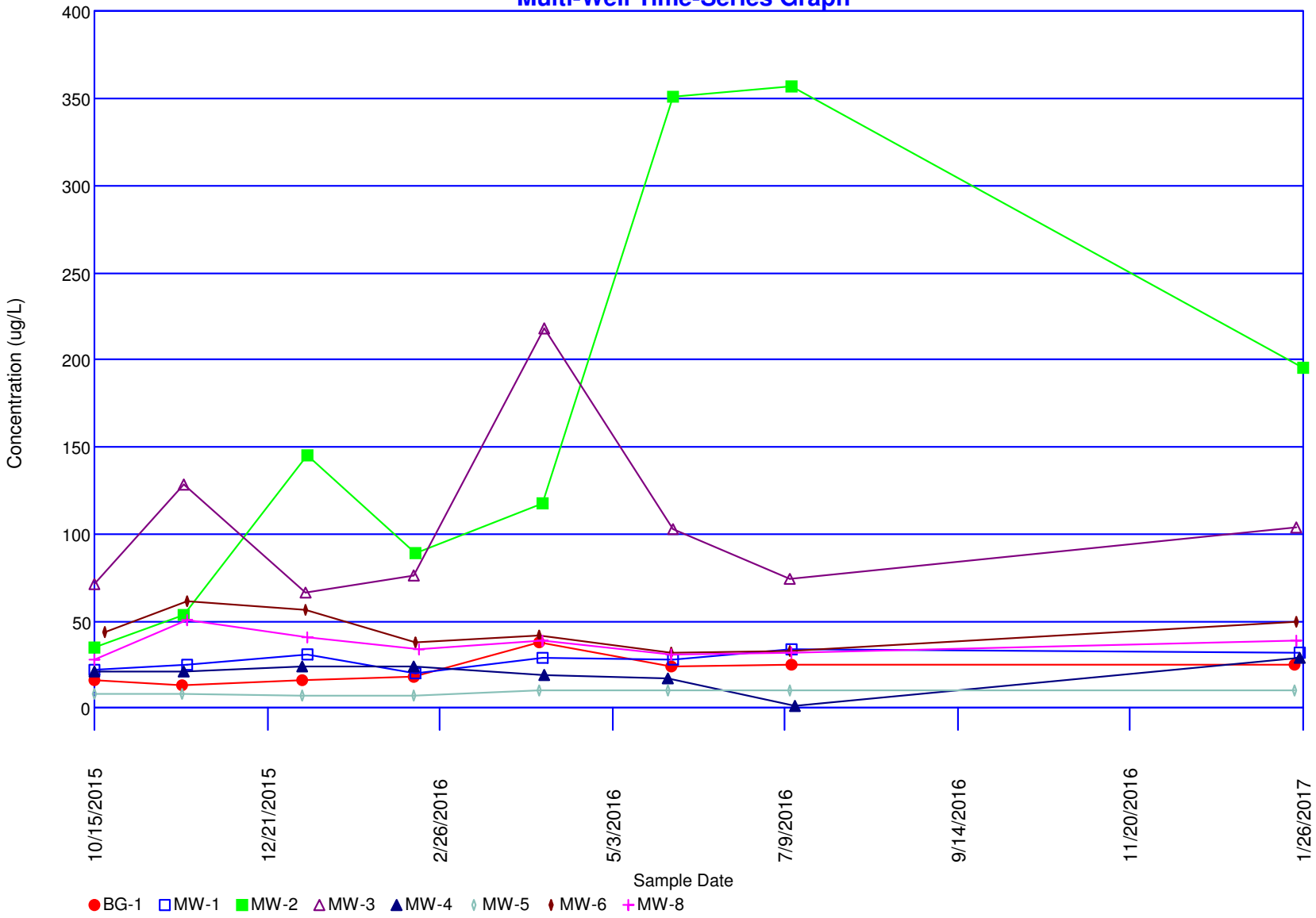
Date	Samples	Mean	Interval	Significant
1/24/2017	1	48.5	[0, 48.6955]	FALSE

Well MW-8

Date	Samples	Mean	Interval	Significant
1/24/2017	1	38.3	[0, 48.6955]	FALSE

Lithium

Multi-Well Time-Series Graph



Concentrations (ug/L)

Parameter: Molybdenum

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

Total Measurements: 80
Total Non-Detect: 51
Percent Non-Detects: 63.75%
Total Background Measurements: 9
There is 1 background location

Loc.	Meas.	ND	Date	Conc.	Original
BG-1	9	7 (77.7778%)	8/12/2015	0.55 J	0.55 J
			10/15/2015	ND<5 U	ND<5 U
			11/18/2015	ND<5 U	ND<5 U
			1/4/2016	ND<5 U	ND<5 U
			2/16/2016	6.8	6.8
			4/5/2016	ND<5 U	ND<5 U
			5/26/2016	ND<5 U	ND<5 U
			7/12/2016	ND<5 U	ND<5 U
			1/23/2017	ND<5 U	ND<5 U

There are 8 compliance locations

Loc.	Meas.	ND	Date	Conc.	Original
MW-1	9	8 (88.8889%)	8/12/2015	1.3 J	1.3 J
			10/15/2015	ND<5 U	ND<5 U
			11/20/2015	ND<5 U	ND<5 U
			1/6/2016	ND<5 U	ND<5 U
			2/17/2016	ND<5 U	ND<5 U
			4/6/2016	ND<5 U	ND<5 U
			5/27/2016	ND<5 U	ND<5 U
			7/12/2016	ND<5 U	ND<5 U
			1/25/2017	ND<5 U	ND<5 U
MW-2	9	0 (0%)	8/12/2015	11	11
			10/15/2015	20.6	20.6
			11/19/2015	21.1	21.1
			1/6/2016	18.1	18.1
			2/17/2016	19.1	19.1
			4/6/2016	9.5	9.5
			5/27/2016	10.1	10.1
			7/12/2016	10.8	10.8
			1/26/2017	13.1	13.1
MW-3	9	0 (0%)	8/12/2015	21	21
			10/15/2015	10.5	10.5
			11/19/2015	10.4	10.4
			1/5/2016	10.9	10.9
			2/16/2016	13.8	13.8
			4/7/2016	8.6	8.6
			5/27/2016	10.2	10.2
			7/11/2016	12	12
			1/24/2017	7.2	7.2
MW-4	9	7 (77.7778%)	8/12/2015	1.6 J	1.6 J

			10/15/2015	ND<5 U	ND<5 U
			11/19/2015	ND<5 U	ND<5 U
			1/4/2016	ND<5 U	ND<5 U
			2/16/2016	ND<5 U	ND<5 U
			4/7/2016	ND<5 U	ND<5 U
			5/25/2016	ND<5 U	ND<5 U
			7/13/2016	ND<5 U	ND<5 U
			1/25/2017	8.9	8.9
MW-5	9	8 (88.8889%)	8/12/2015	1.6 J	1.6 J
			10/15/2015	ND<5 U	ND<5 U
			11/18/2015	ND<5 U	ND<5 U
			1/4/2016	ND<5 U	ND<5 U
			2/16/2016	ND<5 U	ND<5 U
			4/5/2016	ND<5 U	ND<5 U
			5/25/2016	ND<5 U	ND<5 U
			7/11/2016	ND<5 U	ND<5 U
			1/23/2017	ND<5 U	ND<5 U
MW-6	9	7 (77.7778%)	8/12/2015	1.4 J	1.4 J
			10/19/2015	ND<5 U	ND<5 U
			11/20/2015	ND<5 U	ND<5 U
			1/5/2016	5.4	5.4
			2/17/2016	ND<5 U	ND<5 U
			4/5/2016	ND<5 U	ND<5 U
			5/26/2016	ND<5 U	ND<5 U
			7/11/2016	ND<5 U	ND<5 U
			1/24/2017	ND<5 U	ND<5 U
MW-7	8	6 (75%)	8/12/2015	3.6 J	3.6 J
			10/16/2015	ND<5 U	ND<5 U
			11/20/2015	ND<5 U	ND<5 U
			1/5/2016	6.4	6.4
			2/18/2016	ND<5 U	ND<5 U
			4/6/2016	ND<5 U	ND<5 U
			5/26/2016	ND<5 U	ND<5 U
			7/11/2016	ND<5 U	ND<5 U
MW-8	9	8 (88.8889%)	8/12/2015	ND<10 U	ND<10 U
			10/15/2015	ND<5 U	ND<5 U
			11/20/2015	ND<5 U	ND<5 U
			1/6/2016	ND<5 U	ND<5 U
			2/18/2016	5.6	5.6
			4/6/2016	ND<5 U	ND<5 U
			5/26/2016	ND<5 U	ND<5 U
			7/12/2016	ND<5 U	ND<5 U
			1/24/2017	ND<5 U	ND<5 U

There are 0 unused locations

Loc.	Meas.	ND	Date	Conc.	Original

Rosner's Test for Outliers

Parameter: Molybdenum

All Locations

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

Data set mean = 6.76437

10 most extreme of 80 measurements

by order of magnitude difference from the mean

1	11/19/2015	MW-2	21.1	14.3356
2	8/12/2015	MW-3	21	14.2356
3	10/15/2015	MW-2	20.6	13.8356
4	2/17/2016	MW-2	19.1	12.3356
5	1/6/2016	MW-2	18.1	11.3356
6	2/16/2016	MW-3	13.8	7.03563
7	1/26/2017	MW-2	13.1	6.33563
8	8/12/2015	BG-1	0.55 J	-6.21437
9	8/12/2015	MW-1	1.3 J	-5.46437
10	8/12/2015	MW-6	1.4 J	-5.36437

Iteration i = 9

Mean of 71 measurements = 5.80986
Std Dev = 2.20831
x(i+1) = 1.4 from measurement 8/12/2015 from location MW-6
Rosner Statistic R = |1.4 - 5.80986|/2.20831 = 1.99694
Lambda(80, 10, 0.05) = 3.26
1.99694 < 3.26 -- No outliers detected for i = 9

Iteration i = 8

Mean of 72 measurements = 5.74722
Std Dev = 2.25619
x(i+1) = 1.3 from measurement 8/12/2015 from location MW-1
Rosner Statistic R = |1.3 - 5.74722|/2.25619 = 1.97112
Lambda(80, 9, 0.05) = 3.266
1.97112 < 3.266 -- No outliers detected for i = 8

Iteration i = 7

Mean of 73 measurements = 5.67603
Std Dev = 2.32158
x(i+1) = 0.55 from measurement 8/12/2015 from location BG-1
Rosner Statistic R = |0.55 - 5.67603|/2.32158 = 2.20799
Lambda(80, 8, 0.05) = 3.272
2.20799 < 3.272 -- No outliers detected for i = 7

Iteration i = 6

Mean of 74 measurements = 5.77635
Std Dev = 2.46185
x(i+1) = 13.1 from measurement 1/26/2017 from location MW-2
Rosner Statistic R = |13.1 - 5.77635|/2.46185 = 2.97486
Lambda(80, 7, 0.05) = 3.278
2.97486 < 3.278 -- No outliers detected for i = 6

Iteration i = 5
Mean of 75 measurements = 5.88333
Std Dev = 2.6148
x(i+1) = 13.8 from measurement 2/16/2016 from location MW-3
Rosner Statistic R = |13.8 - 5.88333|/2.6148 = 3.02764
Lambda(80, 6, 0.05) = 3.284
3.02764 < 3.284 -- No outliers detected for i = 5

Iteration i = 4
Mean of 76 measurements = 6.04408
Std Dev = 2.95124
x(i+1) = 18.1 from measurement 1/6/2016 from location MW-2
Rosner Statistic R = |18.1 - 6.04408|/2.95124 = 4.08504
Lambda(80, 5, 0.05) = 3.29
4.08504 > 3.29 -- Measurement 1/6/2016 for location MW-2 is an outlier

Iteration i = 3
Mean of 77 measurements = 6.21364
Std Dev = 3.28769
x(i+1) = 19.1 from measurement 2/17/2016 from location MW-2
Rosner Statistic R = |19.1 - 6.21364|/3.28769 = 3.91958
Lambda(80, 4, 0.05) = 3.29
Measurement 2/17/2016 for location MW-2 is an outlier

Iteration i = 2
Mean of 78 measurements = 6.39808
Std Dev = 3.64993
x(i+1) = 20.6 from measurement 10/15/2015 from location MW-2
Rosner Statistic R = |20.6 - 6.39808|/3.64993 = 3.89101
Lambda(80, 3, 0.05) = 3.3
Measurement 10/15/2015 for location MW-2 is an outlier

Iteration i = 1
Mean of 79 measurements = 6.58291
Std Dev = 3.98122
x(i+1) = 21 from measurement 8/12/2015 from location MW-3
Rosner Statistic R = |21 - 6.58291|/3.98122 = 3.62127
Lambda(80, 2, 0.05) = 3.3
Measurement 8/12/2015 for location MW-3 is an outlier

Iteration i = 0
Mean of 80 measurements = 6.76438
Std Dev = 4.27596
x(i+1) = 21.1 from measurement 11/19/2015 from location MW-2
Rosner Statistic R = |21.1 - 6.76438|/4.27596 = 3.35261
Lambda(80, 1, 0.05) = 3.31
Measurement 11/19/2015 for location MW-2 is an outlier

Non-Parametric Prediction Interval

Inter-Well Comparison

Parameter: Molybdenum

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

Total Percent Non-Detects = 62.5%
Number of comparisons = 7
Future Samples (k) = 7
Recent Dates = 1
Background Measurements (n) = 9
Maximum Background Value = 6.8
Confidence Level = 56.3%
False Positive Rate = 43.7%

Location	Date	Count	Mean	Significant
MW-1	1/25/2017	1	5	FALSE
MW-2	**1/26/2017**	**1**	**13.1**	**TRUE**
MW-3	**1/24/2017**	**1**	**7.2**	**TRUE**
MW-4	**1/25/2017**	**1**	**8.9**	**TRUE**
MW-5	1/23/2017	1	5	FALSE
MW-6	1/24/2017	1	5	FALSE
MW-8	1/24/2017	1	5	FALSE

Sen's Slope Analysis

Parameter: Molybdenum

Location: MW-2

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

90% Confidence Level

Xj	Xk	(Xj - Xk)/(j-k)	Q
20.6 (10/15/2015)	11 (8/12/2015)	(20.6 - 11)/(2 - 1)	9.6
21.1 (11/19/2015)	11 (8/12/2015)	(21.1 - 11)/(3 - 1)	5.05
18.1 (1/6/2016)	11 (8/12/2015)	(18.1 - 11)/(4 - 1)	2.36667
19.1 (2/17/2016)	11 (8/12/2015)	(19.1 - 11)/(5 - 1)	2.025
9.5 (4/6/2016)	11 (8/12/2015)	(9.5 - 11)/(6 - 1)	-0.3
10.1 (5/27/2016)	11 (8/12/2015)	(10.1 - 11)/(7 - 1)	-0.15
10.8 (7/12/2016)	11 (8/12/2015)	(10.8 - 11)/(8 - 1)	-0.0285714
13.1 (1/26/2017)	11 (8/12/2015)	(13.1 - 11)/(9 - 1)	0.2625
21.1 (11/19/2015)	20.6 (10/15/2015)	(21.1 - 20.6)/(3 - 2)	0.5
18.1 (1/6/2016)	20.6 (10/15/2015)	(18.1 - 20.6)/(4 - 2)	-1.25
19.1 (2/17/2016)	20.6 (10/15/2015)	(19.1 - 20.6)/(5 - 2)	-0.5
9.5 (4/6/2016)	20.6 (10/15/2015)	(9.5 - 20.6)/(6 - 2)	-2.775
10.1 (5/27/2016)	20.6 (10/15/2015)	(10.1 - 20.6)/(7 - 2)	-2.1
10.8 (7/12/2016)	20.6 (10/15/2015)	(10.8 - 20.6)/(8 - 2)	-1.63333
13.1 (1/26/2017)	20.6 (10/15/2015)	(13.1 - 20.6)/(9 - 2)	-1.07143
18.1 (1/6/2016)	21.1 (11/19/2015)	(18.1 - 21.1)/(4 - 3)	-3
19.1 (2/17/2016)	21.1 (11/19/2015)	(19.1 - 21.1)/(5 - 3)	-1
9.5 (4/6/2016)	21.1 (11/19/2015)	(9.5 - 21.1)/(6 - 3)	-3.86667
10.1 (5/27/2016)	21.1 (11/19/2015)	(10.1 - 21.1)/(7 - 3)	-2.75
10.8 (7/12/2016)	21.1 (11/19/2015)	(10.8 - 21.1)/(8 - 3)	-2.06
13.1 (1/26/2017)	21.1 (11/19/2015)	(13.1 - 21.1)/(9 - 3)	-1.33333
19.1 (2/17/2016)	18.1 (1/6/2016)	(19.1 - 18.1)/(5 - 4)	1
9.5 (4/6/2016)	18.1 (1/6/2016)	(9.5 - 18.1)/(6 - 4)	-4.3
10.1 (5/27/2016)	18.1 (1/6/2016)	(10.1 - 18.1)/(7 - 4)	-2.66667
10.8 (7/12/2016)	18.1 (1/6/2016)	(10.8 - 18.1)/(8 - 4)	-1.825
13.1 (1/26/2017)	18.1 (1/6/2016)	(13.1 - 18.1)/(9 - 4)	-1
9.5 (4/6/2016)	19.1 (2/17/2016)	(9.5 - 19.1)/(6 - 5)	-9.6
10.1 (5/27/2016)	19.1 (2/17/2016)	(10.1 - 19.1)/(7 - 5)	-4.5
10.8 (7/12/2016)	19.1 (2/17/2016)	(10.8 - 19.1)/(8 - 5)	-2.76667
13.1 (1/26/2017)	19.1 (2/17/2016)	(13.1 - 19.1)/(9 - 5)	-1.5
10.1 (5/27/2016)	9.5 (4/6/2016)	(10.1 - 9.5)/(7 - 6)	0.6
10.8 (7/12/2016)	9.5 (4/6/2016)	(10.8 - 9.5)/(8 - 6)	0.65
13.1 (1/26/2017)	9.5 (4/6/2016)	(13.1 - 9.5)/(9 - 6)	1.2
10.8 (7/12/2016)	10.1 (5/27/2016)	(10.8 - 10.1)/(8 - 7)	0.7
13.1 (1/26/2017)	10.1 (5/27/2016)	(13.1 - 10.1)/(9 - 7)	1.5
13.1 (1/26/2017)	10.8 (7/12/2016)	(13.1 - 10.8)/(9 - 8)	2.3

Number of Q values = 36

Ordered Q Values

n	Q
1	-9.6
2	-4.5
3	-4.3
4	-3.86667
5	-3
6	-2.775
7	-2.76667
8	-2.75
9	-2.66667
10	-2.1
11	-2.06
12	-1.825
13	-1.63333
14	-1.5
15	-1.33333
16	-1.25
17	-1.07143
18	-1
19	-1
20	-0.5
21	-0.3
22	-0.15
23	-0.0285714
24	0.2625
25	0.5
26	0.6
27	0.65
28	0.7
29	1
30	1.2
31	1.5
32	2.025
33	2.3
34	2.36667
35	5.05
36	9.6

Sen's Estimator (Median Q) is -1

Time Period	Observations
8/12/2015	1
10/15/2015	1
11/19/2015	1
1/6/2016	1
2/17/2016	1
4/6/2016	1
5/27/2016	1
7/12/2016	1
1/26/2017	1

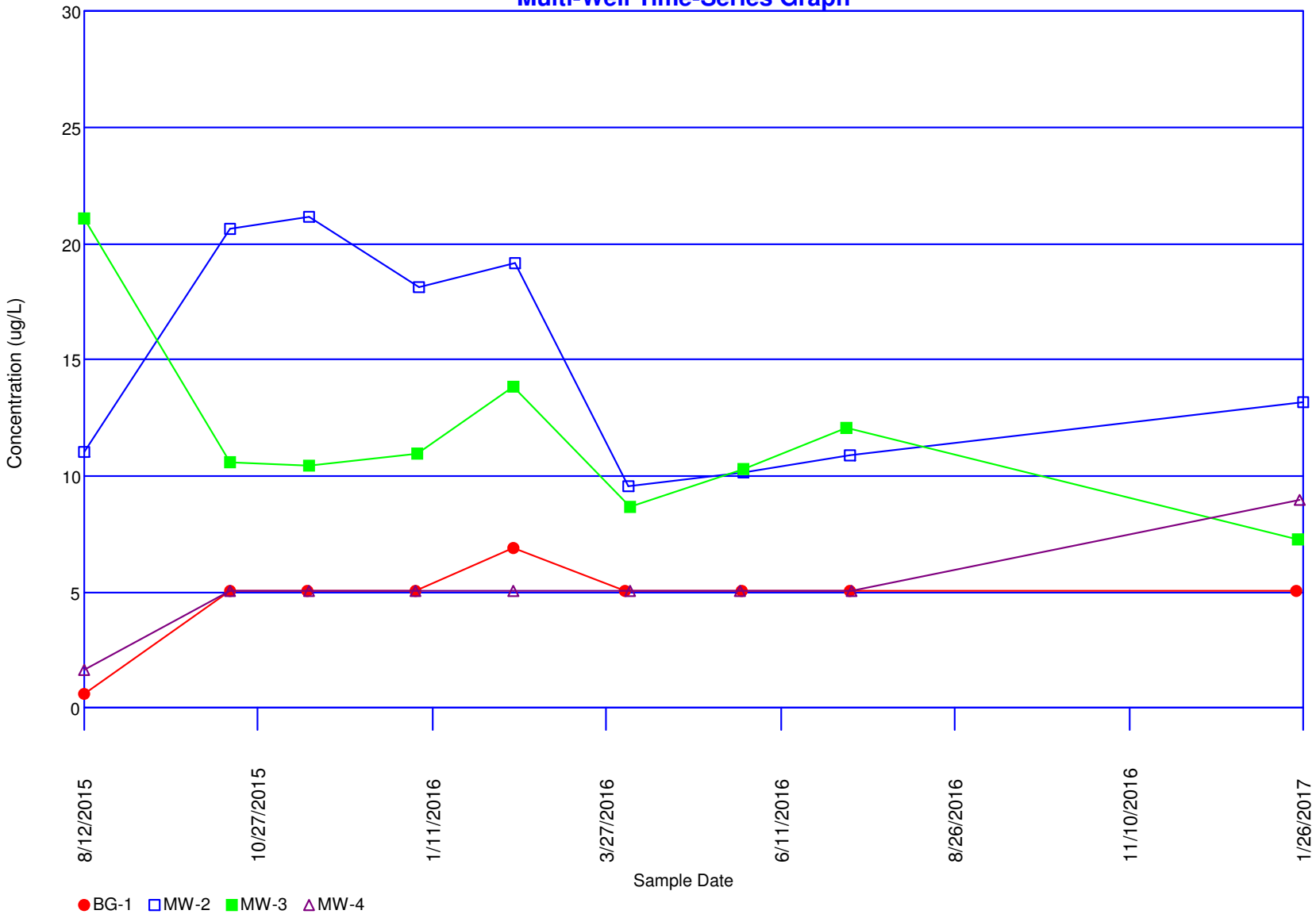
There are 0 time periods with multiple data

A = 0
B = 0
C = 0
D = 0
E = 0
F = 0

a = 1656
b = 4536
c = 144
Group Variance = 92
For 90% confidence interval (two-tailed), Z at (1-0.9)/2 = 1.64485
C = 15.7769
M1 = (36 - 15.7769)/2.0 = 10.1116
M2 = (36 + 15.7769)/2.0 + 1 = 26.8884
Lower limit is -2.1 = Q(10)
Upper limit is 0.65 = Q(27)
-2.1 < 0 < 0.65 indicating no trend in data.

Molybdenum

Multi-Well Time-Series Graph



Concentrations (ug/L)

Parameter: Nickel

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

Total Measurements: 80
Total Non-Detect: 61
Percent Non-Detects: 76.25%
Total Background Measurements: 9
There is 1 background location

Loc.	Meas.	ND	Date	Conc.	Original
BG-1	9	8 (88.8889%)	8/12/2015	1.3 J	1.3 J
			10/15/2015	ND<5 U	ND<5 U
			11/18/2015	ND<5 U	ND<5 U
			1/4/2016	ND<5 U	ND<5 U
			2/16/2016	ND<5 U	ND<5 U
			4/5/2016	ND<5 U	ND<5 U
			5/26/2016	ND<5 U	ND<5 U
			7/12/2016	ND<5 U	ND<5 U
			1/23/2017	ND<5 U	ND<5 U

There are 8 compliance locations

Loc.	Meas.	ND	Date	Conc.	Original
MW-1	9	8 (88.8889%)	8/12/2015	3.1 J	3.1 J
			10/15/2015	ND<5 U	ND<5 U
			11/20/2015	ND<5 U	ND<5 U
			1/6/2016	ND<5 U	ND<5 U
			2/17/2016	ND<5 U	ND<5 U
			4/6/2016	ND<5 U	ND<5 U
			5/27/2016	ND<5 U	ND<5 U
			7/12/2016	ND<5 U	ND<5 U
			1/25/2017	ND<5 U	ND<5 U
MW-2	9	4 (44.4444%)	8/12/2015	6.1	6.1
			10/15/2015	7.8	7.8
			11/19/2015	ND<5 U	ND<5 U
			1/6/2016	8.7	8.7
			2/17/2016	13.5	13.5
			4/6/2016	ND<5 U	ND<5 U
			5/27/2016	ND<5 U	ND<5 U
			7/12/2016	ND<5 U	ND<5 U
			1/26/2017	15.2	15.2
MW-3	9	8 (88.8889%)	8/12/2015	3.7 J	3.7 J
			10/15/2015	ND<5 U	ND<5 U
			11/19/2015	ND<5 U	ND<5 U
			1/5/2016	ND<5 U	ND<5 U
			2/16/2016	ND<5 U	ND<5 U
			4/7/2016	ND<5 U	ND<5 U
			5/27/2016	ND<5 U	ND<5 U
			7/11/2016	ND<5 U	ND<5 U
			1/24/2017	ND<5 U	ND<5 U
MW-4	9	8 (88.8889%)	8/12/2015	8.4	8.4

			10/15/2015	ND<5 U	ND<5 U
			11/19/2015	ND<5 U	ND<5 U
			1/4/2016	ND<5 U	ND<5 U
			2/16/2016	ND<5 U	ND<5 U
			4/7/2016	ND<5 U	ND<5 U
			5/25/2016	ND<5 U	ND<5 U
			7/13/2016	ND<5 U	ND<5 U
			1/25/2017	ND<5 U	ND<5 U
MW-5	9	7 (77.7778%)	8/12/2015	3 J	3 J
			10/15/2015	12.6	12.6
			11/18/2015	ND<5 U	ND<5 U
			1/4/2016	ND<5 U	ND<5 U
			2/16/2016	ND<5 U	ND<5 U
			4/5/2016	ND<5 U	ND<5 U
			5/25/2016	ND<5 U	ND<5 U
			7/11/2016	ND<5 U	ND<5 U
			1/23/2017	ND<5 U	ND<5 U
MW-6	9	8 (88.8889%)	8/12/2015	2.8 J	2.8 J
			10/19/2015	ND<5 U	ND<5 U
			11/20/2015	ND<5 U	ND<5 U
			1/5/2016	ND<5 U	ND<5 U
			2/17/2016	ND<5 U	ND<5 U
			4/5/2016	ND<5 U	ND<5 U
			5/26/2016	ND<5 U	ND<5 U
			7/11/2016	ND<5 U	ND<5 U
			1/24/2017	ND<5 U	ND<5 U
MW-7	8	4 (50%)	8/12/2015	4.5 J	4.5 J
			10/16/2015	8.7	8.7
			11/20/2015	7.2	7.2
			1/5/2016	ND<5 U	ND<5 U
			2/18/2016	13.2	13.2
			4/6/2016	ND<5 U	ND<5 U
			5/26/2016	ND<5 U	ND<5 U
			7/11/2016	ND<5 U	ND<5 U
MW-8	9	6 (66.6667%)	8/12/2015	2.4 J	2.4 J
			10/15/2015	18.2	18.2
			11/20/2015	ND<5 U	ND<5 U
			1/6/2016	ND<5 U	ND<5 U
			2/18/2016	ND<5 U	ND<5 U
			4/6/2016	ND<5 U	ND<5 U
			5/26/2016	ND<5 U	ND<5 U
			7/12/2016	ND<5 U	ND<5 U
			1/24/2017	42.1	42.1

There are 0 unused locations

Loc.	Meas.	ND	Date	Conc.	Original

Rosner's Test for Outliers

Parameter: Nickel

All Locations

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

Data set mean = 6.09375

10 most extreme of 80 measurements

by order of magnitude difference from the mean

1	1/24/2017	MW-8	42.1	36.0063
2	10/15/2015	MW-8	18.2	12.1062
3	1/26/2017	MW-2	15.2	9.10625
4	2/17/2016	MW-2	13.5	7.40625
5	2/18/2016	MW-7	13.2	7.10625
6	10/15/2015	MW-5	12.6	6.50625
7	8/12/2015	BG-1	1.3 J	-4.79375
8	8/12/2015	MW-8	2.4 J	-3.69375
9	8/12/2015	MW-6	2.8 J	-3.29375
10	8/12/2015	MW-5	3 J	-3.09375

Iteration i = 9

Mean of 71 measurements = 5.15775
Std Dev = 0.930539
x(i+1) = 3 from measurement 8/12/2015 from location MW-5
Rosner Statistic R = |3 - 5.15775|/0.930539 = 2.31881
Lambda(80, 10, 0.05) = 3.26
2.31881 < 3.26 -- No outliers detected for i = 9

Iteration i = 8

Mean of 72 measurements = 5.125
Std Dev = 0.96484
x(i+1) = 2.8 from measurement 8/12/2015 from location MW-6
Rosner Statistic R = |2.8 - 5.125|/0.96484 = 2.40973
Lambda(80, 9, 0.05) = 3.266
2.40973 < 3.266 -- No outliers detected for i = 8

Iteration i = 7

Mean of 73 measurements = 5.08767
Std Dev = 1.00981
x(i+1) = 2.4 from measurement 8/12/2015 from location MW-8
Rosner Statistic R = |2.4 - 5.08767|/1.00981 = 2.66157
Lambda(80, 8, 0.05) = 3.272
2.66157 < 3.272 -- No outliers detected for i = 7

Iteration i = 6

Mean of 74 measurements = 5.03649
Std Dev = 1.09527
x(i+1) = 1.3 from measurement 8/12/2015 from location BG-1
Rosner Statistic R = |1.3 - 5.03649|/1.09527 = 3.41149
Lambda(80, 7, 0.05) = 3.278
3.41149 > 3.278 -- Measurement 8/12/2015 for location BG-1 is an outlier

Iteration i = 5
Mean of 75 measurements = 5.13733
Std Dev = 1.39505
x(i+1) = 12.6 from measurement 10/15/2015 from location MW-5
Rosner Statistic R = |12.6 - 5.13733|/1.39505 = 5.3494
Lambda(80, 6, 0.05) = 3.284
Measurement 10/15/2015 for location MW-5 is an outlier

Iteration i = 4
Mean of 76 measurements = 5.24342
Std Dev = 1.666
x(i+1) = 13.2 from measurement 2/18/2016 from location MW-7
Rosner Statistic R = |13.2 - 5.24342|/1.666 = 4.77586
Lambda(80, 5, 0.05) = 3.29
Measurement 2/18/2016 for location MW-7 is an outlier

Iteration i = 3
Mean of 77 measurements = 5.35065
Std Dev = 1.90378
x(i+1) = 13.5 from measurement 2/17/2016 from location MW-2
Rosner Statistic R = |13.5 - 5.35065|/1.90378 = 4.28062
Lambda(80, 4, 0.05) = 3.29
Measurement 2/17/2016 for location MW-2 is an outlier

Iteration i = 2
Mean of 78 measurements = 5.47692
Std Dev = 2.19568
x(i+1) = 15.2 from measurement 1/26/2017 from location MW-2
Rosner Statistic R = |15.2 - 5.47692|/2.19568 = 4.42827
Lambda(80, 3, 0.05) = 3.3
Measurement 1/26/2017 for location MW-2 is an outlier

Iteration i = 1
Mean of 79 measurements = 5.63797
Std Dev = 2.60927
x(i+1) = 18.2 from measurement 10/15/2015 from location MW-8
Rosner Statistic R = |18.2 - 5.63797|/2.60927 = 4.81439
Lambda(80, 2, 0.05) = 3.3
Measurement 10/15/2015 for location MW-8 is an outlier

Iteration i = 0
Mean of 80 measurements = 6.09375
Std Dev = 4.83121
x(i+1) = 42.1 from measurement 1/24/2017 from location MW-8
Rosner Statistic R = |42.1 - 6.09375|/4.83121 = 7.45284
Lambda(80, 1, 0.05) = 3.31
Measurement 1/24/2017 for location MW-8 is an outlier

Non-Parametric Prediction Interval

Inter-Well Comparison

Parameter: Nickel

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

Total Percent Non-Detects = 79.1667%
Number of comparisons = 7
Future Samples (k) = 7
Recent Dates = 1
Background Measurements (n) = 9
Maximum Background Value = 5
Confidence Level = 56.3%
False Positive Rate = 43.7%

Location	Date	Count	Mean	Significant
MW-1	1/25/2017	1	5	FALSE
MW-2	**1/26/2017**	**1**	**15.2**	**TRUE**
MW-3	1/24/2017	1	5	FALSE
MW-4	1/25/2017	1	5	FALSE
MW-5	1/23/2017	1	5	FALSE
MW-6	1/24/2017	1	5	FALSE
MW-8	**1/24/2017**	**1**	**42.1**	**TRUE**

Sen's Slope Analysis

Parameter: Nickel

Location: MW-2

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

90% Confidence Level

Xj	Xk	(Xj - Xk)/(j-k)	Q
7.8 (10/15/2015)	6.1 (8/12/2015)	(7.8 - 6.1)/(2 - 1)	1.7
ND<5 U (11/19/2015)	6.1 (8/12/2015)	(5 - 6.1)/(3 - 1)	-0.55
8.7 (1/6/2016)	6.1 (8/12/2015)	(8.7 - 6.1)/(4 - 1)	0.866667
13.5 (2/17/2016)	6.1 (8/12/2015)	(13.5 - 6.1)/(5 - 1)	1.85
ND<5 U (4/6/2016)	6.1 (8/12/2015)	(5 - 6.1)/(6 - 1)	-0.22
ND<5 U (5/27/2016)	6.1 (8/12/2015)	(5 - 6.1)/(7 - 1)	-0.183333
ND<5 U (7/12/2016)	6.1 (8/12/2015)	(5 - 6.1)/(8 - 1)	-0.157143
15.2 (1/26/2017)	6.1 (8/12/2015)	(15.2 - 6.1)/(9 - 1)	1.1375
ND<5 U (11/19/2015)	7.8 (10/15/2015)	(5 - 7.8)/(3 - 2)	-2.8
8.7 (1/6/2016)	7.8 (10/15/2015)	(8.7 - 7.8)/(4 - 2)	0.45
13.5 (2/17/2016)	7.8 (10/15/2015)	(13.5 - 7.8)/(5 - 2)	1.9
ND<5 U (4/6/2016)	7.8 (10/15/2015)	(5 - 7.8)/(6 - 2)	-0.7
ND<5 U (5/27/2016)	7.8 (10/15/2015)	(5 - 7.8)/(7 - 2)	-0.56
ND<5 U (7/12/2016)	7.8 (10/15/2015)	(5 - 7.8)/(8 - 2)	-0.466667
15.2 (1/26/2017)	7.8 (10/15/2015)	(15.2 - 7.8)/(9 - 2)	1.05714
8.7 (1/6/2016)	ND<5 U (11/19/2015)	(8.7 - 5)/(4 - 3)	3.7
13.5 (2/17/2016)	ND<5 U (11/19/2015)	(13.5 - 5)/(5 - 3)	4.25
ND<5 U (4/6/2016)	ND<5 U (11/19/2015)	(5 - 5)/(6 - 3)	0
ND<5 U (5/27/2016)	ND<5 U (11/19/2015)	(5 - 5)/(7 - 3)	0
ND<5 U (7/12/2016)	ND<5 U (11/19/2015)	(5 - 5)/(8 - 3)	0
15.2 (1/26/2017)	ND<5 U (11/19/2015)	(15.2 - 5)/(9 - 3)	1.7
13.5 (2/17/2016)	8.7 (1/6/2016)	(13.5 - 8.7)/(5 - 4)	4.8
ND<5 U (4/6/2016)	8.7 (1/6/2016)	(5 - 8.7)/(6 - 4)	-1.85
ND<5 U (5/27/2016)	8.7 (1/6/2016)	(5 - 8.7)/(7 - 4)	-1.23333
ND<5 U (7/12/2016)	8.7 (1/6/2016)	(5 - 8.7)/(8 - 4)	-0.925
15.2 (1/26/2017)	8.7 (1/6/2016)	(15.2 - 8.7)/(9 - 4)	1.3
ND<5 U (4/6/2016)	13.5 (2/17/2016)	(5 - 13.5)/(6 - 5)	-8.5
ND<5 U (5/27/2016)	13.5 (2/17/2016)	(5 - 13.5)/(7 - 5)	-4.25
ND<5 U (7/12/2016)	13.5 (2/17/2016)	(5 - 13.5)/(8 - 5)	-2.83333
15.2 (1/26/2017)	13.5 (2/17/2016)	(15.2 - 13.5)/(9 - 5)	0.425
ND<5 U (5/27/2016)	ND<5 U (4/6/2016)	(5 - 5)/(7 - 6)	0
ND<5 U (7/12/2016)	ND<5 U (4/6/2016)	(5 - 5)/(8 - 6)	0
15.2 (1/26/2017)	ND<5 U (4/6/2016)	(15.2 - 5)/(9 - 6)	3.4
ND<5 U (7/12/2016)	ND<5 U (5/27/2016)	(5 - 5)/(8 - 7)	0
15.2 (1/26/2017)	ND<5 U (5/27/2016)	(15.2 - 5)/(9 - 7)	5.1
15.2 (1/26/2017)	ND<5 U (7/12/2016)	(15.2 - 5)/(9 - 8)	10.2

Number of Q values = 36

Ordered Q Values

n	Q
1	-8.5
2	-4.25
3	-2.83333
4	-2.8
5	-1.85
6	-1.23333
7	-0.925
8	-0.7
9	-0.56
10	-0.55
11	-0.466667
12	-0.22
13	-0.183333
14	-0.157143
15	0
16	0
17	0
18	0
19	0
20	0
21	0.425
22	0.45
23	0.866667
24	1.05714
25	1.1375
26	1.3
27	1.7
28	1.7
29	1.85
30	1.9
31	3.4
32	3.7
33	4.25
34	4.8
35	5.1
36	10.2

Sen's Estimator (Median Q) is 0

Tied Group	Value	Members
1	5	4

Time Period	Observations
8/12/2015	1
10/15/2015	1
11/19/2015	1
1/6/2016	1
2/17/2016	1
4/6/2016	1
5/27/2016	1
7/12/2016	1
1/26/2017	1

There are 0 time periods with multiple data

A = 156
B = 0
C = 24

D = 0
E = 12
F = 0
a = 1656
b = 4536
c = 144
Group Variance = 83.3333
For 90% confidence interval (two-tailed), Z at (1-0.9)/2 = 1.64485
C = 15.0154
M1 = (36 - 15.0154)/2.0 = 10.4923
M2 = (36 + 15.0154)/2.0 + 1 = 26.5077
Lower limit is -0.55 = Q(10)
Upper limit is 1.7 = Q(27)
-0.55 < 0 < 1.7 indicating no trend in data.

Sen's Slope Analysis

Parameter: Nickel

Location: MW-8

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

90% Confidence Level

Xj	Xk	(Xj - Xk)/(j-k)	Q
18.2 (10/15/2015)	2.4 J (8/12/2015)	(18.2 - 2.4)/(2 - 1)	15.8
ND<5 U (11/20/2015)	2.4 J (8/12/2015)	(5 - 2.4)/(3 - 1)	1.3
ND<5 U (1/6/2016)	2.4 J (8/12/2015)	(5 - 2.4)/(4 - 1)	0.866667
ND<5 U (2/18/2016)	2.4 J (8/12/2015)	(5 - 2.4)/(5 - 1)	0.65
ND<5 U (4/6/2016)	2.4 J (8/12/2015)	(5 - 2.4)/(6 - 1)	0.52
ND<5 U (5/26/2016)	2.4 J (8/12/2015)	(5 - 2.4)/(7 - 1)	0.433333
ND<5 U (7/12/2016)	2.4 J (8/12/2015)	(5 - 2.4)/(8 - 1)	0.371429
42.1 (1/24/2017)	2.4 J (8/12/2015)	(42.1 - 2.4)/(9 - 1)	4.9625
ND<5 U (11/20/2015)	18.2 (10/15/2015)	(5 - 18.2)/(3 - 2)	-13.2
ND<5 U (1/6/2016)	18.2 (10/15/2015)	(5 - 18.2)/(4 - 2)	-6.6
ND<5 U (2/18/2016)	18.2 (10/15/2015)	(5 - 18.2)/(5 - 2)	-4.4
ND<5 U (4/6/2016)	18.2 (10/15/2015)	(5 - 18.2)/(6 - 2)	-3.3
ND<5 U (5/26/2016)	18.2 (10/15/2015)	(5 - 18.2)/(7 - 2)	-2.64
ND<5 U (7/12/2016)	18.2 (10/15/2015)	(5 - 18.2)/(8 - 2)	-2.2
42.1 (1/24/2017)	18.2 (10/15/2015)	(42.1 - 18.2)/(9 - 2)	3.41429
ND<5 U (1/6/2016)	ND<5 U (11/20/2015)	(5 - 5)/(4 - 3)	0
ND<5 U (2/18/2016)	ND<5 U (11/20/2015)	(5 - 5)/(5 - 3)	0
ND<5 U (4/6/2016)	ND<5 U (11/20/2015)	(5 - 5)/(6 - 3)	0
ND<5 U (5/26/2016)	ND<5 U (11/20/2015)	(5 - 5)/(7 - 3)	0
ND<5 U (7/12/2016)	ND<5 U (11/20/2015)	(5 - 5)/(8 - 3)	0
42.1 (1/24/2017)	ND<5 U (11/20/2015)	(42.1 - 5)/(9 - 3)	6.18333
ND<5 U (2/18/2016)	ND<5 U (1/6/2016)	(5 - 5)/(5 - 4)	0
ND<5 U (4/6/2016)	ND<5 U (1/6/2016)	(5 - 5)/(6 - 4)	0
ND<5 U (5/26/2016)	ND<5 U (1/6/2016)	(5 - 5)/(7 - 4)	0
ND<5 U (7/12/2016)	ND<5 U (1/6/2016)	(5 - 5)/(8 - 4)	0
42.1 (1/24/2017)	ND<5 U (1/6/2016)	(42.1 - 5)/(9 - 4)	7.42
ND<5 U (4/6/2016)	ND<5 U (2/18/2016)	(5 - 5)/(6 - 5)	0
ND<5 U (5/26/2016)	ND<5 U (2/18/2016)	(5 - 5)/(7 - 5)	0
ND<5 U (7/12/2016)	ND<5 U (2/18/2016)	(5 - 5)/(8 - 5)	0
42.1 (1/24/2017)	ND<5 U (2/18/2016)	(42.1 - 5)/(9 - 5)	9.275
ND<5 U (5/26/2016)	ND<5 U (4/6/2016)	(5 - 5)/(7 - 6)	0
ND<5 U (7/12/2016)	ND<5 U (4/6/2016)	(5 - 5)/(8 - 6)	0
42.1 (1/24/2017)	ND<5 U (4/6/2016)	(42.1 - 5)/(9 - 6)	12.3667
ND<5 U (7/12/2016)	ND<5 U (5/26/2016)	(5 - 5)/(8 - 7)	0
42.1 (1/24/2017)	ND<5 U (5/26/2016)	(42.1 - 5)/(9 - 7)	18.55
42.1 (1/24/2017)	ND<5 U (7/12/2016)	(42.1 - 5)/(9 - 8)	37.1

Number of Q values = 36

Ordered Q Values

n	Q
1	-13.2
2	-6.6
3	-4.4
4	-3.3
5	-2.64
6	-2.2
7	0
8	0
9	0
10	0
11	0
12	0
13	0
14	0
15	0
16	0
17	0
18	0
19	0
20	0
21	0
22	0.371429
23	0.433333
24	0.52
25	0.65
26	0.866667
27	1.3
28	3.41429
29	4.9625
30	6.18333
31	7.42
32	9.275
33	12.3667
34	15.8
35	18.55
36	37.1

Sen's Estimator (Median Q) is 0

Tied Group	Value	Members
1	5	6

Time Period	Observations
8/12/2015	1
10/15/2015	1
11/20/2015	1
1/6/2016	1
2/18/2016	1
4/6/2016	1
5/26/2016	1
7/12/2016	1
1/24/2017	1

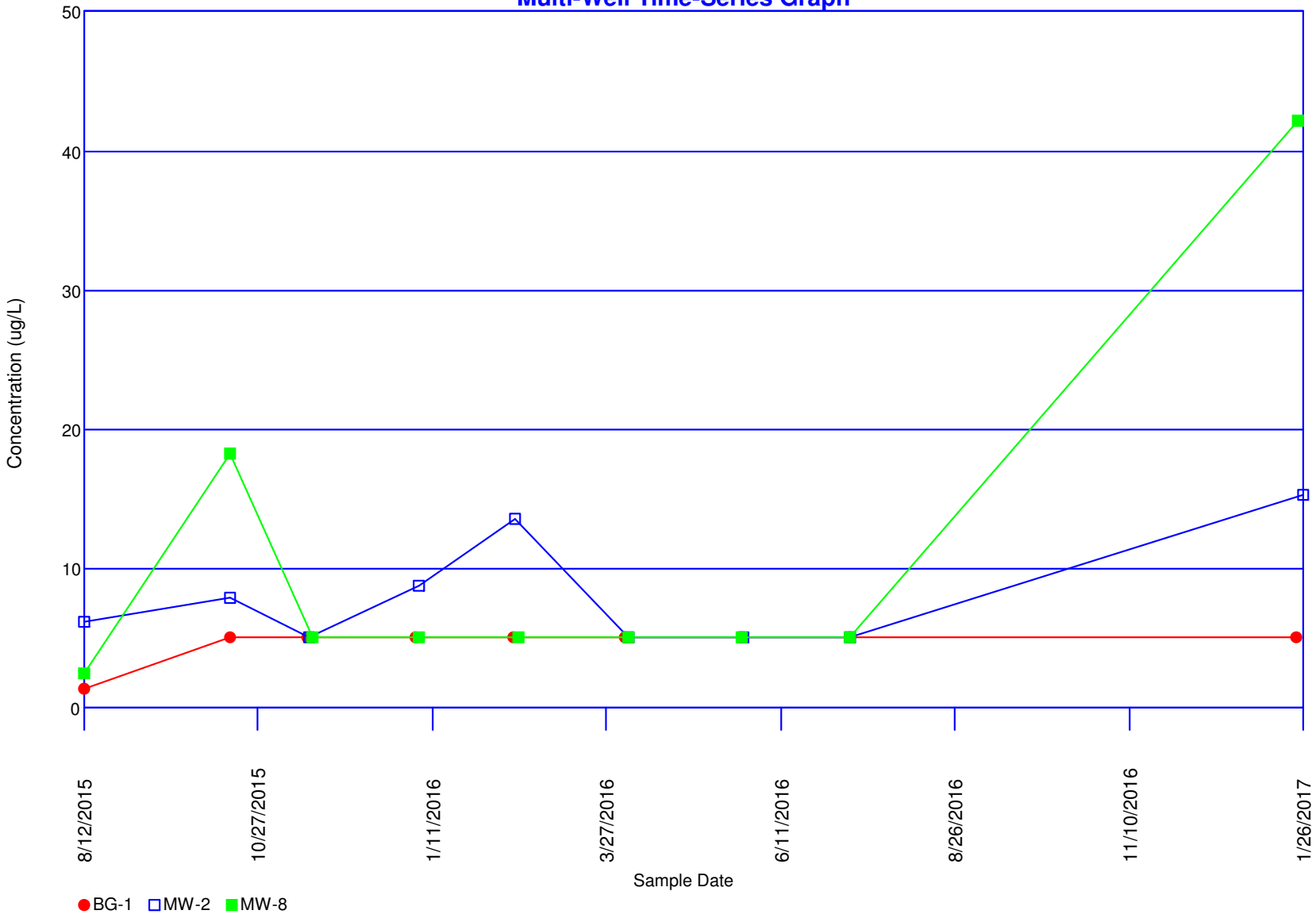
There are 0 time periods with multiple data

A = 510
B = 0
C = 120

D = 0
E = 30
F = 0
a = 1656
b = 4536
c = 144
Group Variance = 63.6667
For 90% confidence interval (two-tailed), Z at (1-0.9)/2 = 1.64485
C = 13.1245
M1 = (36 - 13.1245)/2.0 = 11.4377
M2 = (36 + 13.1245)/2.0 + 1 = 25.5623
Lower limit is 0 = Q(11)
Upper limit is 0.866667 = Q(26)
0 < 0 < 0.866667 indicating no trend in data.

Nickel

Multi-Well Time-Series Graph



Concentrations (pCi/L)

Parameter: Radium-226

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

Total Measurements: 79
Total Non-Detect: 11
Percent Non-Detects: 13.9241%
Total Background Measurements: 9
There is 1 background location

Loc.	Meas.	ND	Date	Conc.	Original
BG-1	9	1 (11.1111%)	8/12/2015	0.802	0.802
			10/15/2015	0.362	0.362
			11/18/2015	0.8	0.8
			1/4/2016	ND<0.206	ND<0.206
			2/16/2016	0.553	0.553
			4/5/2016	0.407	0.407
			5/26/2016	0.654	0.654
			7/12/2016	0.777	0.777
			1/23/2017	0.532	0.532

There are 8 compliance locations

Loc.	Meas.	ND	Date	Conc.	Original
MW-1	9	1 (11.1111%)	8/12/2015	0.709	0.709
			10/15/2015	0.387	0.387
			11/20/2015	0.414	0.414
			1/6/2016	0.209	0.209
			2/17/2016	0.276	0.276
			4/6/2016	0.141	0.141
			5/27/2016	0.254	0.254
			7/12/2016	0.448	0.448
			1/25/2017	ND<0.188	ND<0.188
MW-2	9	0 (0%)	8/12/2015	1.33	1.33
			10/15/2015	0.681	0.681
			11/20/2015	0.985	0.985
			1/6/2016	0.716	0.716
			2/17/2016	1.22	1.22
			4/6/2016	1.94	1.94
			5/27/2016	0.69	0.69
			7/12/2016	0.58	0.58
			1/26/2017	1.02	1.02
MW-3	9	0 (0%)	8/12/2015	0.99	0.99
			10/15/2015	1.59	1.59
			11/19/2015	0.816	0.816
			1/5/2016	0.213	0.213
			2/16/2016	1.18	1.18
			4/7/2016	0.605	0.605
			5/27/2016	1.24	1.24
			7/11/2016	0.308	0.308
			1/24/2017	1.25	1.25
MW-4	9	1 (11.1111%)	8/12/2015	0.814	0.814

			10/15/2015	0.281	0.281
			11/19/2015	0.406	0.406
			1/4/2016	ND<0.12	ND<0.12
			2/16/2016	0.0693	0.0693
			4/7/2016	0.444	0.444
			5/25/2016	0.295	0.295
			7/11/2016	0.185	0.185
			1/25/2017	0.224	0.224
MW-5	9	4 (44.4444%)	8/12/2015	0.564	0.564
			10/15/2015	0.708	0.708
			11/18/2015	0.592	0.592
			1/4/2016	ND<0.066	ND<0.066
			2/16/2016	ND<0.142	ND<0.142
			4/5/2016	ND<0	ND<0
			5/25/2016	0.0766	0.0766
			7/11/2016	ND<0.092	ND<0.092
			1/23/2017	0.0732	0.0732
MW-6	9	2 (22.2222%)	8/12/2015	0.806	0.806
			10/19/2015	0.172	0.172
			11/20/2015	0.0638	0.0638
			1/5/2016	0.91	0.91
			2/17/2016	0.0812	0.0812
			4/5/2016	ND<0.068	ND<0.068
			5/26/2016	ND<0.075	ND<0.075
			7/11/2016	0.393	0.393
			1/24/2017	0.126	0.126
MW-7	7	1 (14.2857%)	8/12/2015	0.423	0.423
			10/16/2015	0.464	0.464
			11/20/2015	0.856	0.856
			1/5/2016	0.349	0.349
			4/6/2016	0.279	0.279
			5/26/2016	0.0643	0.0643
			7/11/2016	ND<0	ND<0
MW-8	9	1 (11.1111%)	8/12/2015	0.92	0.92
			10/15/2015	0.0774	0.0774
			11/20/2015	1.16	1.16
			1/6/2016	ND<0	ND<0
			2/18/2016	0.116	0.116
			4/6/2016	0.73	0.73
			5/26/2016	0.719	0.719
			7/12/2016	0.616	0.616
			1/24/2017	0.0618	0.0618

There are 0 unused locations

Loc.	Meas.	ND	Date	Conc.	Original

Rosner's Test for Outliers

Parameter: Radium-226

All Locations

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

Data set mean = 0.508299

10 most extreme of 79 measurements

by order of magnitude difference from the mean

1	4/6/2016	MW-2	1.94	1.4317
2	10/15/2015	MW-3	1.59	1.0817
3	8/12/2015	MW-2	1.33	0.821701
4	1/24/2017	MW-3	1.25	0.741701
5	5/27/2016	MW-3	1.24	0.731701
6	2/17/2016	MW-2	1.22	0.711701
7	2/16/2016	MW-3	1.18	0.671701
8	11/20/2015	MW-8	1.16	0.651701
9	1/26/2017	MW-2	1.02	0.511701
10	7/11/2016	MW-7	ND<0	-0.508299

Iteration i = 9

Mean of 70 measurements = 0.403223
Std Dev = 0.291756
x(i+1) = 0 from measurement 7/11/2016 from location MW-7
Rosner Statistic R = |0 - 0.403223|/0.291756 = 1.38206
Lambda(79, 10, 0.05) = 3.255
1.38206 < 3.255 -- No outliers detected for i = 9

Iteration i = 8

Mean of 71 measurements = 0.41191
Std Dev = 0.29877
x(i+1) = 1.02 from measurement 1/26/2017 from location MW-2
Rosner Statistic R = |1.02 - 0.41191|/0.29877 = 2.03531
Lambda(79, 9, 0.05) = 3.261
2.03531 < 3.261 -- No outliers detected for i = 8

Iteration i = 7

Mean of 72 measurements = 0.4223
Std Dev = 0.309482
x(i+1) = 1.16 from measurement 11/20/2015 from location MW-8
Rosner Statistic R = |1.16 - 0.4223|/0.309482 = 2.38366
Lambda(79, 8, 0.05) = 3.267
2.38366 < 3.267 -- No outliers detected for i = 7

Iteration i = 6

Mean of 73 measurements = 0.432679
Std Dev = 0.319864
x(i+1) = 1.18 from measurement 2/16/2016 from location MW-3
Rosner Statistic R = |1.18 - 0.432679|/0.319864 = 2.33637
Lambda(79, 7, 0.05) = 3.273
2.33637 < 3.273 -- No outliers detected for i = 6

Iteration i = 5
Mean of 74 measurements = 0.443319
Std Dev = 0.330588
x(i+1) = 1.22 from measurement 2/17/2016 from location MW-2
Rosner Statistic R = |1.22 - 0.443319|/0.330588 = 2.34939
Lambda(79, 6, 0.05) = 3.279
2.34939 < 3.279 -- No outliers detected for i = 5

Iteration i = 4
Mean of 75 measurements = 0.453941
Std Dev = 0.34099
x(i+1) = 1.24 from measurement 5/27/2016 from location MW-3
Rosner Statistic R = |1.24 - 0.453941|/0.34099 = 2.30523
Lambda(79, 5, 0.05) = 3.285
2.30523 < 3.285 -- No outliers detected for i = 4

Iteration i = 3
Mean of 76 measurements = 0.464416
Std Dev = 0.350802
x(i+1) = 1.25 from measurement 1/24/2017 from location MW-3
Rosner Statistic R = |1.25 - 0.464416|/0.350802 = 2.2394
Lambda(79, 4, 0.05) = 3.285
2.2394 < 3.285 -- No outliers detected for i = 3

Iteration i = 2
Mean of 77 measurements = 0.475657
Std Dev = 0.362178
x(i+1) = 1.33 from measurement 8/12/2015 from location MW-2
Rosner Statistic R = |1.33 - 0.475657|/0.362178 = 2.3589
Lambda(79, 3, 0.05) = 3.295
2.3589 < 3.295 -- No outliers detected for i = 2

Iteration i = 1
Mean of 78 measurements = 0.489944
Std Dev = 0.3813
x(i+1) = 1.59 from measurement 10/15/2015 from location MW-3
Rosner Statistic R = |1.59 - 0.489944|/0.3813 = 2.88502
Lambda(79, 2, 0.05) = 3.295
2.88502 < 3.295 -- No outliers detected for i = 1

Iteration i = 0
Mean of 79 measurements = 0.508299
Std Dev = 0.412482
x(i+1) = 1.94 from measurement 4/6/2016 from location MW-2
Rosner Statistic R = |1.94 - 0.508299|/0.412482 = 3.47094
Lambda(79, 1, 0.05) = 3.305
3.47094 > 3.305 -- Measurement 4/6/2016 for location MW-2 is an outlier

Shapiro-Wilks Test of Normality

Parameter: Radium-226

All Locations

Normality Test of Parameter Concentrations

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

K = 4 for 9 measurements

i	x(i)	x(n-i+1)	x(n-1+1)-x(i)	a(n-i+1)	b(i)
1	0.206	0.802	0.596	0.5888	0.350925
2	0.362	0.8	0.438	0.3244	0.142087
3	0.407	0.777	0.37	0.1976	0.073112
4	0.532	0.654	0.122	0.0947	0.0115534
5	0.553	0.553	0		
6	0.654	0.532	-0.122		
7	0.777	0.407	-0.37		
8	0.8	0.362	-0.438		
9	0.802	0.206	-0.596		

Sum of b values = 0.577677
Sample Standard Deviation = 0.212291
W Statistic = 0.92559

5% Critical value of 0.829 is less than 0.92559
Data is normally distributed at 95% level of significance

1% Critical value of 0.764 is less than 0.92559
Data is normally distributed at 99% level of significance

Parametric Prediction Interval Analysis

Inter-Well Comparison

Parameter: Radium-226

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

Inter-Well Unified Guid. Formula 95% One-Sided Comparison

Background Samples = 9
Background Mean = 0.565889
Background Std Dev = 0.212291

Number of comparisons = 7
Future Samples (k) = 7
Actual confidence level is 1.0 - (0.05/7) = 99.2857 %
t is Percentile of Student's T-Test (0.95/7) = 0.992857
Degrees of Freedom = 9 (background observations) - 1
t(0.992857, 9) = 3.1587

Well MW-1

Date	Samples	Mean	Interval	Significant
1/25/2017	1	0.188	[0, 1.27272]	FALSE

Well MW-2

Date	Samples	Mean	Interval	Significant
1/26/2017	1	1.02	[0, 1.27272]	FALSE

Well MW-3

Date	Samples	Mean	Interval	Significant
1/24/2017	1	1.25	[0, 1.27272]	FALSE

Well MW-4

Date	Samples	Mean	Interval	Significant
1/25/2017	1	0.224	[0, 1.27272]	FALSE

Well MW-5

Date	Samples	Mean	Interval	Significant
1/23/2017	1	0.0732	[0, 1.27272]	FALSE

Well MW-6

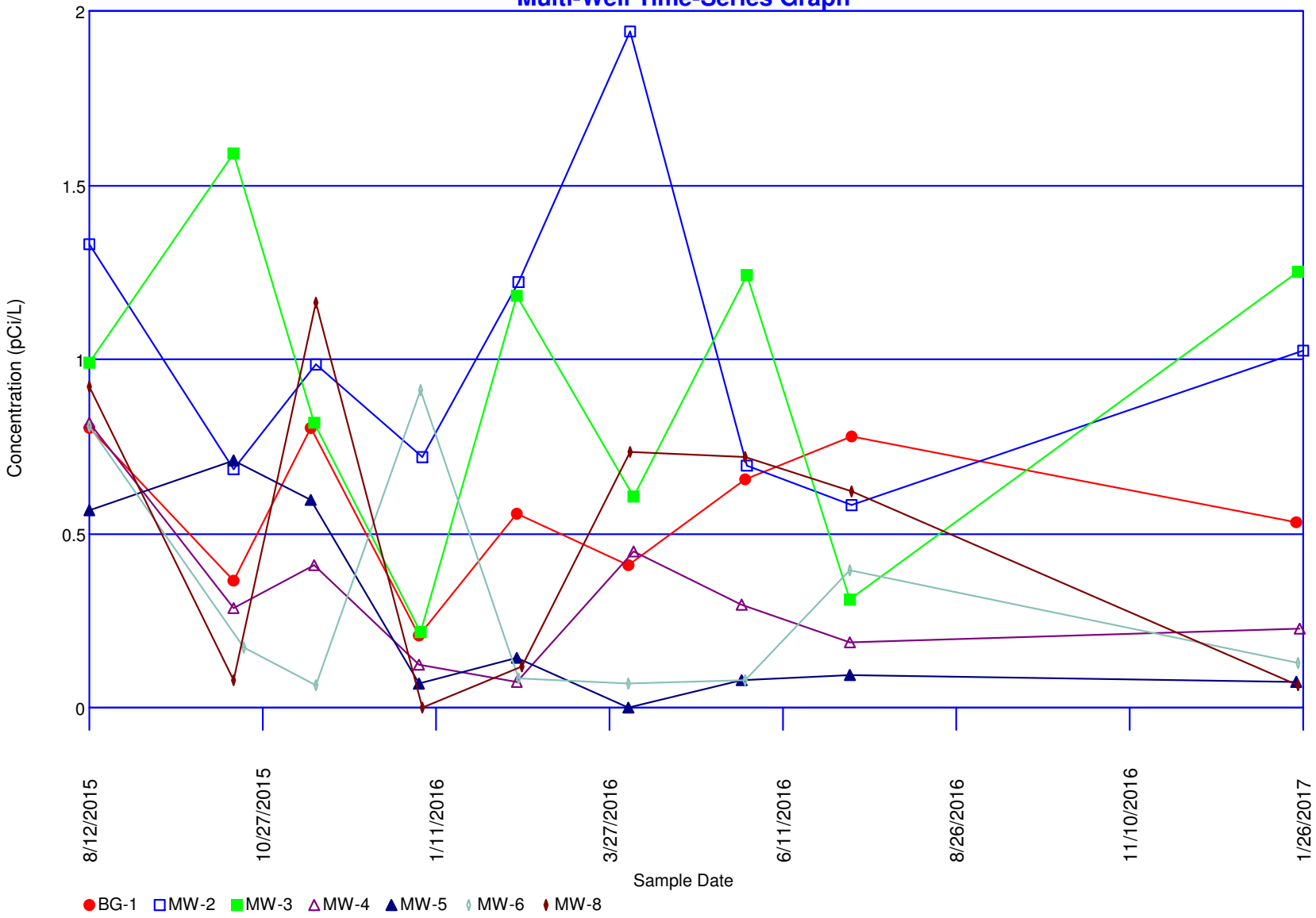
Date	Samples	Mean	Interval	Significant
1/24/2017	1	0.126	[0, 1.27272]	FALSE

Well MW-8

Date	Samples	Mean	Interval	Significant
1/24/2017	1	0.0618	[0, 1.27272]	FALSE

Radium-226

Multi-Well Time-Series Graph



Concentrations (pCi/L)

Parameter: Radium-228

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

Total Measurements: 79
Total Non-Detect: 10
Percent Non-Detects: 12.6582%
Total Background Measurements: 9
There is 1 background location

Loc.	Meas.	ND	Date	Conc.	Original
BG-1	9	1 (11.1111%)	8/12/2015	ND<0.496 U	ND<0.496 U
			10/15/2015	0.723	0.723
			11/18/2015	1.29	1.29
			1/4/2016	0.808	0.808
			2/16/2016	0.256	0.256
			4/5/2016	0.828	0.828
			5/26/2016	0.0108	0.0108
			7/12/2016	0.163	0.163
			1/23/2017	0.442	0.442

There are 8 compliance locations

Loc.	Meas.	ND	Date	Conc.	Original
MW-1	9	2 (22.2222%)	8/12/2015	ND<0.538 U	ND<0.538 U
			10/15/2015	0.0801	0.0801
			11/20/2015	0.511	0.511
			1/6/2016	0.455	0.455
			2/17/2016	0.47	0.47
			4/6/2016	0.402	0.402
			5/27/2016	ND<0.0467	ND<0.0467
			7/12/2016	0.833	0.833
			1/25/2017	0.237	0.237
MW-2	9	1 (11.1111%)	8/12/2015	ND<1.39 U	ND<1.39 U
			10/15/2015	1.56	1.56
			11/19/2015	1.75	1.75
			1/6/2016	1.69	1.69
			2/17/2016	1.15	1.15
			4/6/2016	1.08	1.08
			5/27/2016	0.433	0.433
			7/12/2016	0.98	0.98
			1/26/2017	0.979	0.979
MW-3	9	0 (0%)	8/12/2015	2.03	2.03
			10/15/2015	1.34	1.34
			11/19/2015	1.95	1.95
			1/5/2016	0.209	0.209
			2/16/2016	1.78	1.78
			4/7/2016	1.22	1.22
			5/27/2016	1.75	1.75
			7/11/2016	0.801	0.801
			1/24/2017	0.387	0.387
MW-4	9	1 (11.1111%)	8/12/2015	ND<1.52 U	ND<1.52 U

			10/15/2015	0.023	0.023
			11/19/2015	0.174	0.174
			1/4/2016	0.481	0.481
			2/16/2016	0.171	0.171
			4/7/2016	0.019	0.019
			5/25/2016	0.584	0.584
			7/11/2016	0.455	0.455
			1/25/2017	0.243	0.243
MW-5	9	2 (22.2222%)	8/12/2015	ND<0.52 U	ND<0.52 U
			10/15/2015	0.331	0.331
			11/18/2015	0.359	0.359
			1/4/2016	0.425	0.425
			2/16/2016	0.154	0.154
			4/5/2016	0.951	0.951
			5/25/2016	ND<0.0121	ND<0.0121
			7/11/2016	0.568	0.568
			1/23/2017	1.08	1.08
MW-6	9	1 (11.1111%)	8/12/2015	ND<1.26 U	ND<1.26 U
			10/19/2015	0.395	0.395
			11/20/2015	0.791	0.791
			1/5/2016	0.555	0.555
			2/17/2016	0.249	0.249
			4/5/2016	0.912	0.912
			5/26/2016	0.148	0.148
			7/11/2016	0.907	0.907
			1/24/2017	0.416	0.416
MW-7	7	1 (14.2857%)	8/12/2015	ND<0.271 U	ND<0.271 U
			10/16/2015	0.273	0.273
			11/20/2015	1.15	1.15
			1/5/2016	0.243	0.243
			4/6/2016	0.188	0.188
			5/26/2016	0.126	0.126
			7/11/2016	0.019	0.019
MW-8	9	1 (11.1111%)	8/12/2015	ND<0.931 U	ND<0.931 U
			10/15/2015	0.809	0.809
			11/20/2015	0.702	0.702
			1/6/2016	0.864	0.864
			2/18/2016	1.11	1.11
			4/6/2016	0.937	0.937
			5/26/2016	0.521	0.521
			7/12/2016	0.548	0.548
			1/24/2017	0.392	0.392

There are 0 unused locations

Loc.	Meas.	ND	Date	Conc.	Original

Rosner's Test for Outliers

Parameter: Radium-228

All Locations

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

Data set mean = 0.681718

10 most extreme of 79 measurements

by order of magnitude difference from the mean

1	8/12/2015	MW-3	2.03	1.34828
2	11/19/2015	MW-3	1.95	1.26828
3	2/16/2016	MW-3	1.78	1.09828
4	11/19/2015	MW-2	1.75	1.06828
5	5/27/2016	MW-3	1.75	1.06828
6	1/6/2016	MW-2	1.69	1.00828
7	10/15/2015	MW-2	1.56	0.878282
8	8/12/2015	MW-4	ND<1.52 U	0.838282
9	8/12/2015	MW-2	ND<1.39 U	0.708282
10	5/26/2016	BG-1	0.0108	-0.670918

Iteration i = 9

Mean of 70 measurements = 0.549081
Std Dev = 0.367897
x(i+1) = 0.0108 from measurement 5/26/2016 from location BG-1
Rosner Statistic R = |0.0108 - 0.549081|/0.367897 = 1.46313
Lambda(79, 10, 0.05) = 3.255
1.46313 < 3.255 -- No outliers detected for i = 9

Iteration i = 8

Mean of 71 measurements = 0.560925
Std Dev = 0.378648
x(i+1) = 1.39 from measurement 8/12/2015 from location MW-2
Rosner Statistic R = |1.39 - 0.560925|/0.378648 = 2.18956
Lambda(79, 9, 0.05) = 3.261
2.18956 < 3.261 -- No outliers detected for i = 8

Iteration i = 7

Mean of 72 measurements = 0.574246
Std Dev = 0.392595
x(i+1) = 1.52 from measurement 8/12/2015 from location MW-4
Rosner Statistic R = |1.52 - 0.574246|/0.392595 = 2.40898
Lambda(79, 8, 0.05) = 3.267
2.40898 < 3.267 -- No outliers detected for i = 7

Iteration i = 6

Mean of 73 measurements = 0.587749
Std Dev = 0.406572
x(i+1) = 1.56 from measurement 10/15/2015 from location MW-2
Rosner Statistic R = |1.56 - 0.587749|/0.406572 = 2.39134
Lambda(79, 7, 0.05) = 3.273
2.39134 < 3.273 -- No outliers detected for i = 6

Iteration i = 5
Mean of 74 measurements = 0.602645
Std Dev = 0.423621
x(i+1) = 1.69 from measurement 1/6/2016 from location MW-2
Rosner Statistic R = |1.69 - 0.602645|/0.423621 = 2.56681
Lambda(79, 6, 0.05) = 3.279
2.56681 < 3.279 -- No outliers detected for i = 5

Iteration i = 4
Mean of 75 measurements = 0.617943
Std Dev = 0.441115
x(i+1) = 1.75 from measurement 5/27/2016 from location MW-3
Rosner Statistic R = |1.75 - 0.617943|/0.441115 = 2.56636
Lambda(79, 5, 0.05) = 3.285
2.56636 < 3.285 -- No outliers detected for i = 4

Iteration i = 3
Mean of 76 measurements = 0.632838
Std Dev = 0.457001
x(i+1) = 1.75 from measurement 11/19/2015 from location MW-2
Rosner Statistic R = |1.75 - 0.632838|/0.457001 = 2.44455
Lambda(79, 4, 0.05) = 3.285
2.44455 < 3.285 -- No outliers detected for i = 3

Iteration i = 2
Mean of 77 measurements = 0.647736
Std Dev = 0.472433
x(i+1) = 1.78 from measurement 2/16/2016 from location MW-3
Rosner Statistic R = |1.78 - 0.647736|/0.472433 = 2.39667
Lambda(79, 3, 0.05) = 3.295
2.39667 < 3.295 -- No outliers detected for i = 2

Iteration i = 1
Mean of 78 measurements = 0.664432
Std Dev = 0.491972
x(i+1) = 1.95 from measurement 11/19/2015 from location MW-3
Rosner Statistic R = |1.95 - 0.664432|/0.491972 = 2.61309
Lambda(79, 2, 0.05) = 3.295
2.61309 < 3.295 -- No outliers detected for i = 1

Iteration i = 0
Mean of 79 measurements = 0.681718
Std Dev = 0.512385
x(i+1) = 2.03 from measurement 8/12/2015 from location MW-3
Rosner Statistic R = |2.03 - 0.681718|/0.512385 = 2.63139
Lambda(79, 1, 0.05) = 3.305
2.63139 < 3.305 -- No outliers detected for i = 0

Shapiro-Wilks Test of Normality

Parameter: Radium-228

All Locations

Normality Test of Parameter Concentrations

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

K = 4 for 9 measurements

i	x(i)	x(n-i+1)	x(n-1+1)-x(i)	a(n-i+1)	b(i)
1	0.0108	1.29	1.2792	0.5888	0.753193
2	0.163	0.828	0.665	0.3244	0.215726
3	0.256	0.808	0.552	0.1976	0.109075
4	0.442	0.723	0.281	0.0947	0.0266107
5	0.496	0.496	0		
6	0.723	0.442	-0.281		
7	0.808	0.256	-0.552		
8	0.828	0.163	-0.665		
9	1.29	0.0108	-1.2792		

Sum of b values = 1.1046
Sample Standard Deviation = 0.397241
W Statistic = 0.966531

5% Critical value of 0.829 is less than 0.966531
Data is normally distributed at 95% level of significance

1% Critical value of 0.764 is less than 0.966531
Data is normally distributed at 99% level of significance

Parametric Prediction Interval Analysis

Inter-Well Comparison

Parameter: Radium-228

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

Inter-Well Unified Guid. Formula 95% One-Sided Comparison

Background Samples = 9
Background Mean = 0.557422
Background Std Dev = 0.397241

Number of comparisons = 7
Future Samples (k) = 7
Actual confidence level is 1.0 - (0.05/7) = 99.2857 %
t is Percentile of Student's T-Test (0.95/7) = 0.992857
Degrees of Freedom = 9 (background observations) - 1
t(0.992857, 9) = 3.1587

Well MW-1

Date	Samples	Mean	Interval	Significant
1/25/2017	1	0.237	[0, 1.88006]	FALSE

Well MW-2

Date	Samples	Mean	Interval	Significant
1/26/2017	1	0.979	[0, 1.88006]	FALSE

Well MW-3

Date	Samples	Mean	Interval	Significant
1/24/2017	1	0.387	[0, 1.88006]	FALSE

Well MW-4

Date	Samples	Mean	Interval	Significant
1/25/2017	1	0.243	[0, 1.88006]	FALSE

Well MW-5

Date	Samples	Mean	Interval	Significant
1/23/2017	1	1.08	[0, 1.88006]	FALSE

Well MW-6

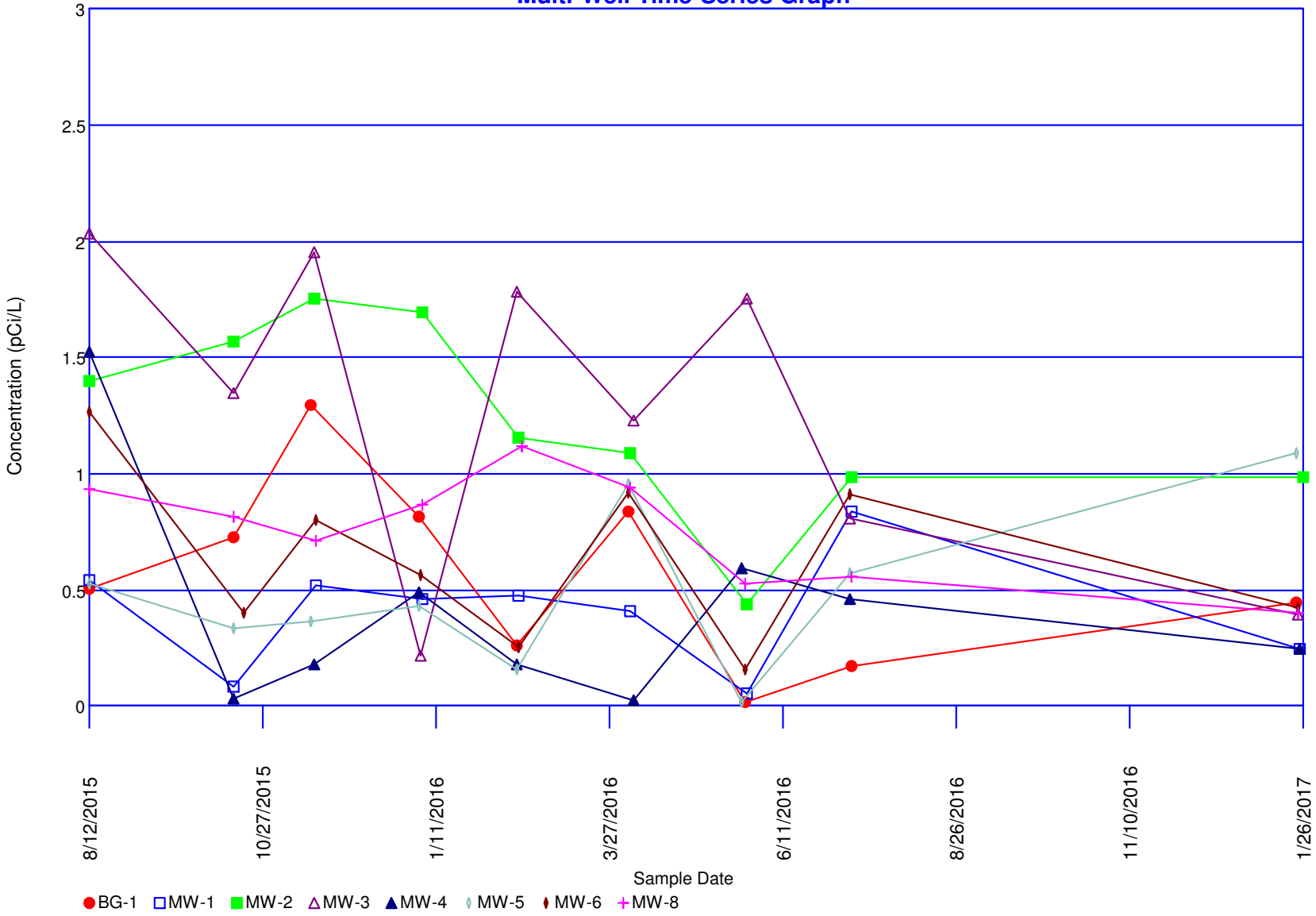
Date	Samples	Mean	Interval	Significant
1/24/2017	1	0.416	[0, 1.88006]	FALSE

Well MW-8

Date	Samples	Mean	Interval	Significant
1/24/2017	1	0.392	[0, 1.88006]	FALSE

Radium-228

Multi-Well Time-Series Graph



Concentrations (mg/L)

Parameter: Sulfate

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

Total Measurements: 80
Total Non-Detect: 0
Percent Non-Detects: 0%
Total Background Measurements: 9
There is 1 background location

Loc.	Meas.	ND	Date	Conc.	Original
BG-1	9	0 (0%)	8/12/2015	23	23
			10/15/2015	15.1	15.1
			11/18/2015	17.5	17.5
			1/4/2016	19.5	19.5
			2/16/2016	18.6	18.6
			4/5/2016	19.6	19.6
			5/26/2016	19.3	19.3
			7/12/2016	18.2	18.2
			1/23/2017	20	20

There are 8 compliance locations

Loc.	Meas.	ND	Date	Conc.	Original
MW-1	9	0 (0%)	8/12/2015	23 J	23 J
			10/15/2015	13.1	13.1
			11/20/2015	9.8	9.8
			1/6/2016	11.2	11.2
			2/17/2016	8.7	8.7
			4/6/2016	10.5	10.5
			5/27/2016	10.9	10.9
			7/12/2016	9.4	9.4
			1/25/2017	7	7
MW-2	9	0 (0%)	8/12/2015	79	79
			10/15/2015	199	199
			11/19/2015	238	238
			1/6/2016	228	228
			2/17/2016	247	247
			4/6/2016	230	230
			5/27/2016	163	163
			7/12/2016	205	205
			1/26/2017	338	338
MW-3	9	0 (0%)	8/12/2015	24 J	24 J
			10/15/2015	14	14
			11/19/2015	12.3	12.3
			1/5/2016	10	10
			2/16/2016	9.1	9.1
			4/7/2016	12.9	12.9
			5/27/2016	16.8	16.8
			7/11/2016	125	125
			1/24/2017	174	174
MW-4	9	0 (0%)	8/12/2015	11	11

			10/15/2015	7	7
			11/19/2015	5.9	5.9
			1/4/2016	6.3	6.3
			2/16/2016	5.6	5.6
			4/7/2016	3.9	3.9
			5/25/2016	3.4	3.4
			7/13/2016	9.2	9.2
			1/25/2017	10	10
MW-5	9	0 (0%)	8/12/2015	4.1	4.1
			10/15/2015	3.7	3.7
			11/18/2015	3.1	3.1
			1/4/2016	4.1	4.1
			2/16/2016	3.6	3.6
			4/5/2016	3.1	3.1
			5/25/2016	3.4	3.4
			7/11/2016	2.6	2.6
			1/23/2017	3.7	3.7
MW-6	9	0 (0%)	8/12/2015	48	48
			10/19/2015	66.1	66.1
			11/20/2015	137	137
			1/5/2016	194	194
			2/17/2016	87.7	87.7
			4/5/2016	214	214
			5/26/2016	51.6	51.6
			7/11/2016	53.8	53.8
			1/24/2017	145	145
MW-7	8	0 (0%)	8/12/2015	36	36
			10/16/2015	46.9	46.9
			11/20/2015	44.3	44.3
			1/5/2016	32.1	32.1
			2/18/2016	40.4	40.4
			4/6/2016	38	38
			5/26/2016	19.1	19.1
			7/11/2016	11.2	11.2
MW-8	9	0 (0%)	8/12/2015	6.3	6.3
			10/15/2015	6.1	6.1
			11/20/2015	4.4	4.4
			1/6/2016	5.5	5.5
			2/18/2016	5.6	5.6
			4/6/2016	5.7	5.7
			5/26/2016	6	6
			7/12/2016	5.9	5.9
			1/24/2017	6	6

There are 0 unused locations

Loc.	Meas.	ND	Date	Conc.	Original

Rosner's Test for Outliers

Parameter: Sulfate

All Locations

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

Data set mean = 50.1237

10 most extreme of 80 measurements

by order of magnitude difference from the mean

1	1/26/2017	MW-2	338	287.876
2	2/17/2016	MW-2	247	196.876
3	11/19/2015	MW-2	238	187.876
4	4/6/2016	MW-2	230	179.876
5	1/6/2016	MW-2	228	177.876
6	4/5/2016	MW-6	214	163.876
7	7/12/2016	MW-2	205	154.876
8	10/15/2015	MW-2	199	148.876
9	1/5/2016	MW-6	194	143.876
10	1/24/2017	MW-3	174	123.876

Iteration i = 9

Mean of 71 measurements = 26.9986
Std Dev = 38.5116
x(i+1) = 174 from measurement 1/24/2017 from location MW-3
Rosner Statistic R = |174 - 26.9986|/38.5116 = 3.81707
Lambda(80, 10, 0.05) = 3.26
3.81707 > 3.26 -- Measurement 1/24/2017 for location MW-3 is an outlier

---

Iteration i = 8

Mean of 72 measurements = 29.3181
Std Dev = 43.0071
x(i+1) = 194 from measurement 1/5/2016 from location MW-6
Rosner Statistic R = |194 - 29.3181|/43.0071 = 3.82918
Lambda(80, 9, 0.05) = 3.266
Measurement 1/5/2016 for location MW-6 is an outlier

Iteration i = 7

Mean of 73 measurements = 31.6425
Std Dev = 47.0991
x(i+1) = 199 from measurement 10/15/2015 from location MW-2
Rosner Statistic R = |199 - 31.6425|/47.0991 = 3.5533
Lambda(80, 8, 0.05) = 3.272
Measurement 10/15/2015 for location MW-2 is an outlier

Iteration i = 6

Mean of 74 measurements = 33.9851
Std Dev = 50.9319
x(i+1) = 205 from measurement 7/12/2016 from location MW-2
Rosner Statistic R = |205 - 33.9851|/50.9319 = 3.35771
Lambda(80, 7, 0.05) = 3.278
Measurement 7/12/2016 for location MW-2 is an outlier

Iteration i = 5
Mean of 75 measurements = 36.3853
Std Dev = 54.6907
x(i+1) = 214 from measurement 4/5/2016 from location MW-6
Rosner Statistic R = |214 - 36.3853|/54.6907 = 3.24762
Lambda(80, 6, 0.05) = 3.284
Measurement 4/5/2016 for location MW-6 is an outlier

Iteration i = 4
Mean of 76 measurements = 38.9066
Std Dev = 58.6029
x(i+1) = 228 from measurement 1/6/2016 from location MW-2
Rosner Statistic R = |228 - 38.9066|/58.6029 = 3.22669
Lambda(80, 5, 0.05) = 3.29
Measurement 1/6/2016 for location MW-2 is an outlier

Iteration i = 3
Mean of 77 measurements = 41.3883
Std Dev = 62.1559
x(i+1) = 230 from measurement 4/6/2016 from location MW-2
Rosner Statistic R = |230 - 41.3883|/62.1559 = 3.03449
Lambda(80, 4, 0.05) = 3.29
Measurement 4/6/2016 for location MW-2 is an outlier

Iteration i = 2
Mean of 78 measurements = 43.909
Std Dev = 65.6413
x(i+1) = 238 from measurement 11/19/2015 from location MW-2
Rosner Statistic R = |238 - 43.909|/65.6413 = 2.95684
Lambda(80, 3, 0.05) = 3.3
Measurement 11/19/2015 for location MW-2 is an outlier

Iteration i = 1
Mean of 79 measurements = 46.4797
Std Dev = 69.106
x(i+1) = 247 from measurement 2/17/2016 from location MW-2
Rosner Statistic R = |247 - 46.4797|/69.106 = 2.90163
Lambda(80, 2, 0.05) = 3.3
Measurement 2/17/2016 for location MW-2 is an outlier

Iteration i = 0
Mean of 80 measurements = 50.1237
Std Dev = 76.0098
x(i+1) = 338 from measurement 1/26/2017 from location MW-2
Rosner Statistic R = |338 - 50.1237|/76.0098 = 3.78736
Lambda(80, 1, 0.05) = 3.31
Measurement 1/26/2017 for location MW-2 is an outlier

Shapiro-Wilks Test of Normality

Parameter: Sulfate

All Locations

Normality Test of Parameter Concentrations

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

K = 4 for 9 measurements

i	x(i)	x(n-i+1)	x(n-1+1)-x(i)	a(n-i+1)	b(i)
1	15.1	23	7.9	0.5888	4.65152
2	17.5	20	2.5	0.3244	0.811
3	18.2	19.6	1.4	0.1976	0.27664
4	18.6	19.5	0.9	0.0947	0.08523
5	19.3	19.3	0		
6	19.5	18.6	-0.9		
7	19.6	18.2	-1.4		
8	20	17.5	-2.5		
9	23	15.1	-7.9		

Sum of b values = 5.82439
Sample Standard Deviation = 2.12001
W Statistic = 0.943485

5% Critical value of 0.829 is less than 0.943485
Data is normally distributed at 95% level of significance

1% Critical value of 0.764 is less than 0.943485
Data is normally distributed at 99% level of significance

Parametric Prediction Interval Analysis

Inter-Well Comparison

Parameter: Sulfate

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

Inter-Well Unified Guid. Formula 95% One-Sided Comparison

Background Samples = 9
Background Mean = 18.9778
Background Std Dev = 2.12001

Number of comparisons = 7
Future Samples (k) = 7
Actual confidence level is 1.0 - (0.05/7) = 99.2857 %
t is Percentile of Student's T-Test (0.95/7) = 0.992857
Degrees of Freedom = 9 (background observations) - 1
t(0.992857, 9) = 3.1587

Well MW-1

Date	Samples	Mean	Interval	Significant
1/25/2017	1	7	[0, 26.0365]	FALSE

Well MW-2

Date	Samples	Mean	Interval	Significant
1/26/2017	**1**	**338**	**[0, 26.0365]**	**TRUE**

Well MW-3

Date	Samples	Mean	Interval	Significant
1/24/2017	**1**	**174**	**[0, 26.0365]**	**TRUE**

Well MW-4

Date	Samples	Mean	Interval	Significant
1/25/2017	1	10	[0, 26.0365]	FALSE

Well MW-5

Date	Samples	Mean	Interval	Significant
1/23/2017	1	3.7	[0, 26.0365]	FALSE

Well MW-6

Date	Samples	Mean	Interval	Significant
1/24/2017	**1**	**145**	**[0, 26.0365]**	**TRUE**

Well MW-8

Date	Samples	Mean	Interval	Significant
1/24/2017	1	6	[0, 26.0365]	FALSE

Sen's Slope Analysis

Parameter: Sulfate

Location: MW-2

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

90% Confidence Level

Xj	Xk	(Xj - Xk)/(j-k)	Q
199 (10/15/2015)	79 (8/12/2015)	(199 - 79)/(2 - 1)	120
238 (11/19/2015)	79 (8/12/2015)	(238 - 79)/(3 - 1)	79.5
228 (1/6/2016)	79 (8/12/2015)	(228 - 79)/(4 - 1)	49.6667
247 (2/17/2016)	79 (8/12/2015)	(247 - 79)/(5 - 1)	42
230 (4/6/2016)	79 (8/12/2015)	(230 - 79)/(6 - 1)	30.2
163 (5/27/2016)	79 (8/12/2015)	(163 - 79)/(7 - 1)	14
205 (7/12/2016)	79 (8/12/2015)	(205 - 79)/(8 - 1)	18
338 (1/26/2017)	79 (8/12/2015)	(338 - 79)/(9 - 1)	32.375
238 (11/19/2015)	199 (10/15/2015)	(238 - 199)/(3 - 2)	39
228 (1/6/2016)	199 (10/15/2015)	(228 - 199)/(4 - 2)	14.5
247 (2/17/2016)	199 (10/15/2015)	(247 - 199)/(5 - 2)	16
230 (4/6/2016)	199 (10/15/2015)	(230 - 199)/(6 - 2)	7.75
163 (5/27/2016)	199 (10/15/2015)	(163 - 199)/(7 - 2)	-7.2
205 (7/12/2016)	199 (10/15/2015)	(205 - 199)/(8 - 2)	1
338 (1/26/2017)	199 (10/15/2015)	(338 - 199)/(9 - 2)	19.8571
228 (1/6/2016)	238 (11/19/2015)	(228 - 238)/(4 - 3)	-10
247 (2/17/2016)	238 (11/19/2015)	(247 - 238)/(5 - 3)	4.5
230 (4/6/2016)	238 (11/19/2015)	(230 - 238)/(6 - 3)	-2.66667
163 (5/27/2016)	238 (11/19/2015)	(163 - 238)/(7 - 3)	-18.75
205 (7/12/2016)	238 (11/19/2015)	(205 - 238)/(8 - 3)	-6.6
338 (1/26/2017)	238 (11/19/2015)	(338 - 238)/(9 - 3)	16.6667
247 (2/17/2016)	228 (1/6/2016)	(247 - 228)/(5 - 4)	19
230 (4/6/2016)	228 (1/6/2016)	(230 - 228)/(6 - 4)	1
163 (5/27/2016)	228 (1/6/2016)	(163 - 228)/(7 - 4)	-21.6667
205 (7/12/2016)	228 (1/6/2016)	(205 - 228)/(8 - 4)	-5.75
338 (1/26/2017)	228 (1/6/2016)	(338 - 228)/(9 - 4)	22
230 (4/6/2016)	247 (2/17/2016)	(230 - 247)/(6 - 5)	-17
163 (5/27/2016)	247 (2/17/2016)	(163 - 247)/(7 - 5)	-42
205 (7/12/2016)	247 (2/17/2016)	(205 - 247)/(8 - 5)	-14
338 (1/26/2017)	247 (2/17/2016)	(338 - 247)/(9 - 5)	22.75
163 (5/27/2016)	230 (4/6/2016)	(163 - 230)/(7 - 6)	-67
205 (7/12/2016)	230 (4/6/2016)	(205 - 230)/(8 - 6)	-12.5
338 (1/26/2017)	230 (4/6/2016)	(338 - 230)/(9 - 6)	36
205 (7/12/2016)	163 (5/27/2016)	(205 - 163)/(8 - 7)	42
338 (1/26/2017)	163 (5/27/2016)	(338 - 163)/(9 - 7)	87.5
338 (1/26/2017)	205 (7/12/2016)	(338 - 205)/(9 - 8)	133

Number of Q values = 36

Ordered Q Values

n	Q
1	-67
2	-42
3	-21.6667
4	-18.75
5	-17
6	-14
7	-12.5
8	-10
9	-7.2
10	-6.6
11	-5.75
12	-2.66667
13	1
14	1
15	4.5
16	7.75
17	14
18	14.5
19	16
20	16.6667
21	18
22	19
23	19.8571
24	22
25	22.75
26	30.2
27	32.375
28	36
29	39
30	42
31	42
32	49.6667
33	79.5
34	87.5
35	120
36	133

Sen's Estimator (Median Q) is 15.25

Time Period	Observations
8/12/2015	1
10/15/2015	1
11/19/2015	1
1/6/2016	1
2/17/2016	1
4/6/2016	1
5/27/2016	1
7/12/2016	1
1/26/2017	1

There are 0 time periods with multiple data

A = 0
B = 0
C = 0
D = 0
E = 0
F = 0

a = 1656
b = 4536
c = 144
Group Variance = 92
For 90% confidence interval (two-tailed), Z at (1-0.9)/2 = 1.64485
C = 15.7769
M1 = (36 - 15.7769)/2.0 = 10.1116
M2 = (36 + 15.7769)/2.0 + 1 = 26.8884
Lower limit is -6.6 = Q(10)
Upper limit is 32.375 = Q(27)
-6.6 < 0 < 32.375 indicating no trend in data.

Sen's Slope Analysis

Parameter: Sulfate

Location: MW-3

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

90% Confidence Level

Xj	Xk	(Xj - Xk)/(j-k)	Q
14 (10/15/2015)	24 J (8/12/2015)	(14 - 24)/(2 - 1)	-10
12.3 (11/19/2015)	24 J (8/12/2015)	(12.3 - 24)/(3 - 1)	-5.85
10 (1/5/2016)	24 J (8/12/2015)	(10 - 24)/(4 - 1)	-4.66667
9.1 (2/16/2016)	24 J (8/12/2015)	(9.1 - 24)/(5 - 1)	-3.725
12.9 (4/7/2016)	24 J (8/12/2015)	(12.9 - 24)/(6 - 1)	-2.22
16.8 (5/27/2016)	24 J (8/12/2015)	(16.8 - 24)/(7 - 1)	-1.2
125 (7/11/2016)	24 J (8/12/2015)	(125 - 24)/(8 - 1)	14.4286
174 (1/24/2017)	24 J (8/12/2015)	(174 - 24)/(9 - 1)	18.75
12.3 (11/19/2015)	14 (10/15/2015)	(12.3 - 14)/(3 - 2)	-1.7
10 (1/5/2016)	14 (10/15/2015)	(10 - 14)/(4 - 2)	-2
9.1 (2/16/2016)	14 (10/15/2015)	(9.1 - 14)/(5 - 2)	-1.63333
12.9 (4/7/2016)	14 (10/15/2015)	(12.9 - 14)/(6 - 2)	-0.275
16.8 (5/27/2016)	14 (10/15/2015)	(16.8 - 14)/(7 - 2)	0.56
125 (7/11/2016)	14 (10/15/2015)	(125 - 14)/(8 - 2)	18.5
174 (1/24/2017)	14 (10/15/2015)	(174 - 14)/(9 - 2)	22.8571
10 (1/5/2016)	12.3 (11/19/2015)	(10 - 12.3)/(4 - 3)	-2.3
9.1 (2/16/2016)	12.3 (11/19/2015)	(9.1 - 12.3)/(5 - 3)	-1.6
12.9 (4/7/2016)	12.3 (11/19/2015)	(12.9 - 12.3)/(6 - 3)	0.2
16.8 (5/27/2016)	12.3 (11/19/2015)	(16.8 - 12.3)/(7 - 3)	1.125
125 (7/11/2016)	12.3 (11/19/2015)	(125 - 12.3)/(8 - 3)	22.54
174 (1/24/2017)	12.3 (11/19/2015)	(174 - 12.3)/(9 - 3)	26.95
9.1 (2/16/2016)	10 (1/5/2016)	(9.1 - 10)/(5 - 4)	-0.9
12.9 (4/7/2016)	10 (1/5/2016)	(12.9 - 10)/(6 - 4)	1.45
16.8 (5/27/2016)	10 (1/5/2016)	(16.8 - 10)/(7 - 4)	2.26667
125 (7/11/2016)	10 (1/5/2016)	(125 - 10)/(8 - 4)	28.75
174 (1/24/2017)	10 (1/5/2016)	(174 - 10)/(9 - 4)	32.8
12.9 (4/7/2016)	9.1 (2/16/2016)	(12.9 - 9.1)/(6 - 5)	3.8
16.8 (5/27/2016)	9.1 (2/16/2016)	(16.8 - 9.1)/(7 - 5)	3.85

125 (7/11/2016)	9.1 (2/16/2016)	(125 - 9.1)/(8 - 5)	38.6333
174 (1/24/2017)	9.1 (2/16/2016)	(174 - 9.1)/(9 - 5)	41.225
16.8 (5/27/2016)	12.9 (4/7/2016)	(16.8 - 12.9)/(7 - 6)	3.9
125 (7/11/2016)	12.9 (4/7/2016)	(125 - 12.9)/(8 - 6)	56.05
174 (1/24/2017)	12.9 (4/7/2016)	(174 - 12.9)/(9 - 6)	53.7
125 (7/11/2016)	16.8 (5/27/2016)	(125 - 16.8)/(8 - 7)	108.2
174 (1/24/2017)	16.8 (5/27/2016)	(174 - 16.8)/(9 - 7)	78.6
174 (1/24/2017)	125 (7/11/2016)	(174 - 125)/(9 - 8)	49

Number of Q values = 36

Ordered Q Values

n	Q
1	-10
2	-5.85
3	-4.66667
4	-3.725
5	-2.3
6	-2.22
7	-2
8	-1.7
9	-1.63333
10	-1.6
11	-1.2
12	-0.9
13	-0.275
14	0.2
15	0.56
16	1.125
17	1.45
18	2.26667
19	3.8
20	3.85
21	3.9
22	14.4286
23	18.5
24	18.75

25	22.54
26	22.8571
27	26.95
28	28.75
29	32.8
30	38.6333
31	41.225
32	49
33	53.7
34	56.05
35	78.6
36	108.2

Sen's Estimator (Median Q) is 3.03333

Time Period	Observations
8/12/2015	1
10/15/2015	1
11/19/2015	1
1/5/2016	1
2/16/2016	1
4/7/2016	1
5/27/2016	1
7/11/2016	1
1/24/2017	1

There are 0 time periods with multiple data

A = 0
B = 0
C = 0
D = 0
E = 0
F = 0
a = 1656
b = 4536
c = 144
Group Variance = 92
For 90% confidence interval (two-tailed), Z at (1-0.9)/2 = 1.64485
C = 15.7769
M1 = (36 - 15.7769)/2.0 = 10.1116
M2 = (36 + 15.7769)/2.0 + 1 = 26.8884
Lower limit is -1.6 = Q(10)

Upper limit is 26.95 = Q(27)
-1.6 < 0 < 26.95 indicating no trend in data.

Sen's Slope Analysis

Parameter: Sulfate

Location: MW-6

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

90% Confidence Level

Xj	Xk	(Xj - Xk)/(j-k)	Q
66.1 (10/19/2015)	48 (8/12/2015)	(66.1 - 48)/(2 - 1)	18.1
137 (11/20/2015)	48 (8/12/2015)	(137 - 48)/(3 - 1)	44.5
194 (1/5/2016)	48 (8/12/2015)	(194 - 48)/(4 - 1)	48.6667
87.7 (2/17/2016)	48 (8/12/2015)	(87.7 - 48)/(5 - 1)	9.925
214 (4/5/2016)	48 (8/12/2015)	(214 - 48)/(6 - 1)	33.2
51.6 (5/26/2016)	48 (8/12/2015)	(51.6 - 48)/(7 - 1)	0.6
53.8 (7/11/2016)	48 (8/12/2015)	(53.8 - 48)/(8 - 1)	0.828571
145 (1/24/2017)	48 (8/12/2015)	(145 - 48)/(9 - 1)	12.125
137 (11/20/2015)	66.1 (10/19/2015)	(137 - 66.1)/(3 - 2)	70.9
194 (1/5/2016)	66.1 (10/19/2015)	(194 - 66.1)/(4 - 2)	63.95
87.7 (2/17/2016)	66.1 (10/19/2015)	(87.7 - 66.1)/(5 - 2)	7.2
214 (4/5/2016)	66.1 (10/19/2015)	(214 - 66.1)/(6 - 2)	36.975
51.6 (5/26/2016)	66.1 (10/19/2015)	(51.6 - 66.1)/(7 - 2)	-2.9
53.8 (7/11/2016)	66.1 (10/19/2015)	(53.8 - 66.1)/(8 - 2)	-2.05
145 (1/24/2017)	66.1 (10/19/2015)	(145 - 66.1)/(9 - 2)	11.2714
194 (1/5/2016)	137 (11/20/2015)	(194 - 137)/(4 - 3)	57
87.7 (2/17/2016)	137 (11/20/2015)	(87.7 - 137)/(5 - 3)	-24.65
214 (4/5/2016)	137 (11/20/2015)	(214 - 137)/(6 - 3)	25.6667
51.6 (5/26/2016)	137 (11/20/2015)	(51.6 - 137)/(7 - 3)	-21.35
53.8 (7/11/2016)	137 (11/20/2015)	(53.8 - 137)/(8 - 3)	-16.64
145 (1/24/2017)	137 (11/20/2015)	(145 - 137)/(9 - 3)	1.33333
87.7 (2/17/2016)	194 (1/5/2016)	(87.7 - 194)/(5 - 4)	-106.3
214 (4/5/2016)	194 (1/5/2016)	(214 - 194)/(6 - 4)	10
51.6 (5/26/2016)	194 (1/5/2016)	(51.6 - 194)/(7 - 4)	-47.4667
53.8 (7/11/2016)	194 (1/5/2016)	(53.8 - 194)/(8 - 4)	-35.05
145 (1/24/2017)	194 (1/5/2016)	(145 - 194)/(9 - 4)	-9.8
214 (4/5/2016)	87.7 (2/17/2016)	(214 - 87.7)/(6 - 5)	126.3
51.6 (5/26/2016)	87.7 (2/17/2016)	(51.6 - 87.7)/(7 - 5)	-18.05
53.8 (7/11/2016)	87.7 (2/17/2016)	(53.8 - 87.7)/(8 - 5)	-11.3
145 (1/24/2017)	87.7 (2/17/2016)	(145 - 87.7)/(9 - 5)	14.325
51.6 (5/26/2016)	214 (4/5/2016)	(51.6 - 214)/(7 - 6)	-162.4
53.8 (7/11/2016)	214 (4/5/2016)	(53.8 - 214)/(8 - 6)	-80.1
145 (1/24/2017)	214 (4/5/2016)	(145 - 214)/(9 - 6)	-23
53.8 (7/11/2016)	51.6 (5/26/2016)	(53.8 - 51.6)/(8 - 7)	2.2
145 (1/24/2017)	51.6 (5/26/2016)	(145 - 51.6)/(9 - 7)	46.7
145 (1/24/2017)	53.8 (7/11/2016)	(145 - 53.8)/(9 - 8)	91.2

Number of Q values = 36

Ordered Q Values

n	Q
1	-162.4
2	-106.3
3	-80.1
4	-47.4667
5	-35.05
6	-24.65
7	-23
8	-21.35
9	-18.05
10	-16.64
11	-11.3
12	-9.8
13	-2.9
14	-2.05
15	0.6
16	0.828571
17	1.33333
18	2.2
19	7.2
20	9.925
21	10
22	11.2714
23	12.125
24	14.325
25	18.1
26	25.6667
27	33.2
28	36.975
29	44.5
30	46.7
31	48.6667
32	57
33	63.95
34	70.9
35	91.2
36	126.3

Sen's Estimator (Median Q) is 4.7

Time Period	Observations
8/12/2015	1
10/19/2015	1
11/20/2015	1
1/5/2016	1
2/17/2016	1
4/5/2016	1
5/26/2016	1
7/11/2016	1
1/24/2017	1

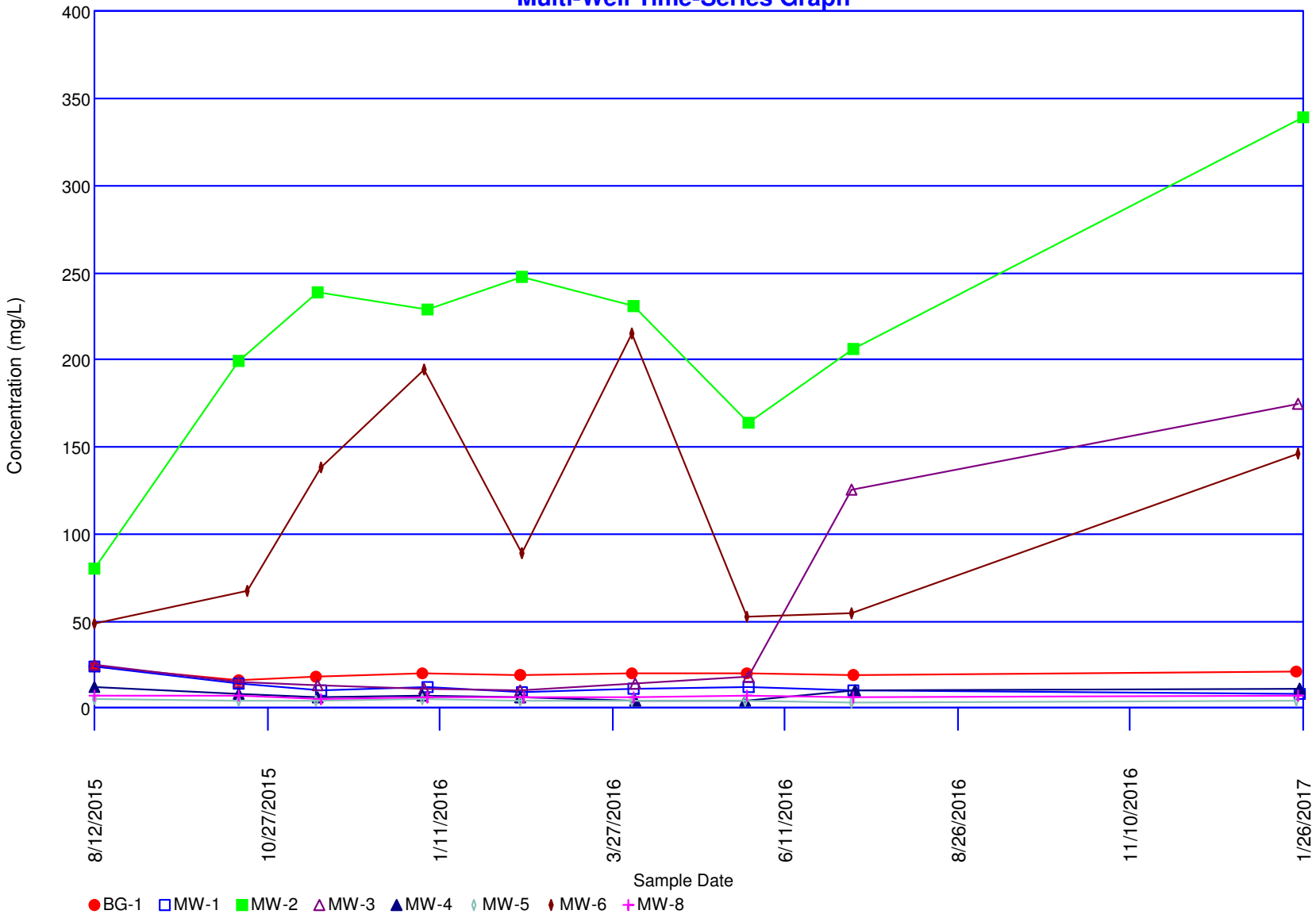
There are 0 time periods with multiple data

A = 0
B = 0
C = 0
D = 0
E = 0
F = 0

a = 1656
b = 4536
c = 144
Group Variance = 92
For 90% confidence interval (two-tailed), Z at (1-0.9)/2 = 1.64485
C = 15.7769
M1 = (36 - 15.7769)/2.0 = 10.1116
M2 = (36 + 15.7769)/2.0 + 1 = 26.8884
Lower limit is -16.64 = Q(10)
Upper limit is 33.2 = Q(27)
-16.64 < 0 < 33.2 indicating no trend in data.

Sulfate

Multi-Well Time-Series Graph



Concentrations (mg/L)

Parameter: Total Dissolved Solids

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

Total Measurements: 80
Total Non-Detect: 0
Percent Non-Detects: 0%
Total Background Measurements: 9
There is 1 background location

Loc.	Meas.	ND	Date	Conc.	Original
BG-1	9	0 (0%)	8/12/2015	690 B	690 B
			10/15/2015	654	654
			11/18/2015	652	652
			1/4/2016	643	643
			2/16/2016	650	650
			4/5/2016	628	628
			5/26/2016	633	633
			7/12/2016	668	668
			1/23/2017	623	623

There are 8 compliance locations

Loc.	Meas.	ND	Date	Conc.	Original
MW-1	9	0 (0%)	8/12/2015	1500	1500
			10/15/2015	370	370
			11/20/2015	569	569
			1/6/2016	700	700
			2/17/2016	593	593
			4/6/2016	770	770
			5/27/2016	920	920
			7/12/2016	1410	1410
			1/25/2017	931	931
MW-2	9	0 (0%)	8/12/2015	1700	1700
			10/15/2015	2120	2120
			11/19/2015	257	257
			1/6/2016	2480	2480
			2/17/2016	2470	2470
			4/6/2016	2700	2700
			5/27/2016	2870	2870
			7/12/2016	3290	3290
			1/26/2017	2780	2780
MW-3	9	0 (0%)	8/12/2015	2100	2100
			10/15/2015	2770	2770
			11/19/2015	256	256
			1/5/2016	2490	2490
			2/16/2016	2270	2270
			4/7/2016	2530	2530
			5/27/2016	3180	3180
			7/11/2016	2440	2440
			1/24/2017	303	303
MW-4	9	0 (0%)	8/12/2015	820	820

			10/15/2015	1110	1110
			11/19/2015	395	395
			1/4/2016	806	806
			2/16/2016	800	800
			4/7/2016	513	513
			5/25/2016	486	486
			7/13/2016	1040	1040
			1/25/2017	1150	1150
MW-5	9	0 (0%)	8/12/2015	230	230
			10/15/2015	296	296
			11/18/2015	235	235
			1/4/2016	259	259
			2/16/2016	263	263
			4/5/2016	194	194
			5/25/2016	229	229
			7/11/2016	221	221
			1/23/2017	220	220
MW-6	9	0 (0%)	8/12/2015	680 B	680 B
			10/19/2015	620	620
			11/20/2015	429	429
			1/5/2016	946	946
			2/17/2016	783	783
			4/5/2016	689	689
			5/26/2016	659	659
			7/11/2016	660	660
			1/24/2017	776	776
MW-7	8	0 (0%)	8/12/2015	1100 B	1100 B
			10/16/2015	890	890
			11/20/2015	129	129
			1/5/2016	1120	1120
			2/18/2016	950	950
			4/6/2016	982	982
			5/26/2016	956	956
			7/11/2016	1100	1100
MW-8	9	0 (0%)	8/12/2015	1300 B	1300 B
			10/15/2015	1560	1560
			11/20/2015	224	224
			1/6/2016	1410	1410
			2/18/2016	1050	1050
			4/6/2016	1130	1130
			5/26/2016	1530	1530
			7/12/2016	1340	1340
			1/24/2017	1270	1270

There are 0 unused locations

Loc.	Meas.	ND	Date	Conc.	Original

Rosner's Test for Outliers

Parameter: Total Dissolved Solids

All Locations

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

Data set mean = 1077

10 most extreme of 80 measurements

by order of magnitude difference from the mean

1	7/12/2016	MW-2	3290	2213
2	5/27/2016	MW-3	3180	2103
3	5/27/2016	MW-2	2870	1793
4	1/26/2017	MW-2	2780	1703
5	10/15/2015	MW-3	2770	1693
6	4/6/2016	MW-2	2700	1623
7	4/7/2016	MW-3	2530	1453
8	1/5/2016	MW-3	2490	1413
9	1/6/2016	MW-2	2480	1403
10	2/17/2016	MW-2	2470	1393

Iteration i = 9

Mean of 71 measurements = 860.141
Std Dev = 549.679
x(i+1) = 2470 from measurement 2/17/2016 from location MW-2
Rosner Statistic R = |2470 - 860.141|/549.679 = 2.92873
Lambda(80, 10, 0.05) = 3.26
2.92873 < 3.26 -- No outliers detected for i = 9

Iteration i = 8

Mean of 72 measurements = 882.639
Std Dev = 578.217
x(i+1) = 2480 from measurement 1/6/2016 from location MW-2
Rosner Statistic R = |2480 - 882.639|/578.217 = 2.76256
Lambda(80, 9, 0.05) = 3.266
2.76256 < 3.266 -- No outliers detected for i = 8

Iteration i = 7

Mean of 73 measurements = 904.658
Std Dev = 604.221
x(i+1) = 2490 from measurement 1/5/2016 from location MW-3
Rosner Statistic R = |2490 - 904.658|/604.221 = 2.62378
Lambda(80, 8, 0.05) = 3.272
2.62378 < 3.272 -- No outliers detected for i = 7

Iteration i = 6

Mean of 74 measurements = 926.622
Std Dev = 629.112
x(i+1) = 2530 from measurement 4/7/2016 from location MW-3
Rosner Statistic R = |2530 - 926.622|/629.112 = 2.54864
Lambda(80, 7, 0.05) = 3.278
2.54864 < 3.278 -- No outliers detected for i = 6

Iteration i = 5
Mean of 75 measurements = 950.267
Std Dev = 657.544
x(i+1) = 2700 from measurement 4/6/2016 from location MW-2
Rosner Statistic R = |2700 - 950.267|/657.544 = 2.66101
Lambda(80, 6, 0.05) = 3.284
2.66101 < 3.284 -- No outliers detected for i = 5

Iteration i = 4
Mean of 76 measurements = 974.211
Std Dev = 685.69
x(i+1) = 2770 from measurement 10/15/2015 from location MW-3
Rosner Statistic R = |2770 - 974.211|/685.69 = 2.61895
Lambda(80, 5, 0.05) = 3.29
2.61895 < 3.29 -- No outliers detected for i = 4

Iteration i = 3
Mean of 77 measurements = 997.662
Std Dev = 711.571
x(i+1) = 2780 from measurement 1/26/2017 from location MW-2
Rosner Statistic R = |2780 - 997.662|/711.571 = 2.50479
Lambda(80, 4, 0.05) = 3.29
2.50479 < 3.29 -- No outliers detected for i = 3

Iteration i = 2
Mean of 78 measurements = 1021.67
Std Dev = 738.04
x(i+1) = 2870 from measurement 5/27/2016 from location MW-2
Rosner Statistic R = |2870 - 1021.67|/738.04 = 2.50438
Lambda(80, 3, 0.05) = 3.3
2.50438 < 3.3 -- No outliers detected for i = 2

Iteration i = 1
Mean of 79 measurements = 1048.99
Std Dev = 772.455
x(i+1) = 3180 from measurement 5/27/2016 from location MW-3
Rosner Statistic R = |3180 - 1048.99|/772.455 = 2.75875
Lambda(80, 2, 0.05) = 3.3
2.75875 < 3.3 -- No outliers detected for i = 1

Iteration i = 0
Mean of 80 measurements = 1077
Std Dev = 807.409
x(i+1) = 3290 from measurement 7/12/2016 from location MW-2
Rosner Statistic R = |3290 - 1077|/807.409 = 2.74087
Lambda(80, 1, 0.05) = 3.31
2.74087 < 3.31 -- No outliers detected for i = 0

Shapiro-Wilks Test of Normality

Parameter: Total Dissolved Solids

All Locations

Normality Test of Parameter Concentrations

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

K = 4 for 9 measurements

i	x(i)	x(n-i+1)	x(n-1+1)-x(i)	a(n-i+1)	b(i)
1	623	690	67	0.5888	39.4496
2	628	668	40	0.3244	12.976
3	633	654	21	0.1976	4.1496
4	643	652	9	0.0947	0.8523
5	650	650	0		
6	652	643	-9		
7	654	633	-21		
8	668	628	-40		
9	690	623	-67		

Sum of b values = 57.4275
Sample Standard Deviation = 20.8746
W Statistic = 0.946046

5% Critical value of 0.829 is less than 0.946046
Data is normally distributed at 95% level of significance

1% Critical value of 0.764 is less than 0.946046
Data is normally distributed at 99% level of significance

Parametric Prediction Interval Analysis

Inter-Well Comparison

Parameter: Total Dissolved Solids

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

Inter-Well Unified Guid. Formula 95% One-Sided Comparison

Background Samples = 9
Background Mean = 649
Background Std Dev = 20.8746

Number of comparisons = 7
Future Samples (k) = 7
Actual confidence level is 1.0 - (0.05/7) = 99.2857 %
t is Percentile of Student's T-Test (0.95/7) = 0.992857
Degrees of Freedom = 9 (background observations) - 1
t(0.992857, 9) = 3.1587

Well MW-1

Date	Samples	Mean	Interval	Significant
1/25/2017	1	931	[0, 718.503]	TRUE

Well MW-2

Date	Samples	Mean	Interval	Significant
1/26/2017	1	2780	[0, 718.503]	TRUE

Well MW-3

Date	Samples	Mean	Interval	Significant
1/24/2017	1	303	[0, 718.503]	FALSE

Well MW-4

Date	Samples	Mean	Interval	Significant
1/25/2017	1	1150	[0, 718.503]	TRUE

Well MW-5

Date	Samples	Mean	Interval	Significant
1/23/2017	1	220	[0, 718.503]	FALSE

Well MW-6

Date	Samples	Mean	Interval	Significant
1/24/2017	1	776	[0, 718.503]	TRUE

Well MW-8

Date	Samples	Mean	Interval	Significant
1/24/2017	1	1270	[0, 718.503]	TRUE

Sen's Slope Analysis

Parameter: Total Dissolved Solids

Location: MW-1

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

90% Confidence Level

Xj	Xk	(Xj - Xk)/(j-k)	Q
370 (10/15/2015)	1500 (8/12/2015)	(370 - 1500)/(2 - 1)	-1130
569 (11/20/2015)	1500 (8/12/2015)	(569 - 1500)/(3 - 1)	-465.5
700 (1/6/2016)	1500 (8/12/2015)	(700 - 1500)/(4 - 1)	-266.667
593 (2/17/2016)	1500 (8/12/2015)	(593 - 1500)/(5 - 1)	-226.75
770 (4/6/2016)	1500 (8/12/2015)	(770 - 1500)/(6 - 1)	-146
920 (5/27/2016)	1500 (8/12/2015)	(920 - 1500)/(7 - 1)	-96.6667
1410 (7/12/2016)	1500 (8/12/2015)	(1410 - 1500)/(8 - 1)	-12.8571
931 (1/25/2017)	1500 (8/12/2015)	(931 - 1500)/(9 - 1)	-71.125
569 (11/20/2015)	370 (10/15/2015)	(569 - 370)/(3 - 2)	199
700 (1/6/2016)	370 (10/15/2015)	(700 - 370)/(4 - 2)	165
593 (2/17/2016)	370 (10/15/2015)	(593 - 370)/(5 - 2)	74.3333
770 (4/6/2016)	370 (10/15/2015)	(770 - 370)/(6 - 2)	100
920 (5/27/2016)	370 (10/15/2015)	(920 - 370)/(7 - 2)	110
1410 (7/12/2016)	370 (10/15/2015)	(1410 - 370)/(8 - 2)	173.333
931 (1/25/2017)	370 (10/15/2015)	(931 - 370)/(9 - 2)	80.1429
700 (1/6/2016)	569 (11/20/2015)	(700 - 569)/(4 - 3)	131
593 (2/17/2016)	569 (11/20/2015)	(593 - 569)/(5 - 3)	12
770 (4/6/2016)	569 (11/20/2015)	(770 - 569)/(6 - 3)	67
920 (5/27/2016)	569 (11/20/2015)	(920 - 569)/(7 - 3)	87.75
1410 (7/12/2016)	569 (11/20/2015)	(1410 - 569)/(8 - 3)	168.2
931 (1/25/2017)	569 (11/20/2015)	(931 - 569)/(9 - 3)	60.3333
593 (2/17/2016)	700 (1/6/2016)	(593 - 700)/(5 - 4)	-107
770 (4/6/2016)	700 (1/6/2016)	(770 - 700)/(6 - 4)	35
920 (5/27/2016)	700 (1/6/2016)	(920 - 700)/(7 - 4)	73.3333
1410 (7/12/2016)	700 (1/6/2016)	(1410 - 700)/(8 - 4)	177.5
931 (1/25/2017)	700 (1/6/2016)	(931 - 700)/(9 - 4)	46.2
770 (4/6/2016)	593 (2/17/2016)	(770 - 593)/(6 - 5)	177
920 (5/27/2016)	593 (2/17/2016)	(920 - 593)/(7 - 5)	163.5
1410 (7/12/2016)	593 (2/17/2016)	(1410 - 593)/(8 - 5)	272.333
931 (1/25/2017)	593 (2/17/2016)	(931 - 593)/(9 - 5)	84.5
920 (5/27/2016)	770 (4/6/2016)	(920 - 770)/(7 - 6)	150
1410 (7/12/2016)	770 (4/6/2016)	(1410 - 770)/(8 - 6)	320
931 (1/25/2017)	770 (4/6/2016)	(931 - 770)/(9 - 6)	53.6667
1410 (7/12/2016)	920 (5/27/2016)	(1410 - 920)/(8 - 7)	490
931 (1/25/2017)	920 (5/27/2016)	(931 - 920)/(9 - 7)	5.5
931 (1/25/2017)	1410 (7/12/2016)	(931 - 1410)/(9 - 8)	-479

Number of Q values = 36

Ordered Q Values

n	Q
1	-1130
2	-479
3	-465.5
4	-266.667
5	-226.75
6	-146
7	-107
8	-96.6667
9	-71.125
10	-12.8571
11	5.5
12	12
13	35
14	46.2
15	53.6667
16	60.3333
17	67
18	73.3333
19	74.3333
20	80.1429
21	84.5
22	87.75
23	100
24	110
25	131
26	150
27	163.5
28	165
29	168.2
30	173.333
31	177
32	177.5
33	199
34	272.333
35	320
36	490

Sen's Estimator (Median Q) is 73.8333

Time Period	Observations
8/12/2015	1
10/15/2015	1
11/20/2015	1
1/6/2016	1
2/17/2016	1
4/6/2016	1
5/27/2016	1
7/12/2016	1
1/25/2017	1

There are 0 time periods with multiple data

A = 0
B = 0
C = 0
D = 0
E = 0
F = 0

a = 1656
b = 4536
c = 144
Group Variance = 92
For 90% confidence interval (two-tailed), Z at (1-0.9)/2 = 1.64485
C = 15.7769
M1 = (36 - 15.7769)/2.0 = 10.1116
M2 = (36 + 15.7769)/2.0 + 1 = 26.8884
Lower limit is -12.8571 = Q(10)
Upper limit is 163.5 = Q(27)
-12.8571 < 0 < 163.5 indicating no trend in data.

Sen's Slope Analysis

Parameter: Total Dissolved Solids

Location: MW-2

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

90% Confidence Level

Xj	Xk	(Xj - Xk)/(j-k)	Q
2120 (10/15/2015)	1700 (8/12/2015)	(2120 - 1700)/(2 - 1)	420
257 (11/19/2015)	1700 (8/12/2015)	(257 - 1700)/(3 - 1)	-721.5
2480 (1/6/2016)	1700 (8/12/2015)	(2480 - 1700)/(4 - 1)	260
2470 (2/17/2016)	1700 (8/12/2015)	(2470 - 1700)/(5 - 1)	192.5
2700 (4/6/2016)	1700 (8/12/2015)	(2700 - 1700)/(6 - 1)	200
2870 (5/27/2016)	1700 (8/12/2015)	(2870 - 1700)/(7 - 1)	195
3290 (7/12/2016)	1700 (8/12/2015)	(3290 - 1700)/(8 - 1)	227.143
2780 (1/26/2017)	1700 (8/12/2015)	(2780 - 1700)/(9 - 1)	135
257 (11/19/2015)	2120 (10/15/2015)	(257 - 2120)/(3 - 2)	-1863
2480 (1/6/2016)	2120 (10/15/2015)	(2480 - 2120)/(4 - 2)	180
2470 (2/17/2016)	2120 (10/15/2015)	(2470 - 2120)/(5 - 2)	116.667
2700 (4/6/2016)	2120 (10/15/2015)	(2700 - 2120)/(6 - 2)	145
2870 (5/27/2016)	2120 (10/15/2015)	(2870 - 2120)/(7 - 2)	150
3290 (7/12/2016)	2120 (10/15/2015)	(3290 - 2120)/(8 - 2)	195
2780 (1/26/2017)	2120 (10/15/2015)	(2780 - 2120)/(9 - 2)	94.2857
2480 (1/6/2016)	257 (11/19/2015)	(2480 - 257)/(4 - 3)	2223
2470 (2/17/2016)	257 (11/19/2015)	(2470 - 257)/(5 - 3)	1106.5
2700 (4/6/2016)	257 (11/19/2015)	(2700 - 257)/(6 - 3)	814.333
2870 (5/27/2016)	257 (11/19/2015)	(2870 - 257)/(7 - 3)	653.25
3290 (7/12/2016)	257 (11/19/2015)	(3290 - 257)/(8 - 3)	606.6
2780 (1/26/2017)	257 (11/19/2015)	(2780 - 257)/(9 - 3)	420.5
2470 (2/17/2016)	2480 (1/6/2016)	(2470 - 2480)/(5 - 4)	-10
2700 (4/6/2016)	2480 (1/6/2016)	(2700 - 2480)/(6 - 4)	110
2870 (5/27/2016)	2480 (1/6/2016)	(2870 - 2480)/(7 - 4)	130
3290 (7/12/2016)	2480 (1/6/2016)	(3290 - 2480)/(8 - 4)	202.5
2780 (1/26/2017)	2480 (1/6/2016)	(2780 - 2480)/(9 - 4)	60
2700 (4/6/2016)	2470 (2/17/2016)	(2700 - 2470)/(6 - 5)	230
2870 (5/27/2016)	2470 (2/17/2016)	(2870 - 2470)/(7 - 5)	200
3290 (7/12/2016)	2470 (2/17/2016)	(3290 - 2470)/(8 - 5)	273.333
2780 (1/26/2017)	2470 (2/17/2016)	(2780 - 2470)/(9 - 5)	77.5
2870 (5/27/2016)	2700 (4/6/2016)	(2870 - 2700)/(7 - 6)	170
3290 (7/12/2016)	2700 (4/6/2016)	(3290 - 2700)/(8 - 6)	295
2780 (1/26/2017)	2700 (4/6/2016)	(2780 - 2700)/(9 - 6)	26.6667
3290 (7/12/2016)	2870 (5/27/2016)	(3290 - 2870)/(8 - 7)	420
2780 (1/26/2017)	2870 (5/27/2016)	(2780 - 2870)/(9 - 7)	-45
2780 (1/26/2017)	3290 (7/12/2016)	(2780 - 3290)/(9 - 8)	-510

Number of Q values = 36

Ordered Q Values

n	Q
1	-1863
2	-721.5
3	-510
4	-45
5	-10
6	26.6667
7	60
8	77.5
9	94.2857
10	110
11	116.667
12	130
13	135
14	145
15	150
16	170
17	180
18	192.5
19	195
20	195
21	200
22	200
23	202.5
24	227.143
25	230
26	260
27	273.333
28	295
29	420
30	420
31	420.5
32	606.6
33	653.25
34	814.333
35	1106.5
36	2223

Sen's Estimator (Median Q) is 193.75

Time Period	Observations
8/12/2015	1
10/15/2015	1
11/19/2015	1
1/6/2016	1
2/17/2016	1
4/6/2016	1
5/27/2016	1
7/12/2016	1
1/26/2017	1

There are 0 time periods with multiple data

A = 0
B = 0
C = 0
D = 0
E = 0
F = 0

a = 1656
b = 4536
c = 144
Group Variance = 92
For 90% confidence interval (two-tailed), Z at (1-0.9)/2 = 1.64485
C = 15.7769
M1 = (36 - 15.7769)/2.0 = 10.1116
M2 = (36 + 15.7769)/2.0 + 1 = 26.8884
Lower limit is 110 = Q(10)
Upper limit is 273.333 = Q(27)
110 > 0 indicating an upward trend in data.

Sen's Slope Analysis

Parameter: Total Dissolved Solids

Location: MW-4

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

90% Confidence Level

Xj	Xk	(Xj - Xk)/(j-k)	Q
1110 (10/15/2015)	820 (8/12/2015)	(1110 - 820)/(2 - 1)	290
395 (11/19/2015)	820 (8/12/2015)	(395 - 820)/(3 - 1)	-212.5
806 (1/4/2016)	820 (8/12/2015)	(806 - 820)/(4 - 1)	-4.66667
800 (2/16/2016)	820 (8/12/2015)	(800 - 820)/(5 - 1)	-5
513 (4/7/2016)	820 (8/12/2015)	(513 - 820)/(6 - 1)	-61.4
486 (5/25/2016)	820 (8/12/2015)	(486 - 820)/(7 - 1)	-55.6667
1040 (7/13/2016)	820 (8/12/2015)	(1040 - 820)/(8 - 1)	31.4286
1150 (1/25/2017)	820 (8/12/2015)	(1150 - 820)/(9 - 1)	41.25
395 (11/19/2015)	1110 (10/15/2015)	(395 - 1110)/(3 - 2)	-715
806 (1/4/2016)	1110 (10/15/2015)	(806 - 1110)/(4 - 2)	-152
800 (2/16/2016)	1110 (10/15/2015)	(800 - 1110)/(5 - 2)	-103.333
513 (4/7/2016)	1110 (10/15/2015)	(513 - 1110)/(6 - 2)	-149.25
486 (5/25/2016)	1110 (10/15/2015)	(486 - 1110)/(7 - 2)	-124.8
1040 (7/13/2016)	1110 (10/15/2015)	(1040 - 1110)/(8 - 2)	-11.6667
1150 (1/25/2017)	1110 (10/15/2015)	(1150 - 1110)/(9 - 2)	5.71429
806 (1/4/2016)	395 (11/19/2015)	(806 - 395)/(4 - 3)	411
800 (2/16/2016)	395 (11/19/2015)	(800 - 395)/(5 - 3)	202.5
513 (4/7/2016)	395 (11/19/2015)	(513 - 395)/(6 - 3)	39.3333
486 (5/25/2016)	395 (11/19/2015)	(486 - 395)/(7 - 3)	22.75
1040 (7/13/2016)	395 (11/19/2015)	(1040 - 395)/(8 - 3)	129
1150 (1/25/2017)	395 (11/19/2015)	(1150 - 395)/(9 - 3)	125.833
800 (2/16/2016)	806 (1/4/2016)	(800 - 806)/(5 - 4)	-6
513 (4/7/2016)	806 (1/4/2016)	(513 - 806)/(6 - 4)	-146.5
486 (5/25/2016)	806 (1/4/2016)	(486 - 806)/(7 - 4)	-106.667
1040 (7/13/2016)	806 (1/4/2016)	(1040 - 806)/(8 - 4)	58.5
1150 (1/25/2017)	806 (1/4/2016)	(1150 - 806)/(9 - 4)	68.8
513 (4/7/2016)	800 (2/16/2016)	(513 - 800)/(6 - 5)	-287
486 (5/25/2016)	800 (2/16/2016)	(486 - 800)/(7 - 5)	-157
1040 (7/13/2016)	800 (2/16/2016)	(1040 - 800)/(8 - 5)	80
1150 (1/25/2017)	800 (2/16/2016)	(1150 - 800)/(9 - 5)	87.5
486 (5/25/2016)	513 (4/7/2016)	(486 - 513)/(7 - 6)	-27
1040 (7/13/2016)	513 (4/7/2016)	(1040 - 513)/(8 - 6)	263.5
1150 (1/25/2017)	513 (4/7/2016)	(1150 - 513)/(9 - 6)	212.333
1040 (7/13/2016)	486 (5/25/2016)	(1040 - 486)/(8 - 7)	554
1150 (1/25/2017)	486 (5/25/2016)	(1150 - 486)/(9 - 7)	332
1150 (1/25/2017)	1040 (7/13/2016)	(1150 - 1040)/(9 - 8)	110

Number of Q values = 36

Ordered Q Values

n	Q
1	-715
2	-287
3	-212.5
4	-157
5	-152
6	-149.25
7	-146.5
8	-124.8
9	-106.667
10	-103.333
11	-61.4
12	-55.6667
13	-27
14	-11.6667
15	-6
16	-5
17	-4.66667
18	5.71429
19	22.75
20	31.4286
21	39.3333
22	41.25
23	58.5
24	68.8
25	80
26	87.5
27	110
28	125.833
29	129
30	202.5
31	212.333
32	263.5
33	290
34	332
35	411
36	554

Sen's Estimator (Median Q) is 14.2321

Time Period	Observations
8/12/2015	1
10/15/2015	1
11/19/2015	1
1/4/2016	1
2/16/2016	1
4/7/2016	1
5/25/2016	1
7/13/2016	1
1/25/2017	1

There are 0 time periods with multiple data

A = 0
B = 0
C = 0
D = 0
E = 0
F = 0

a = 1656
b = 4536
c = 144
Group Variance = 92
For 90% confidence interval (two-tailed), Z at (1-0.9)/2 = 1.64485
C = 15.7769
M1 = (36 - 15.7769)/2.0 = 10.1116
M2 = (36 + 15.7769)/2.0 + 1 = 26.8884
Lower limit is -103.333 = Q(10)
Upper limit is 110 = Q(27)
-103.333 < 0 < 110 indicating no trend in data.

Sen's Slope Analysis

Parameter: Total Dissolved Solids

Location: MW-6

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

90% Confidence Level

Xj	Xk	(Xj - Xk)/(j-k)	Q
620 (10/19/2015)	680 B (8/12/2015)	(620 - 680)/(2 - 1)	-60
429 (11/20/2015)	680 B (8/12/2015)	(429 - 680)/(3 - 1)	-125.5
946 (1/5/2016)	680 B (8/12/2015)	(946 - 680)/(4 - 1)	88.6667
783 (2/17/2016)	680 B (8/12/2015)	(783 - 680)/(5 - 1)	25.75
689 (4/5/2016)	680 B (8/12/2015)	(689 - 680)/(6 - 1)	1.8
659 (5/26/2016)	680 B (8/12/2015)	(659 - 680)/(7 - 1)	-3.5
660 (7/11/2016)	680 B (8/12/2015)	(660 - 680)/(8 - 1)	-2.85714
776 (1/24/2017)	680 B (8/12/2015)	(776 - 680)/(9 - 1)	12
429 (11/20/2015)	620 (10/19/2015)	(429 - 620)/(3 - 2)	-191
946 (1/5/2016)	620 (10/19/2015)	(946 - 620)/(4 - 2)	163
783 (2/17/2016)	620 (10/19/2015)	(783 - 620)/(5 - 2)	54.3333
689 (4/5/2016)	620 (10/19/2015)	(689 - 620)/(6 - 2)	17.25
659 (5/26/2016)	620 (10/19/2015)	(659 - 620)/(7 - 2)	7.8
660 (7/11/2016)	620 (10/19/2015)	(660 - 620)/(8 - 2)	6.66667
776 (1/24/2017)	620 (10/19/2015)	(776 - 620)/(9 - 2)	22.2857
946 (1/5/2016)	429 (11/20/2015)	(946 - 429)/(4 - 3)	517
783 (2/17/2016)	429 (11/20/2015)	(783 - 429)/(5 - 3)	177
689 (4/5/2016)	429 (11/20/2015)	(689 - 429)/(6 - 3)	86.6667
659 (5/26/2016)	429 (11/20/2015)	(659 - 429)/(7 - 3)	57.5
660 (7/11/2016)	429 (11/20/2015)	(660 - 429)/(8 - 3)	46.2
776 (1/24/2017)	429 (11/20/2015)	(776 - 429)/(9 - 3)	57.8333
783 (2/17/2016)	946 (1/5/2016)	(783 - 946)/(5 - 4)	-163
689 (4/5/2016)	946 (1/5/2016)	(689 - 946)/(6 - 4)	-128.5
659 (5/26/2016)	946 (1/5/2016)	(659 - 946)/(7 - 4)	-95.6667
660 (7/11/2016)	946 (1/5/2016)	(660 - 946)/(8 - 4)	-71.5
776 (1/24/2017)	946 (1/5/2016)	(776 - 946)/(9 - 4)	-34
689 (4/5/2016)	783 (2/17/2016)	(689 - 783)/(6 - 5)	-94
659 (5/26/2016)	783 (2/17/2016)	(659 - 783)/(7 - 5)	-62
660 (7/11/2016)	783 (2/17/2016)	(660 - 783)/(8 - 5)	-41
776 (1/24/2017)	783 (2/17/2016)	(776 - 783)/(9 - 5)	-1.75
659 (5/26/2016)	689 (4/5/2016)	(659 - 689)/(7 - 6)	-30
660 (7/11/2016)	689 (4/5/2016)	(660 - 689)/(8 - 6)	-14.5
776 (1/24/2017)	689 (4/5/2016)	(776 - 689)/(9 - 6)	29
660 (7/11/2016)	659 (5/26/2016)	(660 - 659)/(8 - 7)	1
776 (1/24/2017)	659 (5/26/2016)	(776 - 659)/(9 - 7)	58.5
776 (1/24/2017)	660 (7/11/2016)	(776 - 660)/(9 - 8)	116

Number of Q values = 36

Ordered Q Values

n	Q
1	-191
2	-163
3	-128.5
4	-125.5
5	-95.6667
6	-94
7	-71.5
8	-62
9	-60
10	-41
11	-34
12	-30
13	-14.5
14	-3.5
15	-2.85714
16	-1.75
17	1
18	1.8
19	6.66667
20	7.8
21	12
22	17.25
23	22.2857
24	25.75
25	29
26	46.2
27	54.3333
28	57.5
29	57.8333
30	58.5
31	86.6667
32	88.6667
33	116
34	163
35	177
36	517

Sen's Estimator (Median Q) is 4.23333

Time Period	Observations
8/12/2015	1
10/19/2015	1
11/20/2015	1
1/5/2016	1
2/17/2016	1
4/5/2016	1
5/26/2016	1
7/11/2016	1
1/24/2017	1

There are 0 time periods with multiple data

A = 0
B = 0
C = 0
D = 0
E = 0
F = 0

a = 1656
b = 4536
c = 144
Group Variance = 92
For 90% confidence interval (two-tailed), Z at (1-0.9)/2 = 1.64485
C = 15.7769
M1 = (36 - 15.7769)/2.0 = 10.1116
M2 = (36 + 15.7769)/2.0 + 1 = 26.8884
Lower limit is -41 = Q(10)
Upper limit is 54.3333 = Q(27)
-41 < 0 < 54.3333 indicating no trend in data.

Sen's Slope Analysis

Parameter: Total Dissolved Solids

Location: MW-8

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

90% Confidence Level

Xj	Xk	(Xj - Xk)/(j-k)	Q
1560 (10/15/2015)	1300 B (8/12/2015)	(1560 - 1300)/(2 - 1)	260
224 (11/20/2015)	1300 B (8/12/2015)	(224 - 1300)/(3 - 1)	-538
1410 (1/6/2016)	1300 B (8/12/2015)	(1410 - 1300)/(4 - 1)	36.6667
1050 (2/18/2016)	1300 B (8/12/2015)	(1050 - 1300)/(5 - 1)	-62.5
1130 (4/6/2016)	1300 B (8/12/2015)	(1130 - 1300)/(6 - 1)	-34
1530 (5/26/2016)	1300 B (8/12/2015)	(1530 - 1300)/(7 - 1)	38.3333
1340 (7/12/2016)	1300 B (8/12/2015)	(1340 - 1300)/(8 - 1)	5.71429
1270 (1/24/2017)	1300 B (8/12/2015)	(1270 - 1300)/(9 - 1)	-3.75
224 (11/20/2015)	1560 (10/15/2015)	(224 - 1560)/(3 - 2)	-1336
1410 (1/6/2016)	1560 (10/15/2015)	(1410 - 1560)/(4 - 2)	-75
1050 (2/18/2016)	1560 (10/15/2015)	(1050 - 1560)/(5 - 2)	-170
1130 (4/6/2016)	1560 (10/15/2015)	(1130 - 1560)/(6 - 2)	-107.5
1530 (5/26/2016)	1560 (10/15/2015)	(1530 - 1560)/(7 - 2)	-6
1340 (7/12/2016)	1560 (10/15/2015)	(1340 - 1560)/(8 - 2)	-36.6667
1270 (1/24/2017)	1560 (10/15/2015)	(1270 - 1560)/(9 - 2)	-41.4286
1410 (1/6/2016)	224 (11/20/2015)	(1410 - 224)/(4 - 3)	1186
1050 (2/18/2016)	224 (11/20/2015)	(1050 - 224)/(5 - 3)	413
1130 (4/6/2016)	224 (11/20/2015)	(1130 - 224)/(6 - 3)	302
1530 (5/26/2016)	224 (11/20/2015)	(1530 - 224)/(7 - 3)	326.5
1340 (7/12/2016)	224 (11/20/2015)	(1340 - 224)/(8 - 3)	223.2
1270 (1/24/2017)	224 (11/20/2015)	(1270 - 224)/(9 - 3)	174.333
1050 (2/18/2016)	1410 (1/6/2016)	(1050 - 1410)/(5 - 4)	-360
1130 (4/6/2016)	1410 (1/6/2016)	(1130 - 1410)/(6 - 4)	-140
1530 (5/26/2016)	1410 (1/6/2016)	(1530 - 1410)/(7 - 4)	40
1340 (7/12/2016)	1410 (1/6/2016)	(1340 - 1410)/(8 - 4)	-17.5
1270 (1/24/2017)	1410 (1/6/2016)	(1270 - 1410)/(9 - 4)	-28
1130 (4/6/2016)	1050 (2/18/2016)	(1130 - 1050)/(6 - 5)	80
1530 (5/26/2016)	1050 (2/18/2016)	(1530 - 1050)/(7 - 5)	240
1340 (7/12/2016)	1050 (2/18/2016)	(1340 - 1050)/(8 - 5)	96.6667
1270 (1/24/2017)	1050 (2/18/2016)	(1270 - 1050)/(9 - 5)	55
1530 (5/26/2016)	1130 (4/6/2016)	(1530 - 1130)/(7 - 6)	400
1340 (7/12/2016)	1130 (4/6/2016)	(1340 - 1130)/(8 - 6)	105
1270 (1/24/2017)	1130 (4/6/2016)	(1270 - 1130)/(9 - 6)	46.6667
1340 (7/12/2016)	1530 (5/26/2016)	(1340 - 1530)/(8 - 7)	-190
1270 (1/24/2017)	1530 (5/26/2016)	(1270 - 1530)/(9 - 7)	-130
1270 (1/24/2017)	1340 (7/12/2016)	(1270 - 1340)/(9 - 8)	-70

Number of Q values = 36

Ordered Q Values

n	Q
1	-1336
2	-538
3	-360
4	-190
5	-170
6	-140
7	-130
8	-107.5
9	-75
10	-70
11	-62.5
12	-41.4286
13	-36.6667
14	-34
15	-28
16	-17.5
17	-6
18	-3.75
19	5.71429
20	36.6667
21	38.3333
22	40
23	46.6667
24	55
25	80
26	96.6667
27	105
28	174.333
29	223.2
30	240
31	260
32	302
33	326.5
34	400
35	413
36	1186

Sen's Estimator (Median Q) is 0.982143

Time Period	Observations
8/12/2015	1
10/15/2015	1
11/20/2015	1
1/6/2016	1
2/18/2016	1
4/6/2016	1
5/26/2016	1
7/12/2016	1
1/24/2017	1

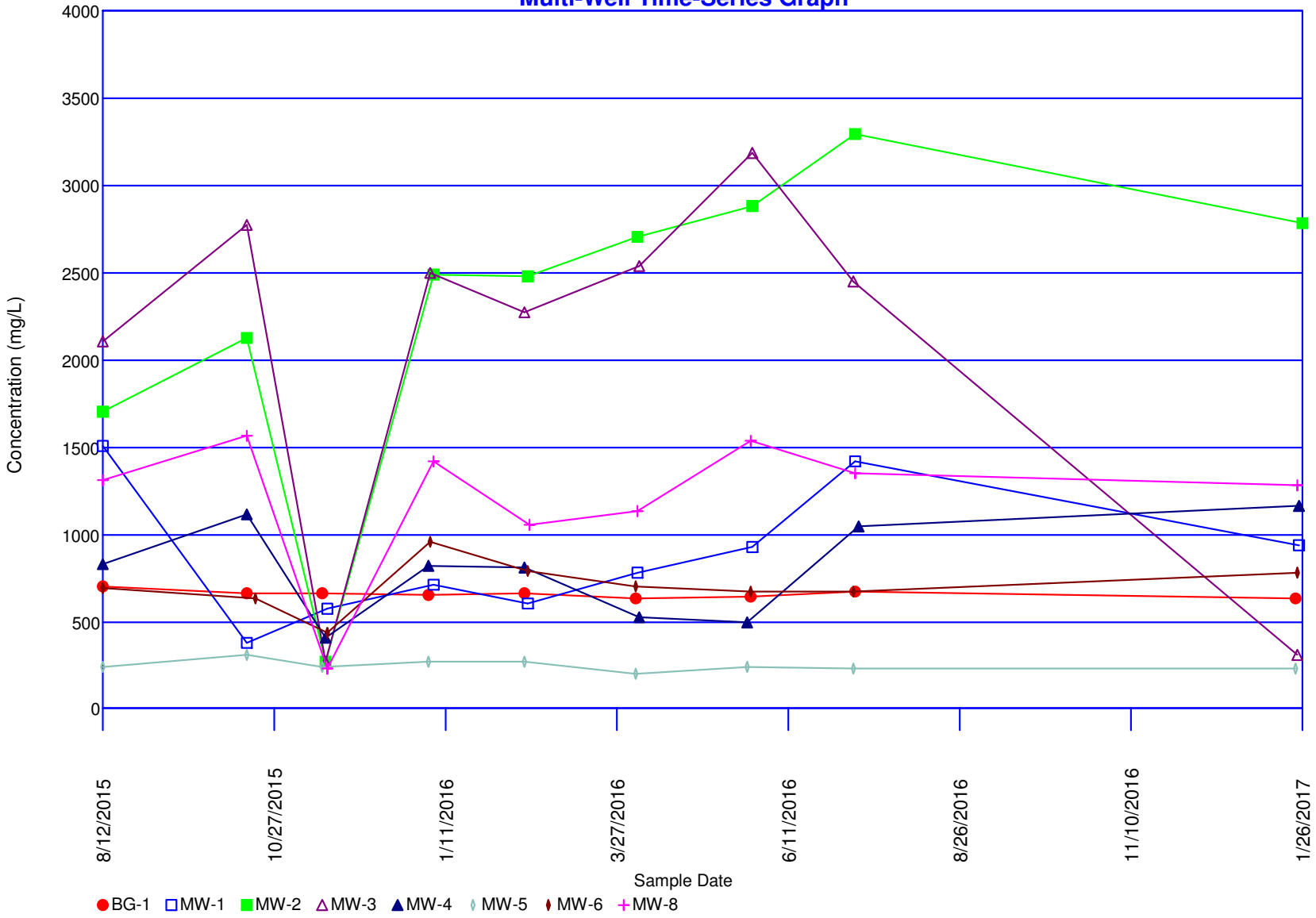
There are 0 time periods with multiple data

A = 0
B = 0
C = 0
D = 0
E = 0
F = 0

a = 1656
b = 4536
c = 144
Group Variance = 92
For 90% confidence interval (two-tailed), Z at (1-0.9)/2 = 1.64485
C = 15.7769
M1 = (36 - 15.7769)/2.0 = 10.1116
M2 = (36 + 15.7769)/2.0 + 1 = 26.8884
Lower limit is -70 = Q(10)
Upper limit is 105 = Q(27)
-70 < 0 < 105 indicating no trend in data.

Total Dissolved Solids

Multi-Well Time-Series Graph



Concentrations (ug/L)

Parameter: Zinc

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

Total Measurements: 80
Total Non-Detect: 44
Percent Non-Detects: 55%
Total Background Measurements: 9
There is 1 background location

Loc.	Meas.	ND	Date	Conc.	Original
BG-1	9	7 (77.7778%)	8/12/2015	8.3 J	8.3 J
			10/15/2015	10	10
			11/18/2015	ND<10 U	ND<10 U
			1/4/2016	ND<10 U	ND<10 U
			2/16/2016	ND<10 U	ND<10 U
			4/5/2016	ND<10 U	ND<10 U
			5/26/2016	ND<10 U	ND<10 U
			7/12/2016	ND<10 U	ND<10 U
			1/23/2017	ND<10 U	ND<10 U

There are 8 compliance locations

Loc.	Meas.	ND	Date	Conc.	Original
MW-1	9	4 (44.4444%)	8/12/2015	7 J	7 J
			10/15/2015	12.4	12.4
			11/20/2015	ND<10 U	ND<10 U
			1/6/2016	13.3	13.3
			2/17/2016	ND<10 U	ND<10 U
			4/6/2016	10.2	10.2
			5/27/2016	ND<10 U	ND<10 U
			7/12/2016	13.2	13.2
			1/25/2017	ND<10 U	ND<10 U
MW-2	9	2 (22.2222%)	8/12/2015	13	13
			10/15/2015	26.8	26.8
			11/19/2015	50.7	50.7
			1/6/2016	ND<10 U	ND<10 U
			2/17/2016	27.2	27.2
			4/6/2016	113	113
			5/27/2016	ND<10 U	ND<10 U
			7/12/2016	37.9	37.9
			1/26/2017	15.8	15.8
MW-3	9	6 (66.6667%)	8/12/2015	5.2 J	5.2 J
			10/15/2015	41.8	41.8
			11/19/2015	ND<10 U	ND<10 U
			1/5/2016	ND<10 U	ND<10 U
			2/16/2016	ND<10 U	ND<10 U
			4/7/2016	12.5	12.5
			5/27/2016	ND<10 U	ND<10 U
			7/11/2016	ND<10 U	ND<10 U
			1/24/2017	ND<10 U	ND<10 U
MW-4	9	8 (88.8889%)	8/12/2015	31	31

			10/15/2015	ND<10 U	ND<10 U
			11/19/2015	ND<10 U	ND<10 U
			1/4/2016	ND<10 U	ND<10 U
			2/16/2016	ND<10 U	ND<10 U
			4/7/2016	ND<10 U	ND<10 U
			5/25/2016	ND<10 U	ND<10 U
			7/13/2016	ND<10 U	ND<10 U
			1/25/2017	ND<10 U	ND<10 U
MW-5	9	5 (55.5556%)	8/12/2015	16	16
			10/15/2015	106	106
			11/18/2015	ND<10 U	ND<10 U
			1/4/2016	ND<10 U	ND<10 U
			2/16/2016	ND<10 U	ND<10 U
			4/5/2016	36.1	36.1
			5/25/2016	ND<10 U	ND<10 U
			7/11/2016	21.2	21.2
			1/23/2017	ND<10 U	ND<10 U
MW-6	9	5 (55.5556%)	8/12/2015	6 J	6 J
			10/19/2015	11.5	11.5
			11/20/2015	ND<10 U	ND<10 U
			1/5/2016	11.3	11.3
			2/17/2016	ND<10 U	ND<10 U
			4/5/2016	ND<10 U	ND<10 U
			5/26/2016	ND<10 U	ND<10 U
			7/11/2016	11.8	11.8
			1/24/2017	ND<10 U	ND<10 U
MW-7	8	6 (75%)	8/12/2015	4.4 J	4.4 J
			10/16/2015	18.6	18.6
			11/20/2015	ND<10 U	ND<10 U
			1/5/2016	ND<10 U	ND<10 U
			2/18/2016	ND<10 U	ND<10 U
			4/6/2016	ND<10 U	ND<10 U
			5/26/2016	ND<10 U	ND<10 U
			7/11/2016	ND<10 U	ND<10 U
MW-8	9	1 (11.1111%)	8/12/2015	5.1 J	5.1 J
			10/15/2015	12	12
			11/20/2015	22.1	22.1
			1/6/2016	18.7	18.7
			2/18/2016	14.6	14.6
			4/6/2016	47.7	47.7
			5/26/2016	ND<10 U	ND<10 U
			7/12/2016	17.8	17.8
			1/24/2017	29.2	29.2

There are 0 unused locations

Loc.	Meas.	ND	Date	Conc.	Original

Rosner's Test for Outliers

Parameter: Zinc

All Locations

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

Data set mean = 16.2425

10 most extreme of 80 measurements

by order of magnitude difference from the mean

1	4/6/2016	MW-2	113	96.7575
2	10/15/2015	MW-5	106	89.7575
3	11/19/2015	MW-2	50.7	34.4575
4	4/6/2016	MW-8	47.7	31.4575
5	10/15/2015	MW-3	41.8	25.5575
6	7/12/2016	MW-2	37.9	21.6575
7	4/5/2016	MW-5	36.1	19.8575
8	8/12/2015	MW-4	31	14.7575
9	1/24/2017	MW-8	29.2	12.9575
10	8/12/2015	MW-7	4.4 J	-11.8425

Iteration i = 9

Mean of 71 measurements = 11.3521
Std Dev = 4.10762
x(i+1) = 4.4 from measurement 8/12/2015 from location MW-7
Rosner Statistic R = |4.4 - 11.3521|/4.10762 = 1.69249
Lambda(80, 10, 0.05) = 3.26
1.69249 < 3.26 -- No outliers detected for i = 9

Iteration i = 8

Mean of 72 measurements = 11.6
Std Dev = 4.58903
x(i+1) = 29.2 from measurement 1/24/2017 from location MW-8
Rosner Statistic R = |29.2 - 11.6|/4.58903 = 3.83524
Lambda(80, 9, 0.05) = 3.266
3.83524 > 3.266 -- Measurement 1/24/2017 for location MW-8 is an outlier

---

Iteration i = 7

Mean of 73 measurements = 11.8658
Std Dev = 5.09139
x(i+1) = 31 from measurement 8/12/2015 from location MW-4
Rosner Statistic R = |31 - 11.8658|/5.09139 = 3.75816
Lambda(80, 8, 0.05) = 3.272
Measurement 8/12/2015 for location MW-4 is an outlier

Iteration i = 6

Mean of 74 measurements = 12.1932
Std Dev = 5.78823
x(i+1) = 36.1 from measurement 4/5/2016 from location MW-5
Rosner Statistic R = |36.1 - 12.1932|/5.78823 = 4.13023
Lambda(80, 7, 0.05) = 3.278
Measurement 4/5/2016 for location MW-5 is an outlier

Iteration i = 5
Mean of 75 measurements = 12.536
Std Dev = 6.47009
x(i+1) = 37.9 from measurement 7/12/2016 from location MW-2
Rosner Statistic R = |37.9 - 12.536|/6.47009 = 3.92019
Lambda(80, 6, 0.05) = 3.284
Measurement 7/12/2016 for location MW-2 is an outlier

Iteration i = 4
Mean of 76 measurements = 12.9211
Std Dev = 7.25066
x(i+1) = 41.8 from measurement 10/15/2015 from location MW-3
Rosner Statistic R = |41.8 - 12.9211|/7.25066 = 3.98294
Lambda(80, 5, 0.05) = 3.29
Measurement 10/15/2015 for location MW-3 is an outlier

Iteration i = 3
Mean of 77 measurements = 13.3727
Std Dev = 8.22126
x(i+1) = 47.7 from measurement 4/6/2016 from location MW-8
Rosner Statistic R = |47.7 - 13.3727|/8.22126 = 4.17543
Lambda(80, 4, 0.05) = 3.29
Measurement 4/6/2016 for location MW-8 is an outlier

Iteration i = 2
Mean of 78 measurements = 13.8513
Std Dev = 9.19644
x(i+1) = 50.7 from measurement 11/19/2015 from location MW-2
Rosner Statistic R = |50.7 - 13.8513|/9.19644 = 4.00685
Lambda(80, 3, 0.05) = 3.3
Measurement 11/19/2015 for location MW-2 is an outlier

Iteration i = 1
Mean of 79 measurements = 15.0177
Std Dev = 13.8194
x(i+1) = 106 from measurement 10/15/2015 from location MW-5
Rosner Statistic R = |106 - 15.0177|/13.8194 = 6.58366
Lambda(80, 2, 0.05) = 3.3
Measurement 10/15/2015 for location MW-5 is an outlier

Iteration i = 0
Mean of 80 measurements = 16.2425
Std Dev = 17.566
x(i+1) = 113 from measurement 4/6/2016 from location MW-2
Rosner Statistic R = |113 - 16.2425|/17.566 = 5.50822
Lambda(80, 1, 0.05) = 3.31
Measurement 4/6/2016 for location MW-2 is an outlier

Non-Parametric Prediction Interval

Inter-Well Comparison

Parameter: Zinc

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

Total Percent Non-Detects = 52.7778%
Number of comparisons = 7
Future Samples (k) = 7
Recent Dates = 1
Background Measurements (n) = 9
Maximum Background Value = 10
Confidence Level = 56.3%
False Positive Rate = 43.7%

Location	Date	Count	Mean	Significant
MW-1	1/25/2017	1	10	FALSE
MW-2	**1/26/2017**	**1**	**15.8**	**TRUE**
MW-3	1/24/2017	1	10	FALSE
MW-4	1/25/2017	1	10	FALSE
MW-5	1/23/2017	1	10	FALSE
MW-6	1/24/2017	1	10	FALSE
MW-8	**1/24/2017**	**1**	**29.2**	**TRUE**

Sen's Slope Analysis

Parameter: Zinc

Location: MW-2

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

90% Confidence Level

Xj	Xk	(Xj - Xk)/(j-k)	Q
26.8 (10/15/2015)	13 (8/12/2015)	(26.8 - 13)/(2 - 1)	13.8
50.7 (11/19/2015)	13 (8/12/2015)	(50.7 - 13)/(3 - 1)	18.85
ND<10 U (1/6/2016)	13 (8/12/2015)	(10 - 13)/(4 - 1)	-1
27.2 (2/17/2016)	13 (8/12/2015)	(27.2 - 13)/(5 - 1)	3.55
113 (4/6/2016)	13 (8/12/2015)	(113 - 13)/(6 - 1)	20
ND<10 U (5/27/2016)	13 (8/12/2015)	(10 - 13)/(7 - 1)	-0.5
37.9 (7/12/2016)	13 (8/12/2015)	(37.9 - 13)/(8 - 1)	3.55714
15.8 (1/26/2017)	13 (8/12/2015)	(15.8 - 13)/(9 - 1)	0.35
50.7 (11/19/2015)	26.8 (10/15/2015)	(50.7 - 26.8)/(3 - 2)	23.9
ND<10 U (1/6/2016)	26.8 (10/15/2015)	(10 - 26.8)/(4 - 2)	-8.4
27.2 (2/17/2016)	26.8 (10/15/2015)	(27.2 - 26.8)/(5 - 2)	0.133333
113 (4/6/2016)	26.8 (10/15/2015)	(113 - 26.8)/(6 - 2)	21.55
ND<10 U (5/27/2016)	26.8 (10/15/2015)	(10 - 26.8)/(7 - 2)	-3.36
37.9 (7/12/2016)	26.8 (10/15/2015)	(37.9 - 26.8)/(8 - 2)	1.85
15.8 (1/26/2017)	26.8 (10/15/2015)	(15.8 - 26.8)/(9 - 2)	-1.57143
ND<10 U (1/6/2016)	50.7 (11/19/2015)	(10 - 50.7)/(4 - 3)	-40.7
27.2 (2/17/2016)	50.7 (11/19/2015)	(27.2 - 50.7)/(5 - 3)	-11.75
113 (4/6/2016)	50.7 (11/19/2015)	(113 - 50.7)/(6 - 3)	20.7667
ND<10 U (5/27/2016)	50.7 (11/19/2015)	(10 - 50.7)/(7 - 3)	-10.175
37.9 (7/12/2016)	50.7 (11/19/2015)	(37.9 - 50.7)/(8 - 3)	-2.56
15.8 (1/26/2017)	50.7 (11/19/2015)	(15.8 - 50.7)/(9 - 3)	-5.81667
27.2 (2/17/2016)	ND<10 U (1/6/2016)	(27.2 - 10)/(5 - 4)	17.2
113 (4/6/2016)	ND<10 U (1/6/2016)	(113 - 10)/(6 - 4)	51.5
ND<10 U (5/27/2016)	ND<10 U (1/6/2016)	(10 - 10)/(7 - 4)	0
37.9 (7/12/2016)	ND<10 U (1/6/2016)	(37.9 - 10)/(8 - 4)	6.975
15.8 (1/26/2017)	ND<10 U (1/6/2016)	(15.8 - 10)/(9 - 4)	1.16
113 (4/6/2016)	27.2 (2/17/2016)	(113 - 27.2)/(6 - 5)	85.8
ND<10 U (5/27/2016)	27.2 (2/17/2016)	(10 - 27.2)/(7 - 5)	-8.6
37.9 (7/12/2016)	27.2 (2/17/2016)	(37.9 - 27.2)/(8 - 5)	3.56667
15.8 (1/26/2017)	27.2 (2/17/2016)	(15.8 - 27.2)/(9 - 5)	-2.85
ND<10 U (5/27/2016)	113 (4/6/2016)	(10 - 113)/(7 - 6)	-103
37.9 (7/12/2016)	113 (4/6/2016)	(37.9 - 113)/(8 - 6)	-37.55
15.8 (1/26/2017)	113 (4/6/2016)	(15.8 - 113)/(9 - 6)	-32.4
37.9 (7/12/2016)	ND<10 U (5/27/2016)	(37.9 - 10)/(8 - 7)	27.9
15.8 (1/26/2017)	ND<10 U (5/27/2016)	(15.8 - 10)/(9 - 7)	2.9
15.8 (1/26/2017)	37.9 (7/12/2016)	(15.8 - 37.9)/(9 - 8)	-22.1

Number of Q values = 36

Ordered Q Values

n	Q
1	-103
2	-40.7
3	-37.55
4	-32.4
5	-22.1
6	-11.75
7	-10.175
8	-8.6
9	-8.4
10	-5.81667
11	-3.36
12	-2.85
13	-2.56
14	-1.57143
15	-1
16	-0.5
17	0
18	0.133333
19	0.35
20	1.16
21	1.85
22	2.9
23	3.55
24	3.55714
25	3.56667
26	6.975
27	13.8
28	17.2
29	18.85
30	20
31	20.7667
32	21.55
33	23.9
34	27.9
35	51.5
36	85.8

Sen's Estimator (Median Q) is 0.241667

Tied Group	Value	Members
1	10	2

Time Period	Observations
8/12/2015	1
10/15/2015	1
11/19/2015	1
1/6/2016	1
2/17/2016	1
4/6/2016	1
5/27/2016	1
7/12/2016	1
1/26/2017	1

There are 0 time periods with multiple data

A = 18
B = 0
C = 0

D = 0
E = 2
F = 0
a = 1656
b = 4536
c = 144
Group Variance = 91
For 90% confidence interval (two-tailed), Z at (1-0.9)/2 = 1.64485
C = 15.6909
M1 = (36 - 15.6909)/2.0 = 10.1546
M2 = (36 + 15.6909)/2.0 + 1 = 26.8454
Lower limit is -5.81667 = Q(10)
Upper limit is 13.8 = Q(27)
-5.81667 < 0 < 13.8 indicating no trend in data.

Sen's Slope Analysis

Parameter: Zinc

Location: MW-8

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

90% Confidence Level

Xj	Xk	(Xj - Xk)/(j-k)	Q
12 (10/15/2015)	5.1 J (8/12/2015)	(12 - 5.1)/(2 - 1)	6.9
22.1 (11/20/2015)	5.1 J (8/12/2015)	(22.1 - 5.1)/(3 - 1)	8.5
18.7 (1/6/2016)	5.1 J (8/12/2015)	(18.7 - 5.1)/(4 - 1)	4.53333
14.6 (2/18/2016)	5.1 J (8/12/2015)	(14.6 - 5.1)/(5 - 1)	2.375
47.7 (4/6/2016)	5.1 J (8/12/2015)	(47.7 - 5.1)/(6 - 1)	8.52
ND<10 U (5/26/2016)	5.1 J (8/12/2015)	(10 - 5.1)/(7 - 1)	0.816667
17.8 (7/12/2016)	5.1 J (8/12/2015)	(17.8 - 5.1)/(8 - 1)	1.81429
29.2 (1/24/2017)	5.1 J (8/12/2015)	(29.2 - 5.1)/(9 - 1)	3.0125
22.1 (11/20/2015)	12 (10/15/2015)	(22.1 - 12)/(3 - 2)	10.1
18.7 (1/6/2016)	12 (10/15/2015)	(18.7 - 12)/(4 - 2)	3.35
14.6 (2/18/2016)	12 (10/15/2015)	(14.6 - 12)/(5 - 2)	0.866667
47.7 (4/6/2016)	12 (10/15/2015)	(47.7 - 12)/(6 - 2)	8.925
ND<10 U (5/26/2016)	12 (10/15/2015)	(10 - 12)/(7 - 2)	-0.4
17.8 (7/12/2016)	12 (10/15/2015)	(17.8 - 12)/(8 - 2)	0.966667
29.2 (1/24/2017)	12 (10/15/2015)	(29.2 - 12)/(9 - 2)	2.45714
18.7 (1/6/2016)	22.1 (11/20/2015)	(18.7 - 22.1)/(4 - 3)	-3.4
14.6 (2/18/2016)	22.1 (11/20/2015)	(14.6 - 22.1)/(5 - 3)	-3.75
47.7 (4/6/2016)	22.1 (11/20/2015)	(47.7 - 22.1)/(6 - 3)	8.53333
ND<10 U (5/26/2016)	22.1 (11/20/2015)	(10 - 22.1)/(7 - 3)	-3.025
17.8 (7/12/2016)	22.1 (11/20/2015)	(17.8 - 22.1)/(8 - 3)	-0.86
29.2 (1/24/2017)	22.1 (11/20/2015)	(29.2 - 22.1)/(9 - 3)	1.18333
14.6 (2/18/2016)	18.7 (1/6/2016)	(14.6 - 18.7)/(5 - 4)	-4.1
47.7 (4/6/2016)	18.7 (1/6/2016)	(47.7 - 18.7)/(6 - 4)	14.5
ND<10 U (5/26/2016)	18.7 (1/6/2016)	(10 - 18.7)/(7 - 4)	-2.9
17.8 (7/12/2016)	18.7 (1/6/2016)	(17.8 - 18.7)/(8 - 4)	-0.225
29.2 (1/24/2017)	18.7 (1/6/2016)	(29.2 - 18.7)/(9 - 4)	2.1
47.7 (4/6/2016)	14.6 (2/18/2016)	(47.7 - 14.6)/(6 - 5)	33.1
ND<10 U (5/26/2016)	14.6 (2/18/2016)	(10 - 14.6)/(7 - 5)	-2.3
17.8 (7/12/2016)	14.6 (2/18/2016)	(17.8 - 14.6)/(8 - 5)	1.06667
29.2 (1/24/2017)	14.6 (2/18/2016)	(29.2 - 14.6)/(9 - 5)	3.65
ND<10 U (5/26/2016)	47.7 (4/6/2016)	(10 - 47.7)/(7 - 6)	-37.7
17.8 (7/12/2016)	47.7 (4/6/2016)	(17.8 - 47.7)/(8 - 6)	-14.95
29.2 (1/24/2017)	47.7 (4/6/2016)	(29.2 - 47.7)/(9 - 6)	-6.16667
17.8 (7/12/2016)	ND<10 U (5/26/2016)	(17.8 - 10)/(8 - 7)	7.8
29.2 (1/24/2017)	ND<10 U (5/26/2016)	(29.2 - 10)/(9 - 7)	9.6
29.2 (1/24/2017)	17.8 (7/12/2016)	(29.2 - 17.8)/(9 - 8)	11.4

Number of Q values = 36

Ordered Q Values

n	Q
1	-37.7
2	-14.95
3	-6.16667
4	-4.1
5	-3.75
6	-3.4
7	-3.025
8	-2.9
9	-2.3
10	-0.86
11	-0.4
12	-0.225
13	0.816667
14	0.866667
15	0.966667
16	1.06667
17	1.18333
18	1.81429
19	2.1
20	2.375
21	2.45714
22	3.0125
23	3.35
24	3.65
25	4.53333
26	6.9
27	7.8
28	8.5
29	8.52
30	8.53333
31	8.925
32	9.6
33	10.1
34	11.4
35	14.5
36	33.1

Sen's Estimator (Median Q) is 1.95714

Time Period	Observations
8/12/2015	1
10/15/2015	1
11/20/2015	1
1/6/2016	1
2/18/2016	1
4/6/2016	1
5/26/2016	1
7/12/2016	1
1/24/2017	1

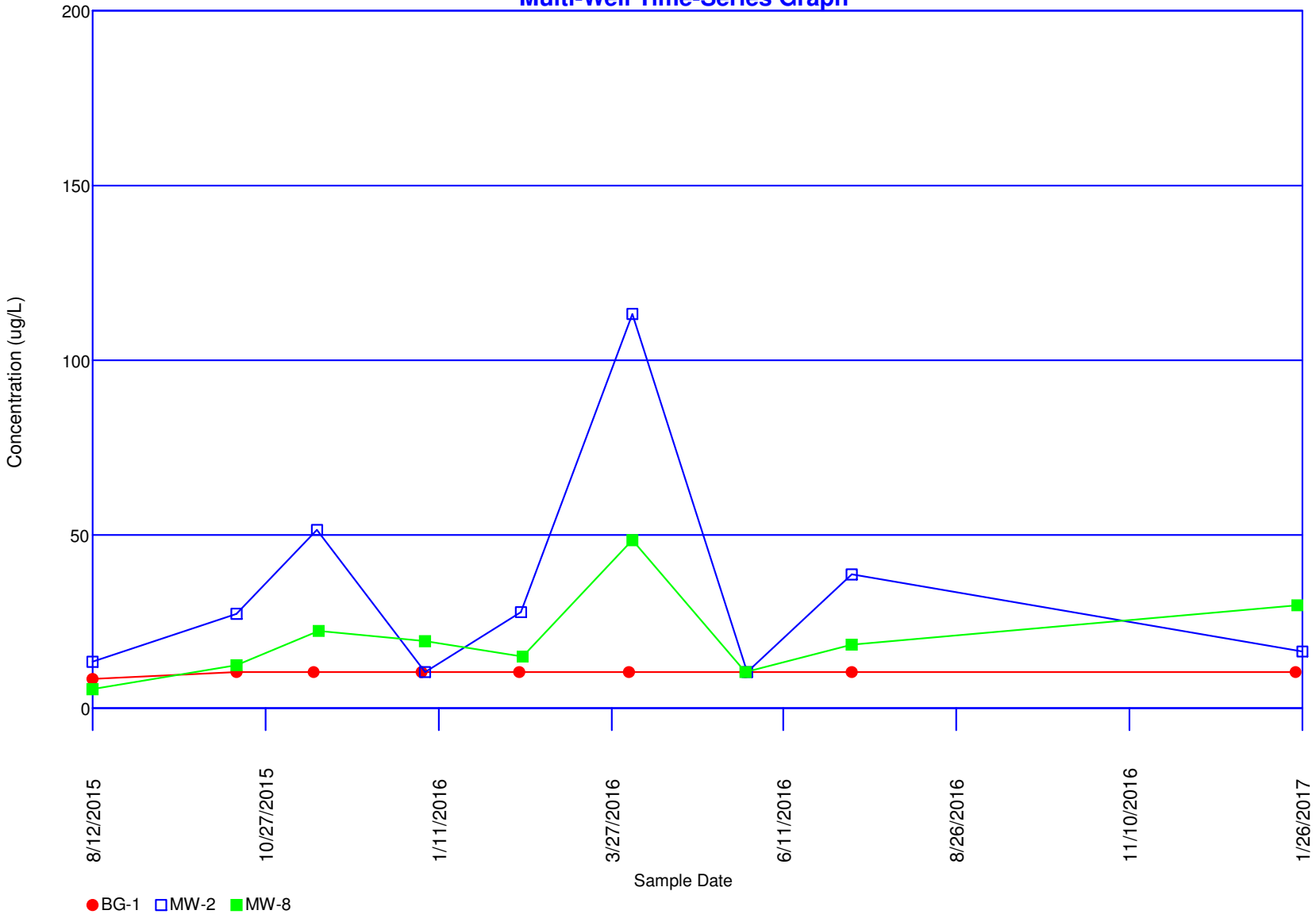
There are 0 time periods with multiple data

A = 0
B = 0
C = 0
D = 0
E = 0
F = 0

a = 1656
b = 4536
c = 144
Group Variance = 92
For 90% confidence interval (two-tailed), Z at (1-0.9)/2 = 1.64485
C = 15.7769
M1 = (36 - 15.7769)/2.0 = 10.1116
M2 = (36 + 15.7769)/2.0 + 1 = 26.8884
Lower limit is -0.86 = Q(10)
Upper limit is 7.8 = Q(27)
-0.86 < 0 < 7.8 indicating no trend in data.

Zinc

Multi-Well Time-Series Graph





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B

Appendix B - 2017 Second Semi-Annual Detection Monitoring Report

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2017 Second Semi-Annual Detection Monitoring Report

Brickhaven No.2 Mine Tract “A” Structural Fill

Charah, LLC

Moncure, Chatham County, North Carolina
October 13, 2017

HDR Engineering, Inc. of the Carolinas
440 S Church Street, Suite 1000, Charlotte, NC 28202-2075
704.338.6700
NC License F0116

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DENR USE ONLY: ☐ Paper Report ☐ Electronic Data - Email CD (data loaded: Yes / No) Doc/Event #:

NC DENR
Division of Waste Management - Solid Waste

Environmental Monitoring Reporting Form

Notice: This form and any information attached to it are "Public Records" as defined in NC General Statute 132-1. As such, these documents are available for inspection and examination by any person upon request (NC General Statute 132-6).

Instructions:

- **Prepare one form for each individually monitored unit.**
- **Please type or print legibly.**
- Attach a notification table with values that attain or exceed NC 2L groundwater standards or NC 2B surface water standards. The notification must include a preliminary analysis of the cause and significance of each value. (e.g. naturally occurring, off-site source, pre-existing condition, etc.).
- Attach a notification table of any groundwater or surface water values that equal or exceed the reporting limits.
- Attach a notification table of any methane gas values that attain or exceed explosive gas levels. This includes any structures on or nearby the facility (NCAC 13B .1629 (4)(a)(i).
- Send the original signed and sealed form, any tables, and Electronic Data Deliverable to: Compliance Unit, NCDENR-DWM, Solid Waste Section, 1646 Mail Service Center, Raleigh, NC 27699-1646.

Solid Waste Monitoring Data Submittal Information

Name of entity submitting data (laboratory, consultant, facility owner):

Green Meadow - Charah, LLC

Contact for questions about data formatting. Include data preparer's name, telephone number and E-mail address:

Name: Michael Plummer, PE Phone: 704.338.6843

E-mail: michael.plummer@hdrinc.com

Facility name:	Facility Address:	Facility Permit #	NC Landfill Rule: (.0500 or .1600)	Actual sampling dates (e.g., October 20-24, 2006)
Charah, LLC Brickhaven No. 2 Mine Tract 'A"	1271 Moncure-Flatwood Road Chatham County Moncure, North Carolina	1910- STRUC-2015	CAMA	July 17 - 20, 2017

Environmental Status: (Check all that apply)

☐ Initial/Background Monitoring ☒ Detection Monitoring ☐ Assessment Monitoring ☐ Corrective Action

Type of data submitted: (Check all that apply)

☒ Groundwater monitoring data from monitoring wells
☐ Groundwater monitoring data from private water supply wells
☒ Leachate monitoring data
☒ Surface water monitoring data
☐ Methane gas monitoring data
☐ Corrective action data (specify) _____
☐ Other(specify) _____

Notification attached?

☐ No. No groundwater or surface water standards were exceeded.
☒ Yes, a notification of values exceeding a groundwater or surface water standard is attached. It includes a list of groundwater and surface water monitoring points, dates, analytical values, NC 2L groundwater standard, NC 2B surface water standard or NC Solid Waste GWPS and preliminary analysis of the cause and significance of any concentration.
☐ Yes, a notification of values exceeding an explosive methane gas limit is attached. It includes the methane monitoring points, dates, sample values and explosive methane gas limits.

Certification

To the best of my knowledge, the information reported and statements made on this data submittal and attachments are true and correct. Furthermore, I have attached complete notification of any sampling values meeting or exceeding groundwater standards or explosive gas levels, and a preliminary analysis of the cause and significance of concentrations exceeding groundwater standards. I am aware that there are significant penalties for making any false statement, representation, or certification including the possibility of a fine and imprisonment.

Michael Plummer | Project Manager | 704.338.6843

Facility Representative Name (Print) | Title | (Area Code) Telephone Number

Signature | Date: 10/13/17

Affix NC Licensed Professional Geologist Seal



HDR Engineering, Inc. of the Carolinas, 440 S. Church St. Suite 1000, Charlotte, NC 28202

Facility Representative Address

F-0116

NC PE Firm License Number (if applicable effective May 1, 2009)

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Appendix B – Laboratory Reports, Chains of Custody, & Quality Control Data
Appendix C – Electronic Data Deliverables (CD-ROM only)
Appendix D – Interwell Statistical Analysis

List of Select Acronyms

µg/L	micrograms per liter
bMDL	below Method Detection Limit
CAMA	North Carolina Coal Ash Management Act of 2014
CCR	Coal Combustion Residuals
DEC	Duke Energy Carolinas
DEP	Duke Energy Progress
DO	Dissolved Oxygen
EDD	Electronic Data Deliverable
EPA	United States Environmental Protection Agency
ft./ft.	feet / foot
ID	Inner Diameter
NCDENR	North Carolina Department of Environment and Natural Resources
NCDEQ	North Carolina Department of Environmental Quality
NCGPS	North Carolina groundwater protection standard
N	Standard Penetration Resistance
ND	Non-detects
NPPL	Non-parametric Prediction Limit
NTU	Nephelometric turbidity units
MCL	Maximum Contaminant Levels
MDL	Method Detection Limit
msl	mean sea level
OD	Outer Diameter
ORP	Oxidation-Reduction Potential
PL	Predictive Limit
PPL	Parametric Prediction Limit
RCRA	Resource Conservation and Recovery Act
ROS	Regression on Order Statistics
SSI	Statistically Significant Increase
UPL	Upper Prediction Limit
USCS	United Soil Classification System

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1 Introduction

1.1 Purpose

This *2017 Second Semi-Annual Detection Monitoring Report* addresses the semi-annual detection monitoring at the Brickhaven No.2 Mine Tract "A" Structural Fill site in Moncure, Chatham County, North Carolina. The report includes results from the July 17 – July 20, 2017 semi-annual detection monitoring event, as well as the statistical results calculated for this monitoring event.

The next semi-annual monitoring event will take place after January 2018.

1.2 Regulatory Compliance

Groundwater monitoring and sampling at the site is governed by the following:

- North Carolina - Coal Ash Management Act (CAMA) of 2014 (Senate Bill 729).
- U.S. Environmental Protection Agency - Coal Combustion Residuals (CCR) Rule (40 CFR Parts 257 and 261).
- Water Quality Monitoring Plan Brickhaven No.2 Mine Tract "A" Structural Fill, approved March 2015.
- North Carolina Department of Environment and Natural Resources (NCDENR)[1] Permit No. 1910-STRUC-2015, issued June 5, 2015.
- NCDENR Solid Waste Section Guidelines for Groundwater, Soil, and Surface Water Sampling, April 2008.
- NCDENR Division of Water Management memorandum concerning electronic document submittal for routine groundwater and surface water monitoring, November 5, 2014.
- U.S. Environmental Protection Agency (EPA) Region I, *Low Stress (low flow) Purging and Sampling Procedure for the Collection of Ground Water Samples from Monitoring Wells*, January 19, 2010.

1.2.1 CAMA

CAMA Section §130A-309.216 addresses Groundwater requirements as follows:

"§ 130A-309.216. Design, construction, and siting requirements for projects using coal combustion products for structural fill.

(b) Liners, Leachate Collection System, Cap, and Groundwater Monitoring System Required for Large Structural Fills. –

> *(4) A groundwater monitoring system that shall be approved by the Department and, at a minimum consists of all of the following:*

[1] On September 18, 2015, the North Carolina Department of Environment and Natural Resources (NCDENR) became the North Carolina Department of Environmental Quality (NCDEQ). Both naming conventions are used in this report, as appropriate.

a. A sufficient number of wells, installed at appropriate locations and depths, to yield groundwater samples from the uppermost aquifer that represent the quality of groundwater passing the relevant point of compliance as approved by the Department. A down-gradient monitoring system shall be installed at the relevant point of compliance so as to ensure detection of groundwater contamination in the uppermost aquifer.

b. A proposed monitoring plan, which shall be certified by a licensed geologist or professional engineer to be effective in providing early detection of any release of hazardous constituents from any point in a structural fill or leachate surface impoundment to the uppermost aquifer, so as to be protective of public health, safety, and welfare; the environment; and natural resources.

c. A groundwater monitoring program, which shall include consistent sampling and analysis procedures that are designed to ensure monitoring results that provide an accurate representation of groundwater quality at the background and down-gradient wells. Monitoring shall be conducted through construction and the post-closure care period. The sampling procedures and frequency shall be protective of public health, safety, and welfare; the environment; and natural resources.

d. A detection monitoring program for all Appendix I constituents. For purposes of this subdivision, the term "Appendix I" means Appendix I to 40 C.F.R. Part 258, "Appendix I Constituents for Detection Monitoring," including subsequent amendments and editions.

e. An assessment monitoring program and corrective action plan if one or more of the constituents listed in Appendix I is detected in exceedance of a groundwater protection standard."

1.2.2 EPA's CCR Rule

On April 17, 2015, EPA published its final rule *Disposal of Coal Combustion Residuals from Electric Utilities* to regulate the disposal of coal combustion residuals (CCR) as solid waste under Subtitle D of the Resource Conservation and Recovery Act (RCRA). Among other requirements, the final rule established requirements for a groundwater monitoring program consisting of detection monitoring and, if necessary, assessment monitoring and corrective action. EPA selected constituents for detection monitoring that are present in CCR, would be expected to migrate rapidly, and would thereby provide early detection as to whether contaminants were migrating from the disposal unit (80 FR 74: 21397).

The CCR Rule establishes requirements for a phased groundwater monitoring program consisting of detection monitoring and, if necessary, assessment monitoring and corrective action. The rule requires that the owner or operator of existing CCR landfills and CCR surface impoundments must comply with the following groundwater monitoring requirements no later than October 17, 2017:

- Installation of the groundwater monitoring system;

- Development of the groundwater sampling and analysis program;
- Selection of statistical procedures to be used to evaluate detection monitoring data;
- Initiate detection monitoring program to include a minimum of eight (8) independent sampling events for each background and downgradient monitoring well; and
- Evaluate groundwater monitoring data for statistically significant increases over background concentrations for each Appendix III constituent.

The first phase of the groundwater monitoring program is detection monitoring, where monitoring will be performed to evaluate background groundwater quality at the site and to determine if downgradient groundwater has potentially been impacted by CCR. The EPA considers several parameters to be leading indicators of groundwater impacted by a CCR unit (i.e., Appendix III constituents). The Appendix III leading indicators are: boron, calcium, chloride, fluoride, pH, sulfate, and total dissolved solids (TDS).

If detection monitoring determines that there are statistically significant increases over background concentrations for Appendix III constituents, the CCR Rule requires assessment monitoring. The parameters selected for assessment monitoring include: antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, fluoride, lead, lithium, mercury, molybdenum, radium 226 and 228 (combined), selenium, and thallium (i.e., Appendix IV constituents). The CCR Rule requires that samples collected during the initial phase of detection monitoring (i.e., the minimum eight detection monitoring events) be analyzed for Appendix III and Appendix IV constituents.

If the results of assessment monitoring indicate that corrective action may be warranted, the CCR Rule requires additional assessment of corrective measures and potentially corrective action monitoring.

Groundwater monitoring and sampling at the site is conducted in general accordance with both CAMA and the U.S. EPA CCR Rule per the NCDENR approved *Water Quality Monitoring Plan for Brickhaven No.2 Mine Tract "A" Structural Fill* (Buxton, 2015a).

1.3 Site Location and Operation

The site is located in Chatham County, approximately four miles southeast of central Moncure, North Carolina (**Figure 1**). The owner of the site is Green Meadow, LLC (Green Meadow). Charah, LLC. (Charah) is responsible for the operation and maintenance of the site. The mine property is approximately 301 acres in total; the structural fill area permitted for CCR placement will comprise of approximately 145 acres.

The property located within the structural fill area was previously owned by General Shale Brick, Inc., which operated the site and an adjacent property as a clay mine beginning in 1985 for their off-site brick manufacturing facility. Mined clay was stockpiled and then transported approximately 3.5 miles south to Brickhaven, North Carolina for brick manufacturing.

The area immediately surrounding the site primarily consists of rural residential (approximately 2,500 feet east, 1,000 feet southeast and 1,000 feet southwest), commercial, industrial, wooded

and agricultural property. According to information obtained from the Chatham County GIS website (October 2015), municipal water is available to the surrounding area.

Charah began CCR placement in the first composite liner containment system (Cell 1, Sub Cell 1A) on October 23, 2015. Charah plans to place approximately 12,000,000 tons of CCR in the structural fill. The placement phase is anticipated to continue for eight years, although it could vary depending on the importation rate. CCRs (including fly ash, bottom ash, boiler slag, and/or flue gas desulfurization materials) were initially brought to the site by truck and is now delivered exclusively by rail. The CCR originated at the Duke Energy Carolinas (DEC) Riverbend Steam Station and Duke Energy Progress (DEP) L.V. Sutton Energy Complex (Sutton Plant) sites. CCRs could eventually be brought to the site from other DEC and/or DEP sites in North Carolina.

Leachate (i.e. product generated from the liquids present in the fill at the time of placement and/or stormwater that infiltrates the fill) is managed on-site through collection, storage, and disposal of the resultant liquid. Green Meadow has approved pump and haul permits to dispose of leachate at the City of Sanford's Big Buffalo Creek Wastewater Treatment Plant and South Harnett Regional Wastewater Treatment Plant in Spring Lake, North Carolina.

1.4 Groundwater Monitoring System

The site's groundwater monitoring system was designed to provide early detection of any release in order to be protective of human health and the environment. The groundwater monitoring system comprises of nine wells; seven downgradient/side-gradient compliance monitoring wells (MW-2, MW-3, MW-4, MW-5, MW-6, MW-7R, and MW-8), one designated upgradient monitoring well (MW-1) and a background well (BG-1). **Table 1** depicts Well Construction Details.

Background monitoring well (BG-1) was installed in July of 2015 near the entrance of the site along Moncure-Flatwood Road. This background well location was installed to improve determination of appropriate levels of constituents existing at the site independent of the site's use as a structural fill.

MW-7R was installed in April of 2017 as a replacement for monitoring well MW-7 as documented and approved in the May 25, 2017 memorandum to NCDEQ - Solid Waste Section. MW-7 will temporarily remain onsite for groundwater gauging purposes only.

Table 1: Well Construction, Survey, and Groundwater Elevations

Well ID	Northing	Easting	Pad Elev. (msl)	TOC Elev. (msl)	TD BGS (ft.)	TD BTOC (ft.)	Screen Length (ft.)	Screen Interval (msl)	DTW BTOC (ft.)	DTW Elevation (msl)	Lithologic Unit
BG-1	670898.50	1996348.25	225.64	228.19	40.50	43.05	15	200.14 - 185.14	11.43	216.76	Layered Rock/PWR*
MW-1	674737.98	1993417.69	277.28	280.08	72.50	75.30	15	220.20 - 205.20	60.89	219.19	Layered Rock/PWR*
MW-2	673677.07	1994537.54	229.27	231.76	47.66	50.15	15	196.61 - 181.61	30.18	201.58	Layered Rock/PWR*
MW-3	672474.63	1994834.76	220.00	222.56	40.80	43.36	15	194.20 - 179.20	18.65	203.91	PWR
MW-4	671326.48	1994974.40	214.49	217.13	22.70	25.34	10	201.79 - 191.79	13.03	204.10	Residuum/PWR
MW-5	671081.19	1993779.03	242.72	244.86	44.00	46.14	10	208.72 - 198.72	22.26	222.60	PWR
MW-6	671267.60	1992793.34	228.63	231.10	27.00	29.47	15	216.63 - 201.63	7.52	223.58	Residuum/PWR
MW-7	672306.28	1992642.35	229.53	231.71	15.00	17.18	10	224.53 - 214.53	15.62	216.09	Residuum/PWR
MW-7R	672221.96	1992702.98	239.99	242.22	36.00	39.94	10	213.99 - 203.99	21.30	220.92	Residuum/PWR
MW-8	673304.83	1992200.37	233.41	236.47	46.00	49.06	15	202.41 - 187.41	37.49	198.98	PWR

Notes:

1. Top-of-casing, ground surface elevations and horizontal locations at MW-4 (PZM-1), MW-5 (PZM-22) and MW-7 (PZM-27) determined by Lawrence Surveying of Monroe, NC.
2. Top-of-casing, ground surface elevations and horizontal locations at BG-1, MW-1, MW-3, MW-6, MW-8 and MW-7R determined by McAdams of Durham, NC.
3. Top-of-casing, ground surface and horizontal location at monitoring well MW-2 determined by Gregory C. Bewley.
4. TD=total depth; BGS=below ground surface; TOC=top of casing; DTW = Depth-to-Water; BTOC = below top-of-casing, msl = above mean sea level, ft.
5. Depth to water measurements obtained on July 17, 2017 to the nearest 0.01 foot with a depth-to-water meter by Pace Analytical, Inc.
6. Based on NAD 83 NGVD88

* = interpreted lithologic unit based on relative drilling hardness and geologic judgment during well installation

1.5 Site Topography and Geographical Setting

According to the 1993 USGS topographic quadrangle (**Figure 1**), the topography of the site and immediately surrounding area can be characterized by moderately rolling hills, which are dissected by dendritic creeks. The northwestern portion of the site generally slopes to the north and northwest from three topographically high ridges with interconnected saddles, ranging from approximately 260 to 270 feet above mean sea level (msl), towards an off-site intermittent tributary. The southeastern portion of the site generally slopes to the southeast, south and west from the three topographic high ridges with similar interconnected saddles, ranging from approximately 260 to 270 feet msl, towards on-site intermittent tributary creeks that drain to the southern property boundary at approximately 205 feet msl.

1.6 Geologic and Hydrogeologic Setting

1.6.1 Regional Geology

The site is located within the Piedmont physiographical province of North Carolina, which is a northeast-southwest trending region extending from New York to Alabama.

According to the 1985 North Carolina Geologic Map prepared by the North Carolina Geological Survey, the site is located in the Triassic Basin Belt of the Piedmont physiographic province. The basement rocks of the Triassic Basin Belt include conglomerate, sandstone, mudstone, limestone, coal, and shale. The majority of the subject property is located within the Sanford Formation which contains conglomerate, fanglomerate, sandstone, and mudstone. The far western portion of the site is located in the Cummock Formation which contains sandstone, mudstone, gray and black coal, and carbonaceous shale. The Triassic Basin is bounded by felsic metavolcanic rock within the Carolina Slate Belt approximately 6.5 miles to the northwest; and is contacted by metamorphosed granite and by biotite gneiss and schist of the Raleigh Belt along a normal fault approximately 2.5 miles to the southeast. The Triassic Basin formations have been intruded by north northwest-south southeast trending igneous diabase dikes during the Jurassic Period (~144 to 208 Ma), and contain northeast-southwest trending normal faults. However, none of these faults were indicated to exist at the subject site on the 1985 geologic map (NCDENR, 1985).

In the Piedmont, the bedrock is typically overlain by a mantle of weathered rock (residuum/saprolite), which has an average thickness of approximately 25 feet. The residuum/saprolite consists of varying amounts of unconsolidated clays, silts and sands, with lesser amounts of rock fragments. Due to the range of the parent rock composition and the variable susceptibility to weathering of each rock type, the residuum/saprolite ranges widely in color, texture and thickness. Generally, the residuum/saprolite is thickest near inter-stream divides (ridges) and thins toward stream beds. In profile, the residuum/saprolite normally grades from clayey soils near the land surface to sandier, partially weathered rock above the competent bedrock (Buxton, 2014).

1.6.2 Site Geology

The geology of the site area can be subdivided into six lithologic units, which include fill, flood plain, soil horizon, residuum, partially weathered rock and layered rock. These geologic units

generally grade downward from a soil horizon, to residuum, to partially weathered rock and finally layered rock. The fill materials were only identified in the road bed and berm located around the east and west sides of MW-4. The flood plain sediments were only identified at MW-4 on the southeast corner of the site. The summary of the site geologic units is based on boring logs from *Design Hydrogeologic Report* (Buxton, March 2016) and is summarized below.

FILL

The fill materials were primarily identified in the road bed and berm located around the east and west sides near MW-4 and generally consisted of mottled reddish yellow, orange, brown, and light gray; sandy silty clay with quartz and brick gravel.

FLOOD PLAIN

Flood plain sediments were only located adjacent at MW-4 on the southeast corner of the site. The sediments were associated with the former adjacent intermittent tributary creek and sediments can be generally characterized by a mottled light gray; fine sandy silty clay. The flood plain sediments were only approximately 5 feet thick in this area and had been deposited above residuum. Based on geotechnical laboratory data, the flood plain sediments consisted of United Soil Classification System (USCS) group symbol CL.

SOIL HORIZON

The soil horizon can generally be characterized by mottled yellowish, brown, orange and red color consisting of silty clay and clayey silt. Root structures were common. The soil horizon at the site is formed from the continued weathering and biologic reworking of residuum, and ranges from 2 to 15 feet in thickness, when present. Based on geotechnical laboratory data, the soil horizon consisted of USCS group symbols SC, MH and CL, and had a hydraulic conductivity value of 2.86×10^{-7} cm/sec.

RESIDUUM

The residuum can generally be characterized by a red and reddish brown color with black and gray mottles, primarily consisting of sandy silty clay with infrequent quartz gravel and cobbles. The residuum often contained a horizontal fissile characteristic (i.e. breaks in horizontal sheets). The residuum generally retains the remnant texture, structure and mineral content of the rock from which it was formed, and ranges from 5 to 15 feet in thickness. The residuum has a Standard Penetration Resistance (N) of less than 100 blows per foot. Based on geotechnical laboratory data, the residuum consisted of USCS group symbol CL and hydraulic conductivity values ranged from 7.69×10^{-8} cm/sec to 3.69×10^{-9} cm/sec.

PARTIALLY WEATHERED ROCK

The partially weathered rock can generally be characterized by a brown, reddish gray and weak red color with light green and purple mottles and stingers, primarily consisting of silty clay and weathered mudstone, which often contain horizontal fissile characteristics. The partially weathered rock generally retains the remnant texture, structure and mineral content of the rock from which it was formed, and ranges from 5 to 40 feet in thickness. Partially weathered rock has a Standard Penetration Resistance (N) of 100 blows per foot or greater and can generally be drilled with standard hollow-stem auger drilling technology. Based on geotechnical laboratory data, the partially weathered rock consisted of USCS group symbol CL. Hydraulic conductivity values ranged from 2.433×10^{-4} cm/sec to 7.154×10^{-8} cm/sec, according slug or recovery test

data (for wells screened solely in partially weathered rock).

LAYERED ROCK

Based on rock coring activities conducted near MW-7/MW-7R and visual inspection of the layered rock exposed on the north side of the MW-4 area, layered rock at the site is primarily composed of reddish to light tan gray mudstone, cross-bedded muddy sandstone, and muddy sandy conglomerate (rounded quartz gravel and cobbles). The layered rock generally occurs as horizontally oriented and relatively thin intermittent layers (especially within the upper 15 feet of contacting layered rock) across the site, based on rock coring and the horizontal fissile nature of residuum and partially weathered rock. The layered rock contained horizontal to near vertical fracturing. Large fractures, oriented approximately N 40° to 60° E at 70 ^{o} northwest, were observed in weathered mudstone to the immediate northeast near MW-8. Rock Quality Designation (RQD) values for the MW-8 area rock core (21 inch recovery) were poor (47.6%). The occurrence of layered rock at the site was generally defined by auger refusal.

1.6.3 Regional Hydrogeology

The occurrence and movement of groundwater in the Piedmont physiographic province is within two separate but interconnected water-bearing zones that typically comprise one aquifer. A shallow water-bearing zone occurs within the residuum/saprolite and a deeper zone within the underlying bedrock.

Groundwater in the residuum/saprolite zone occurs in the interstitial pore spaces between the individual grains comprising the residuum/saprolite. Groundwater in this zone is typically under water table conditions and generally flows from topographic highs to topographic lows. The occurrence and movement of groundwater in the underlying bedrock zone is controlled by joints and fractures within the bedrock. Groundwater within this deeper zone may occur under confined or semi-confined conditions, depending on the extent of fracturing at the saprolite/bedrock interface. Deeper groundwater movement is typically controlled by the distribution of openings in the bedrock and can be variable.

1.7 Groundwater Flow Characteristics

Prior to this sampling event, a synoptic groundwater gauging round occurred to establish depth-to-water below top of casing for all nine of the monitoring wells sampled as well as MW-7. Depths-to-water ranged from 7.52 feet below top of casing (MW-6) to 60.89 feet below top of casing (MW-1). Corresponding groundwater elevations ranged from 198.98 above mean sea level (msl) (MW-8) to 223.58 above msl (MW-6). Groundwater elevations measured on July 17, 2017 are shown in **Table 1**.

1.7.1 Groundwater Direction

Groundwater generally flows toward the southeastern portion of the site, although radial flow away from two topographic high points is depicted on **Figure 2**. A potentiometric surface map for groundwater elevations measured during July 2017 event are shown in **Table 1** and depicted on **Figure 2**. Groundwater elevations and general flow directions remain consistent with prior background and detection monitoring events. Historic groundwater elevations over time are depicted in **Table 2.**

Table 2: Historic Groundwater Elevations

Well ID	TOC Elev. (msl)	Depth to Water Elevation (msl)										
		Aug-15	***Oct-15***	***Nov-15***	***Jan-16***	***Feb-16***	***Apr-16***	***Jun-16***	***Jul-16***	***Jan-17***	***Apr-17***	***Jul-17***
BG-1	228.19	216.31	215.70	216.83	218.14	218.94	218.46	218.46	218.74	217.08	216.61	216.76
MW-1	280.08	220.04	220.18	220.55	222.03	222.76	221.83	221.83	221.51	220.58	219.72	219.19
MW-2	229.97	191.78	190.20	192.90	197.19	198.82	201.17	201.17	204.62	205.42	201.63	201.58
MW-3	222.56	207.62	208.46	210.29	210.64	212.31	212.36	212.36	204.81	202.35	202.36	203.91
MW-4	217.13	205.53	206.37	206.83	206.98	211.36	208.34	208.34	205.66	203.67	203.30	204.10
MW-5	244.86	232.01	229.66	230.11	230.16	228.69	220.06	220.06	222.96	203.32	221.53	222.60
MW-6	231.1	223.31	223.99	223.97	224.53	224.75	224.13	224.13	224.07	224.54	223.31	223.58
MW-7	231.71	223.45	222.36	222.53	216.11	215.31	215.66	215.65	216.21	215.42	215.59	216.09
MW-7R	242.22	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	220.92
MW-8	236.47	199.98	200.58	201.35	200.60	200.55	199.49	199.49	199.82	199.31	199.11	198.98

Notes:
1. NG – Not Gauged (MW-7R newly installed April 2017)

.

Table 3: Hydraulic Conductivity

Well ID	DTW BTOC (ft.)	Length of Water Column (ft.)	Screen Length (ft.)	Screen Interval (msl)	Estimated Effective Porosity	Hydraulic Conductivity (k, cm/sec)	Lithologic Unit
BG-1	11.11	31.94	15	200.14 - 185.14	0.075	7.76E-05	Layered Rock/PWR*
MW-1	59.50	15.80	15	220.20 - 205.20	0.075	4.11E-04	Layered Rock/PWR*
MW-2	26.34	23.81	15	196.61 - 181.61	0.05	3.41E-06	Layered Rock/PWR*
MW-3	20.21	23.15	15	194.20 - 179.20	0.05	4.08E-07	PWR
MW-4	13.46	11.88	10	201.79 - 191.79	0.14	1.41E-04	Residuum/PWR
MW-5	41.54	4.60	10	208.72 - 198.72	0.075	8.01E-06	PWR
MW-6	6.56	22.91	15	216.63 - 201.63	0.15	1.10E-04	Residuum/PWR
MW-7	16.29	0.89	10	224.53 - 214.53	0.15	1.26E-06	Residuum/PWR
MW-8	37.16	11.90	15	202.41 - 187.41	0.075	1.29E-04	PWR

Notes:
1. Depth to water measurements obtained during the Hydrogeologic Report were measured to the nearest 0.01 foot with a depth-to-water meter by Buxton Environmental, Inc. prior to slug testing.
2. TD=total depth; BGS=below ground surface; TOC=top of casing; DTW = Depth-to-Water; BTOC = below top-of-casing, msl = above mean sea level, ft.
3. Hydraulic conductivity values determined by Buxton Environmental, Inc. on September 10, 2015 by conducting rising head slug tests; and solved utilizing the Bouwer-Rice (unconfined slug test) solution with AQTESOLV for Windows Version 4.50 software by Hydrosolv, Inc. (1996-2007).
4. Effective porosity values from geotechnical testing and the literature (McWhorter and Sunada, 1977; Sinhal and Gupta, 2010) where geotechnical data was not available.
5. MW-7R was installed after the Hydrogeologic Report was submitted and MW-7 was utilized for evaluation.
* = interpreted lithologic unit based on relative drilling hardness during well installation

Table 4: Horizontal Hydraulic Gradients (i, dh/dl)

	BG-1	MW-1	MW-2	MW-3	MW-4	MW-5	MW-6	MW-7	MW-8
BG-1	-	0.0005				0.002	0.002		
MW-1		-				0.001	0.001		
MW-2	0.005	0.011	-	0.0019	0.001	0.008	0.007	0.006	
MW-3	0.006	0.006		-	0.0002	0.011	0.008	0.006	
MW-4	0.009	0.004			-	0.015	0.009	0.005	
MW-5						-	0.001		
MW-6							-		
MW-7	0.0002	0.001				0.004	0.01	-	
MW-8	0.004	0.011	0.0011	0.002	0.002	0.009	0.012	0.02	-

Notes:
1. Positive horizontal hydraulic gradients calculated by dividing the difference in hydraulic head between a well pair by the length of the flow path between the well pair. (*i*= dh/dl)
2. All well pairs assumed to be screened in same surficial aquifer unit
3. Horizontal flow path distance calculated by

$$\sqrt{(Easting_1 - Easting_2)^2 + (Northing_1 - Northing_2)^2}$$

4. Top-of-casing and ground surface elevations and horizontal locations at MW-4 (PZM-1), MW-5 (PZM-22) and MW-7 (PZM-27) determined by Lawrence Surveying of Monroe, NC.
5. Top-of-casing and ground surface elevations and horizontal locations at BG-1, MW-1, MW-3, MW-6, MW-8 and MW-7R determined by McAdams of Durham, NC.
6. Top-of-casing, ground surface and horizontal location at monitoring well MW-2 determined by Gregory C. Bewley.
7. Static water level elevations from July 17, 2017 monitoring event. See **Table 1**.
8. MW-7R was installed after the Hydrogeologic Report was submitted and MW-7 was utilized for evaluation.

1.7.2 Hydraulic Conductivity

Horizontal hydraulic conductivity of aquifer materials adjacent to the well screen were estimated through in-situ slug testing during the *Design Hydrogeologic Report* (Buxton, 2016). Results are provided in **Table 3**.

1.7.3 Horizontal Hydraulic Gradients

Horizontal hydraulic gradient is calculated by taking the difference in hydraulic head over the length of the flow path between two wells of similar construction. Hydraulic gradients at the site during this sampling event are depicted in **Table 4.**

1.7.4 Groundwater Flow Velocity

Darcy's Law is an equation that describes the flow rate or flux of fluid through a porous media. To calculate the velocity that moves through a porous media, the specific discharge, or Darcy flux, is divided by the effective porosity, P_e. The result is the average linear velocity, or seepage velocity, of groundwater between two points.

The following equation was used to calculate groundwater velocities between specific wells:

$$V_S = \frac{Ki}{P_e}$$

Where:

V_s = seepage velocity
K = horizontal hydraulic conductivity
i = horizontal hydraulic gradient
P_e = effective porosity

Seepage velocities for groundwater were calculated using horizontal hydraulic gradients and horizontal hydraulic conductivity values referenced above, and estimated effective porosity values from geotechnical testing and from the literature where geotechnical data was not available. (Buxton, 2014; Sinhal and Gupta, 2010).

Seepage velocity varies on a well-by-well basis. Throughout the study area, seepage velocity ranged from nearly 0.01 feet per year (between MW-3 and MW-4) to approximately 34.1 feet per year (between MW-1 and MW-8). The site average seepage velocity is approximately 3.1 feet per year for the evaluated screen intervals and are summarized in **Table 5.** These estimates were calculated with the most recent groundwater level measurements (July 17, 2017).

Table 5: Groundwater Flow Velocity between Well Pairs (Vs, ft./year)

	BG-1	**MW-1**	**MW-2**	**MW-3**	**MW-4**	**MW-5**	**MW-6**	**MW-7**	**MW-8**
BG-1	-	1.2				0.8	1.6		
MW-1		-				0.7	2.3		
MW-2	1.2	7.1	-	0.05	0.3	0.7	1.5	0.1	
MW-3	0.5	1.2		-	0.01	0.32	0.6	0.04	
MW-4	8.9	9.3			-	4.9	7.9	0.5	
MW-5						-	0.2		
MW-6							-		
MW-7	0.02	0.3				0.1	0.6	-	
MW-8	5.1	34.1	0.4	0.2	2.0	3.8	12.6	1.8	-

Notes:
1. Flow velocities between well pairs estimated by:

$$V_S = \frac{Ki}{P_e}$$

Where: V_s = groundwater flow velocity
K = horizontal hydraulic conductivity (See **Table 3**)
i = horizontal hydraulic gradient (See **Table 4**)
P_e = average effective porosity between given well pairs

2. Effective porosity values from geotechnical testing and the literature (McWhorter and Sunada, 1977; Sinhal and Gupta, 2010) where geotechnical data was not available.
3. MW-7R was installed after the Hydrogeologic Report was submitted and MW-7 was utilized for evaluation.

2 Sampling Procedures

2.1 Groundwater Sampling Procedures

Groundwater samples from all nine groundwater monitoring well locations were collected between July 17 and July 20, 2017 (**Figure 2**). All sampling events have been conducted in compliance of the site's Water Quality Monitoring Plan. This monitoring event was conducted by Pace Analytical Services, Inc. (Pace) of Huntersville, North Carolina (NC Certification #37706). Field data sheets are provided in **Appendix A**.

Prior to commencing groundwater sampling, new plastic sheeting was placed around the well head, in order to prevent the sampling equipment from contacting the ground surface. The well lock was then removed from the protective stand-up-cover. New nitrile gloves were donned and static groundwater levels were obtained from below the measuring point (top-of-well polyvinyl chloride (PVC) casing) at each monitoring well to the nearest 0.01 foot with a depth-to-water electrode at each monitoring well. Low flow purging and sampling was conducted utilizing a stainless-steel Proactive SS Mega Monsoon pump with flow rate controller, which was plumbed to new polyethylene sample tubing (1/2-inch outer diameter (OD) 3/8-inch inner diameter (ID)). In the event of low recharge, a peristaltic pump was utilized to purge and sample the well. The base of the pump was set at approximately two feet off the bottom depth above the well base to reduce turbidity. The following information was recorded at timed intervals during the purging process: 1) water levels (below top of casing), 2) purge flow rate, 3) purge rate and cumulative water pumped, and 4) field parameters. Temperature, conductivity, pH, oxygen reduction potential (ORP), and dissolved oxygen (DO) were recorded with a Horiba U-52 meter; and turbidity was recorded with a Micro-TPW meter.

Purging was conducted until a minimum of three well volumes of water had been removed and the below field parameters requirements have been met and stabilized. All measurements, except turbidity, were obtained using a flow-through-cell, while turbidity measurements are obtained before water enters the flow-through-cell.

- Turbidity (10% for values greater than 5 NTU (if three turbidity values are less than 5 NTU, the values are considered stabilized)
- DO (10% for values greater than 0.5 mg/L, if three DO values are less than 0.5 mg/L, the values are considered stabilized)
- Specific conductance (3%)
- Temperature (3%)
- pH ($\pm$ 0.1 unit)
- ORP ($\pm$ 10 millivolts)

If field parameters had stabilized prior to purging three well volumes, or the well was going dry, groundwater samples were then collected. The water level meter and low flow pump were decontaminated in the field with a distilled water rinse, Alconox® wash, and a distilled water rinse, prior to and following sampling at each monitoring well. Following sampling, locks were

placed back on the well stand-up covers. Purge water was discharged to the ground surface at respective well heads.

All samples for this current reporting period were shipped under proper management and Chain of Custody (COC) procedures to Pace Analytical Services, Inc. Sample handling and custody was performed according to the EPA Guidance for Field Samplers.

2.2 Surface Water Sampling Procedures

New nitrile gloves were donned prior to collecting surface water samples. Field parameters (including temperature, conductivity, pH, ORP, and DO) were recorded with a Horiba U-52 meter; turbidity was recorded with a Micro-TPW meter.

Surface water samples were attempted from two locations outside of the structural fill boundary to provide for potential groundwater to surface water interactions and evaluation of potential off-site impacts. The SW-1 sampling location is south of the site, approximately 3,000 feet south of the structural fill boundary along an unnamed tributary of Gulf Creek. The SW-2 sampling located west-northwest of the site, approximately 3,200 feet west of the structural fill boundary along Shaddox Creek. SW-2 however, was found to be dry on each attempt to obtain a sample during this event. Approximate surface water sampling locations are depicted on **Figure 3**.

Gulf Creek and Shaddox Creek are classified as Class WS-IV Waters by NCDEQ and as such are evaluated under North Carolina Surface Water and Wetland Standards (15A NCAC 02B).

2.3 Leachate Sampling Procedures

New nitrile gloves were donned prior to collecting leachate water samples. Field parameters (including temperature, conductivity, pH, ORP, and DO) were recorded with a Horiba U-52 meter; turbidity was recorded with a Micro-TPW meter.

One leachate sample was collected from on-site storage holding tanks. This leachate sample is used to provide an evaluation of potential on-site leachate impacts. The approximate leachate sampling location is depicted on **Figure 4**.

3 Background Conditions and Results

Groundwater analytical results for the constituents listed in 40 CFR 257 Appendix III detection monitoring and 40 CFR 257 Appendix IV assessment monitoring (as previously discussed in **Section 1.2**) were compared to background concentrations to determine if any impact to groundwater is indicated. If any impact to groundwater is inferred from groundwater detection monitoring or if a potential impact is detected, Charah must notify NCDEQ within 14 days. In the event no new potential impacts are observed, Charah must submit a report of the sampling results to NCDEQ with 120 days per the approved Water Quality Plan (90 days per the CCR Rule) of the sampling event.

Groundwater samples were analyzed for assessment monitoring constituents (EPA 40 CFR 257 Appendix IV). Assessment monitoring typically occurs if a statistically significant increase in a detection monitoring constituent is noted and will be further assessed in subsequent reporting. Per the NCDEQ approved Water Quality Monitoring Plan, Appendix IV constituents were analyzed for background events and will continue to be assessed during future semi-annual monitoring events. Groundwater monitoring samples were also analyzed for 40 CFR Part 258 Appendix I metals and volatile organic compounds (VOCs).

A summary of the laboratory parameters detected during the 2017 Second Semi-Annual Detection Monitoring events, along with the highest detected concentration result, is provided in the sections below. Field data sheets are provided in **Appendix A**. Full laboratory report for the monitoring event is provided in **Appendix B** and electronic data deliverables (EDDs) in **Appendix C**.

3.1 Background Site Conditions

Prior to CCR placement, the site groundwater samples (i.e. laboratory analysis from the first and second monitoring events) exhibited high chloride and TDS concentrations in the background well. Additionally several monitoring wells showed continued elevated levels (i.e. same order of magnitude as the NC 2L Groundwater Protection Standards (NCGPS)) or exceedances of NC 2L Standards for antimony, arsenic, barium, chromium, cobalt, lithium, pH, sulfate and vanadium. Surface water samples also exhibited exceedances of NC Surface Water & Wetland Standards for copper and cobalt as well as detections of all of the EPA Appendix III constituents.

The trihalomethanes, bromodichloromethane and dibromochloromethane were detected above NCGPS in groundwater samples from MW-2, MW-3, and MW-7 during the first monitoring event. VOCs, including trihalomethanes, are not present naturally at the site. These detections are attributed to the use of municipal water during previous development activities. These trihalomethanes were only detected in the first sampling event (Round 1); all VOCs were non-detect for the subsequent (2nd through 8th) background sampling events.

A detailed discussion of background groundwater conditions can be found in the *2016 Background Sampling Report* (HDR, 2016b). Additional discussion of the statistical results can be found in **Section 4.0** of this report for a better understanding of predictive limits for the

background well location BG-1 as well as Interwell interactions. Additionally, further discussion of groundwater flow directions, horizontal hydraulic conductivities, horizontal hydraulic gradient calculations and groundwater flow velocities (i.e. seepage velocity) can be found in the *Design Hydrogeologic Report* (Buxton, 2015b).

3.2 2017 Second Semi-Annual Detection Monitoring Groundwater Analytical Results

The focus of this section is the analytical results from the July 17 - 20, 2017 event. Constituent concentrations with exceedances of respective NC 2L Standards for this event are provided below. The monitoring well location of the highest concentration for a given constituent is provided in parentheses.

A summary of the findings from this monitoring event is provided below and depicted in **Table 6**:

EPA Appendix I VOC Detections

- No VOCs were detected in any well

EPA Appendix I Metal Detections

- Vanadium: <0.3 µg/L to 17.6 µg/L (MW-7R)

EPA Appendix III Constituent Detections

- Chloride: 18,200 to 1,280,000 µg/L (MW-2)
- pH: 6.3 to 9.6 SU (MW-7R)
- Total Dissolved Solids: 220,000 to 2,670,000 µg/L (MW-2)

EPA Appendix IV Constituent Detections

- Barium: 101 to 1,190 µg/L (MW-8)
- Cobalt: <1.0 to 5.3 µg/L (MW-4)
- Thallium: <7.7 µg/L to 0.48 µg/L (MW-7R)

No standards have yet been established under the NCGPS nor the Federal Maximum Contaminant Levels in drinking water (Federal MCL) for detected constituents calcium, lithium, molybdenum and Radium 226/Radium 228.

Laboratory analytical results from this sampling event (including exceedances) remained consistent at the site. The groundwater monitoring wells and single background monitoring well (BG-1) consistently shows elevated concentrations of both Appendix III and Appendix IV constituents, which were also observed in pre-CCR placement conditions (Rounds 1 and 2).

In this event, barium, chloride, pH, TDS and thallium were detected above the NC 2L Standard/Federal MCL standards. The presence of naturally occurring metals and pH above the NCGPS is common in North Carolina due to various geologic conditions. This naturally occurring presence (i.e. weathering of crystalline parent material) was discussed in more detail in the *Initial Background Groundwater & Surface Water Monitoring Event* (Buxton, 2015c).

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Table 6: Analytical Detections and Exceedances

July 2017

		Groundwater Analysis											Quality Control			Surface Water Analysis			Leachate Analysis
Analyte	**CAS Number**	BG-1	MW-1	MW-2	MW-3	MW-4	MW-5	MW-6	MW-7R	MW-8	***NCGPS***	***Federal MCL***	Equip. Blank	Amb. Blank	Duplicate (MW-6)	SW-1	SW-2	***NCSWWS***	Leachate-1
EPA APPENDIX III																			
Boron (µg/l)	7440-42-8	ND	ND	50.2	ND	ND	ND	ND	25.3	ND	*700*	--	ND	ND	ND	ND	NT	*NS*	2,120
Calcium (µg/l)	7440-70-2	29,000	159,000	208,000	138,000	63,900	11,400	35,400	87,700	117,000	*NS*	*NS*	ND	ND	37,100	10,900	NT	*NS*	216,000
Chloride (µg/l)	16887-00-6	**283,000**	**603,000**	**1,280,000**	**1,010,000**	**515,000**	19,600	245,000	**312,000**	**473,000**	*250,000*	--	ND	ND	238,000	7,000	NT	*250,000*	12,700
Fluoride (µg/l)	16984-48-8	110	170	400	490	310	540	370	320	ND	*2,000*	--	ND	ND	460	390	NT	*1,800*	180
pH* (standard units)	pH	6.5	6.6	7.5	7.1	6.2	7	6.5	**9.6**	6.9	*6.5-8.5*	--	NT	NT	NT	7.4	NT	*6.0-9.0*	7.3
Sulfate (µg/l)	14808-79-8	17,800	9,300	226,000	125,000	10,800	5,600	86,900	51,200	6,300	*250,000*	--	ND	ND	75,000	3,200	NT	*250,000*	477,000
Total Dissolved Solids (µg/l)	TDS	**606,000**	**1,060,000**	**2,670,000**	**1,870,000**	**1,150,000**	228,000	**692,000**	**740,000**	**934,000**	*500,000*	--	ND	ND	662,000	**1,690,000**	NT	*500,000*	1,040,000
EPA APPENDIX IV																			
Antimony (µg/l)	7440-36-0	ND	ND	ND	ND	ND	ND	ND	ND	ND	*1*	--	ND	ND	ND	ND	NT	*5.6*	8.6
Arsenic (µg/l)	7440-38-2	ND	ND	ND	ND	ND	ND	ND	ND	ND	*10*	--	ND	ND	ND	**18**	NT	*10*	33.4
Barium (ug/l)	7440-39-3	327	171	177	496	332	103	98.8	50.1	**1,190**	*700*	--	ND	ND	95	719	NT	*1,000*	160
Beryllium (µg/l)	7440-41-7	ND	ND	ND	ND	ND	ND	ND	ND	ND	*4*	--	ND	ND	ND	3.3	NT	*6.5*	ND
Cadmium (µg/l)	7440-43-9	ND	ND	ND	ND	ND	ND	ND	ND	ND	*2*	--	ND	ND	ND	ND	NT	*2*	ND
Chromium (µg/l)	7440-47-3	ND	ND	ND	9.4	ND	ND	ND	8.1	ND	*10*	--	ND	ND	ND	24.9	NT	*50*	ND
Cobalt (µg/l)	7440-48-4	ND	ND	ND	ND	**5.3**	ND	ND	ND	ND	*1*	--	ND	ND	ND	**10.6**	NT	*3*	ND
Fluoride (µg/l)	16984-48-8	110	170	400	490	310	540	370	320	ND	*2,000*	--	ND	ND	460	390	NT	*1,800*	180
Lead (µg/l)	7439-92-1	ND	ND	ND	ND	ND	ND	ND	ND	ND	*15*	--	ND	ND	ND	**56.4**	NT	*25*	ND
Lithium (µg/l)	7439-93-2	19.8	36.1	154	97.1	27.7	9.3	45.3	5.6	27.7	*NS*	*NS*	ND	ND	38.1	ND	NT	*NS*	68.2
Mercury (µg/l)	7439-97-6	ND	ND	ND	ND	ND	ND	ND	ND	ND	*1*	--	ND	ND	ND	ND	NT	*0.012*	ND
Molybdenum (µg/l)	7439-98-7	ND	ND	9.3	6.1	ND	ND	ND	19.5	ND	*NS*	*NS*	ND	ND	ND	5.8	NT	*160*	288
Selenium (µg/l)	7782-49-2	ND	ND	ND	ND	ND	ND	ND	ND	ND	*20*	--	ND	ND	ND	ND	NT	*5*	11.1
Thallium (µg/l)	7440-28-0	ND	ND	ND	ND	ND	ND	ND	**0.48**	ND	*0.28*	--	ND	ND	ND	ND	NT	*0.24*	0.66
Radium 226 (pCi/l)	13982-63-3	0.151	0.601	0.74	1.19	0.684	0.12	0.227	-0.059	1.05	*NS*	*5 (combined)*	0.161	-0.112	0.173	0.748	NT	*NS*	0.626
Radium 228 (pCi/l)	15262-20-1	0.132	0.508	1.54	2.27	0.819	0.369	0.68	0.585	0.594	*NS*		-0.112	0.0533	0.546	0.951	NT	*NS*	0.372
EPA APPENDIX I METALS																			
Copper (µg/l)	7440-50-8	ND	ND	ND	ND	ND	ND	ND	ND	ND	*1,000*	--	ND	ND	ND	**25.2**	NT	*7*	5.7
Nickel (µg/l)	7440-02-0	ND	ND	ND	ND	5.2	ND	ND	ND	ND	*100*	--	ND	ND	ND	12.8	NT	*88*	14.6
Silver (µg/l)	7440-22-4	ND	ND	ND	ND	ND	ND	ND	ND	ND	*20*	--	ND	ND	ND	ND	NT	*0.06*	ND
Vanadium (µg/l)	7440-62-2	**5.5**	ND	ND	ND	ND	ND	ND	**17.6**	ND	*0.3*	--	ND	ND	ND	93	NT	*NS*	39.7
Zinc (µg/l)	7440-66-6	ND	28	10.7	ND	ND	16.6	ND	ND	50.7	*1,000*	--	ND	ND	ND	**95.6**	NT	*50*	28
EPA APPENDIX I VOC'S																			
Acetone (µg/l)	67-64-1	ND	ND	ND	ND	ND	ND	ND	ND	ND	*6,000*	--	ND	ND	ND	ND	NT	*2,000*	ND
Bromodichloromethane (µg/l)	75-27-4	ND	ND	ND	ND	ND	ND	ND	ND	ND	*0.6*	*80 (all THM's)*	ND	ND	ND	ND	NT	*NS*	ND
Bromoform (µg/l)	75-25-2	ND	ND	ND	ND	ND	ND	ND	ND	ND	*4*		ND	ND	ND	ND	NT	*4.3*	ND
Chloroform (µg/l)	67-66-3	ND	ND	ND	ND	ND	ND	ND	ND	ND	*70*		ND	ND	ND	ND	NT	*5.6*	ND
Dibromochloromethane (µg/l)	124-48-1	ND	ND	ND	ND	ND	ND	ND	ND	ND	*0.4*		ND	ND	ND	ND	NT	*NS*	ND
Carbon Disulfide (µg/l)	75-15-0	ND	ND	ND	ND	ND	ND	ND	ND	ND	*700*	--	ND	ND	ND	ND	NT	*NS*	ND
Dibromomethane (µg/l)	74-95-3	ND	ND	ND	ND	ND	ND	ND	ND	ND	*70*	--	ND	ND	ND	ND	NT	*47*	ND
1,4-Dichlorobenzene (µg/l)	106-46-7	ND	ND	ND	ND	ND	ND	ND	ND	ND	*6*	--	ND	ND	ND	ND	NT	*63*	ND

Notes:

1. Groundwater, surface water, and leachate samples collected from July 17-20, 2017 and analyzed for above parameters by Pace Analytical Laboratories
2. ND = below detection limits; NE = not established; NS = no standard; NT = not tested; VOC's = volatile organic compounds
3. NCGPS = North Carolina Groundwater Protection Standard (J-flagged data not considered)
4. Federal MCL = Federal Maximum Contaminant Level in drinking water (Federal MCL provided when no established NCGPS; or for further clarification as with THM's)
5. NCSWWS = North Carolina Surface Water and Wetland Standards (15A NCAC 02B) for Gulf Creek (SW-1) and Shaddox Creek (SW-2) which are both Class WS-IV Waters or are National Criteria per EPA
6. THM's = trihalomethanes (bromodichloromethane, bromoform, chloroform and dibromochloromethane) (all generally associated with the breakdown of chlorinated municipal water in contact with natural water)
7. **Bold** and **shade** denotes above established NCGPS's or NCSWWS; µg/l = micrograms per liter; pCi/l - picocuries per liter
8. pH was field tested by Pace Analytical Laboratories
9. MW-7 was replaced by MW-7R by SAEDACCO on April 19, 2017

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3.3 Surface Water Analytical Results

Surface water samples (**Figure 3**) were compared to the North Carolina Surface Water and Wetland Standard (15A NCAC 02B) or EPA National Criteria standard (utilized by North Carolina Division of Water Quality as default standards for parameters not listed in 02B). Laboratory analytical results from this sampling event indicated TDS (1,690,000 µg/L), arsenic (18 µg/L), cobalt (10.6 µg/L), lead (56.4 µg/L), copper (25.2 µg/L) and zinc (95.6 µg/L) in surface water sample SW-1 exceeded its respective 15A NCAC 2B standard. SW-2 was attempted during this 2017 Second Semi-Annual Detection Monitoring event but was dry each time.

Cobalt and copper showed exceedances in pre-CCR placement monitoring events at surface sampling locations. For this event TDS, arsenic, lead, and zinc were also detected within the same order of magnitude or intermittent exceedances of the respective North Carolina Surface Water and Wetland Standards or EPA National Criteria standards. Regional and localized rainfall during this sampling event may have contributed to the increased presence of these parameters. These constituents will be monitored in subsequent sampling events.

No other surface water exceedances were detected during the 2017 Second Semi-Annual Detection Monitoring event.

3.4 Leachate Analytical Results

Leachate generated on-site was collected during the most recent monitoring event to characterize the nature of CCR leachate (**Figure 4**). Parameters decreased or remained similar when compared to prior sampling events.

Leachate sampling is required by the Permit to Operate and is disposed of in compliance with the Clean Water Act at either of the aforementioned permitted disposal facilities.

4 Statistics

4.1 Methodology

An analysis of the groundwater data set including the Second Semi-Annual monitoring event was performed. The data was statistically analyzed using a combination of Starpoint Software, Inc.'s ChemPoint® and ChemStat® as well as EPA's ProUCL statistical software packages. Prediction Limits (PL) and proposed site standards for constituents, measured in background well BG-1 for the Site, were developed in accordance with Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities - Unified Guidance. Additionally, interwell statistical analysis was conducted for the detected groundwater results during the July 2017 sampling event in the Brickhaven No. 2 Mine Tract "A" Structure Fill Site. The newly installed MW-7R was not included in this analysis due to the limited number of sample sets (i.e. less than four monitoring events).

Furthermore, Chatham County hired consultant Smith & Gardner, Inc. (S&G) of Raleigh, North Carolina to perform independent testing (for the 2nd and 4th Quarter of each calendar year) in addition to and in conjunction with the approved semi-annual detection monitoring schedule. Split samples are collected by Pace during these quarterly events to incorporate in the statistical database only.

A statistical summary is included below while the decision flow chart for each parameter and well is shown in **Figure 5**. The data analysis includes the following.

- Test for Outliers
- Adjustment of Non-Detects (NDs)
- Distribution Assessment
- Prediction Limits
- Interwell Comparison
- Statistically Significant Increases
- Trend Analysis

4.1.1 Test for Outliers

Parameters measured during prior sampling events and this most recent monitoring period (i.e., the entire record for a parameter pooled over the 8 downgradient wells and the background well BG-1) were tested for outliers using Rosner's test (valid for sample sizes > 25). Any values identified as outliers were noted in the statistical summary table found in **Appendix D**. However, outliers from downgradient wells were not removed from subsequent analyses, unless the analytical result's quality assurance review determined that the values in question were impacted and sources of impact were known. Outlier tests were not performed for parameters that did not have any measured values greater than its applicable MDL.

Boron and Lithium detected at MW-2 and barium and zinc detected at MW-8 were determined to be outliers during this July 2017 monitoring event. These were evaluated as outliers relative

to all parameters' values collected over the eleven sampling events from each and all wells. The outliers are included in the Interwell statistics.

4.1.2 Adjustment for Non-Detects

Non-detects (NDs) are analytical results reported as below the MDL and are adjusted based on the percentage of below Method Detection Limit (bMDL) values. When less than 15 percent of values for a parameter are NDs, those values are replaced with a value equal to ½ the MDL. When 15 percent to 50 percent of values are reported as NDs, the NDs are adjusted using Regression on Order Statistics (ROS). When more than 50 percent of values for a parameter are reported NDs, the value for a non-detect is replaced with the MDL.

4.1.3 Distribution Assessment

The data distribution is evaluated for each constituent to determine whether the distribution satisfies normality assumptions necessary for further statistical analysis. Normality is currently evaluated using the Shapiro-Wilks Normality test, which applies to cases where there are fewer than 50 samples. There are currently 11 historic monitoring events. Distributions are first evaluated using non-transformed data, and then, if the distribution does not satisfy normality assumptions, it is tested again using natural log (ln) transformed data.

4.1.4 Predictive Limits Determination

An evaluation is performed to determine whether the distribution of each constituent for background well satisfies normality assumptions for further statistical analysis.

The background well calculated PLs are tabulated and compared to 2L Standards or EPA Maximum Concentration Limit (MCL) in Table 1 in **Appendix D**.

4.1.5 Interwell Comparison

Parameter concentrations from compliance wells are compared to corresponding Prediction Limits (PLs) from the background well. Concentrations measured during this sampling event represent the compliance well condition in the interwell comparison. The entire record of measurements from the background well is evaluated to determine whether a Parametric Prediction Limit (PPL) or a Non-parametric Prediction Limit (NPPL) can be used to estimate background well PLs. This evaluation depends on the percentage of measurements below their MDL and whether a distribution satisfies normality assumptions. For parameters with less than 50 percent of measurements from all wells reported as below their MDL and a distribution that satisfies normality assumptions from the background well, a PPL is calculated. For Parameters with greater than 50 percent measurements reported as below their MDL or having a distribution that does not satisfy normality assumptions, an NPPL is calculated.

The detected parameters above the MDL from each compliance well during the July 2017 sampling event is compared to the background well Parametric or non-parametric Prediction Limit. Parameters are considered to be within compliance limits if the July 2017 sampled concentration from the compliance well is less than the background well PL. Otherwise, compliance well values are evaluated to determine the nature of any increases and trends over time.

4.1.6 Statistically Significant Increase (SSI) & Trend Assessment

If the most recently sampled compliance well value exceeds the background well Upper Prediction Limit (UPL), then that value represents a statistically significant increase (SSI) over background. When the UPLs are exceeded, HDR will provide interpretation as to the impact of the exceedance by referencing the trend results. A statistically significant trend where concentrations are increasing over time does suggest that future samples are at a higher risk of exceedances than trends that are either flat or declining over time. The Thiel-Sen procedure ("Sen's Slope Estimator") is used to evaluate trends for each parameter where an SSI is found for the July 2017 monitoring event. The Sen's trend analysis may be used as an indicator as to whether the next few sampling events for a parameter will be increased, decreased, or unchanged. If the data had five or more non-detects over the 11 sampling events, no trend analysis was done, as little statistical information can be gleaned at that level of censorship.

4.1.7 Time Series Plots

Graphs of concentration versus time for all wells are provided for each parameter detected above the MDL this event. The trends in the time series plots graphically display changes in concentrations over time and substantiate the findings from Sen's Slope Estimator tests. The time series plots for all detected parameters can be found in the Statistics Output (**Appendix D**).

4.2 Statistical Analysis & Results

The ChemStat® statistical analysis identified the parameters with a statistically significant increase (SSI) over the background levels for the down/side gradient wells. The results are summarized in Table 1 of **Appendix D**.

4.2.1 Predictive Limits Results

Based on the results from the "Prediction Limits for Background Well Parameters" report, the parameters barium, boron, calcium, chloride, lithium, radium-226, radium-228, and sulfate from the background wells follow normal distributions. Parametric 95 percent upper prediction limits (95% UPL) were estimated for these parameters. The NDs for radium-228 from BG-1 were converted to half the MDL prior to the 95% UPL test since less than 15 percent of the sample consisted of NDs. Compliance observations for these parameters from the July 2017 sampling event were compared to their respective 95% UPLs. Both boron and radium-226 data in the background well follow a normal distribution pattern after the NDs data adjustment with Regression on Order Statistics method (ROS). The detected boron and radium-226 samples from the compliance wells were compared to their respective 95% UPLs.

For the parameters in BG-1 that detected more than 50% frequency, but do not follow normal or log normal distribution using Shapiro-Wilks test (including fluoride and total dissolved solids (TDS)) or for parameters detected with less than 50% frequency (molybdenum and zinc), the 95% Chebyshev Upper Prediction Limits (95% Chebyshev UPL) were calculated. For parameters with detections at or fewer than 4 events during the 11 sampling events from the background well (including chromium, cobalt, and nickel), the UPLs were calculated using the Non-Parametric Prediction Limit (NPPL) method.

All the results are shown in the summary table in **Appendix D**. The results are summarized as follows:

Parameters with Statistically Significant Increase (SSI) above Background PL for the 2017 Second Semi-Annual Detection Monitoring event:

- **Barium:** Barium observations from MW-3 and MW-8 have statistically significant increases (SSIs) above the background 95% UPL. However, barium results show no trend or downward trend over time for these wells using Sen's slope estimator tests.
- **Boron**: Boron observation from MW-2 has SSIs compared to the background 95% UPL. However, the results show no trend over time using Sen's slope estimator tests.
- **Calcium**: Calcium observations from MW-1 to MW-4 and MW-8 have SSIs compared to the background 95% UPL. However, the results show no trend or downward trend overtime using Sen's slope estimator test with the exception of MW-1 and MW-2 where calcium concentrations showed an upward trend.
- **Chloride**: Chloride observations from MW-1 to MW-4 and MW-8 have SSIs compared to the background 95% UPL. However, only the results for MW-1 and MW-2 showed upward trend over time using Sen's slope estimator tests.
- **Chromium**: Chromium detected at MW-3 has SSI compared to the background NPPL; but there is no trend in the chromium results over time at this well using Sen's slope estimator test.
- **Cobalt:** Cobalt detected at MW-4 has SSI compared to the background NPPL; but there is no trend in the cobalt results over time at this well using Sen's slope estimator test.
- **Fluoride**: Fluoride observations from MW-2 to MW-6 have SSIs compared to the background 95% Chebyshev UPL. However, the fluoride results showed no trend or downward trend over time for these wells using Sen's slope estimator tests.
- **Lithium**: Lithium observations from MW-2, MW-3, and MW-6 have SSIs compared to the background 95% UPL. The results at MW-2 showed an upward trend, but there is no trend at MW-3 and MW-6 over time using Sen's slope estimator tests.
- **Molybdenum**: Molybdenum observations detected at MW-2 showed SSIs above the background 95% Chebyshev UPL. However, the results show a downward trend over time using Sen's slope estimator tests.
- **Nickel:** Nickel detected at MW-4 has SSI compared to the background NPPL. However, there is no trend in the nickel results over time at this well using Sen's slope estimator test.
- **Radium-228:** Radium-228 observation from MW-3 has SSIs compared to the background 95% UPL. However, the results show no trend over time using Sen's slope estimator tests.
- **Sulfate**: Sulfate observations from MW-2, MW-3, and MW-6 have SSIs over the background 95% UPL. However, the results showed no trend over time for these wells using Sen's slope estimator tests.
- **Zinc**: Zinc observations detected from MW-1, MW-5, and MW-8 have SSIs above the 95% Chebyshev UPL of background well. However, the results showed no trend for zinc from all these wells over time using Sen's slope estimator tests.

With the exception of calcium and chloride at MW-1 and MW-2 as well as lithium at MW-2, all constituents with SSI were determined to have no trend or downward trends using Sen's slope estimator tests. All remaining monitored constituents either are not detected, not above the MDL or are not statistically significant above the background concentration levels. **Table 7** depicts a summary of statistically significant constituents with trends in the next section.

5 Summary

The 2017 Second Semi-Annual Detection Monitoring event was conducted at Brickhaven No. 2 Mine Tract "A" Structural Fill site from July 17 – 20, 2017. The detections are similar to the background levels and therefore do don't demonstrate impact from the structural fill placement. A summary of the findings from the 2017 Second Semi-Annual Detection monitoring event is provided below**.**

5.1 Groundwater

- Constituents above established NCGPS or Federal MCL were detected in MW-1, MW-2, MW-3, MW-4, MW-6, MW-7R, MW-8 and the background monitoring well BG-1.
- No standards have been yet to be established by NCGPS nor the Federal MCL for the detected constituents calcium, lithium, molybdenum and Radium 226/Radium 228.
- Laboratory analytical results from the sampling event remained constant in groundwater concentrations for Appendix III constituents in most of the monitoring wells with the exception of MW-7R reporting increases in pH.
- Monitoring well MW-8 showed exceedances in barium, monitoring well MW-4 showed exceedances in cobalt, while monitoring well MW-7R showed exceedances in thallium and vanadium. All remained constant in groundwater concentrations when compared with pre-CCR placement conditions.
- The groundwater monitoring wells and single background monitoring well (BG-1) consistently show elevated concentrations of Appendix III and Appendix IV constituents, (barium, cobalt, chloride, pH, thallium, and TDS) which were also observed in pre-CCR placement conditions.

5.2 Surface Water

- Laboratory analytical results from this sampling event indicated TDS, arsenic, cobalt, lead, copper and zinc in surface water sample SW-1 were in exceedance of its respective 15A NCAC 2B standard. These constituents were detected within the same order of magnitude or intermittent exceedances of the respective North Carolina Surface Water and Wetland Standards or EPA National Criteria standards. These constituents have also been detected in pre-CCR placement monitoring events.
- Regional and localized rainfall during this sampling event may have contributed to the increased detection of these parameters. Constituents will be monitored in subsequent sampling events.
- SW-2 was attempted during this event but was dry each time.

5.3 Leachate

- Leachate sample parameters exhibited similar or decreased concentrations when compared to prior sampling events.

5.4 Statistical Analysis

- The analysis is based on 11 monitoring events (three more than the required eight). Additional sampling events will provide greater refinement and confidence of statistical significance.
- Boron and lithium detected at MW-2 as well as barium and zinc detected at MW-1 during the 2017 Second Semi-Annual Detection Monitoring Event were determined to be outliers relative to all of the parameter values collected over the nine sampling events from all wells to date.
- **Table 7** depicts those parameters with statistical significance compared to background at each well location and its relative trend based on the Sen's slope estimator test.
- The SSI(s) over background levels for EPA Appendix III constituents; calcium and chloride as well as EPA Appendix IV constituent; lithium generally resulted from natural variation in groundwater quality and remain consistent with pre-CCR placement conditions at the site.

Table 7: Statistically Significant Constituents with Trends

Constituent with SSI	Comparison of Recent Results to Standard	MW-1	MW-2	MW-3	MW-4	MW-5	MW-6	MW-7	MW-8
Barium	**Above NCGPS**			▼					▶
Boron	Below NCGPS		▶						
Calcium	No Standard	▲	▲	▼	▶				▶
Chloride	**Above NCGPS**	▲	▲	▶	▶				
Chromium	Below NCGPS								
Cobalt	**Above NCGPS**								
Fluoride	Below NCGPS		▼	▶	▶	▼	▶		
Lithium	No Standard		▲	▶			▶		
Molybdenum	No Standard		▼						
Nickel	Below NCGPS								
Radium-228	No Standard			▶					
Sulfate	Below NCGPS		▶	▶			▶		
Zinc	Below NCGPS	▶				▶			▶

▲	Upward Trend
▼	Downward Trend
▶	No Trend
Blank	N/A No SSI

6 Recommendations

Based on the findings of this assessment, HDR makes the following recommendations:

- Incorporate MW-7R into statistical analysis after four sampling events.
- Continue to sample quarterly to improve dataset for greater statistical confidence
- Continue communication with NCDEQ related to ongoing detection monitoring and further refinement of the background statistical analysis.

7 References

Buxton Environmental. 2015a. *Water Quality Monitoring Plan for Brickhaven No.2 Mine Tract "A" Structural Fill.*

Buxton Environmental. 2015b. *Compliance Groundwater Well Installation, Development, Surveying and Hydraulic Conductivity Determination Activities Report for Brickhaven No.2 Mine Tract "A" Structural Fill.*

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HDR. 2015. *2015 Semi-Annual Groundwater, Surface Water, and Leachate Sampling Report. December 2015.*

HDR. 2016a. *2016 First Semi-Annual Groundwater, Surface Water, and Leachate Sampling Report. May 2016.*

HDR. 2016b. *Background Sampling Report. November 2016.*

HDR. 2017. *2017 Initial Semi-Annual Detection Monitoring Report. January 2017.*

North Carolina Department of Natural Resources and Community Development. 1985. *North Carolina Geologic Map.*

North Carolina General Assembly. *Coal Ash Management Act (CAMA) of 2014 (Senate Bill 729).* Ratified.

NCDEQ. 2008. *Solid Waste Section Guidelines for Groundwater, Soil, and Surface Water Sampling.*

Singhal, B. B.S. and R. P. Gupta. 2010*. Applied Hydrogeology of Fractured Rocks: Springer, 2nd Edition*, 408p. (Table 8-1, p. 140)

United States Geological Survey. 2004. *Arsenic, Nitrate, and Chloride in Groundwater, Oakland County, Michigan.*

Figures

Figure 1: Regional Site Location Map
Figure 2: Potentiometric Surface Map – July 2017
Figure 3: Surface Water Sample Location Map
Figure 4: Leachate Sample Collection Location
Figure 5: Statistical Flow Chart

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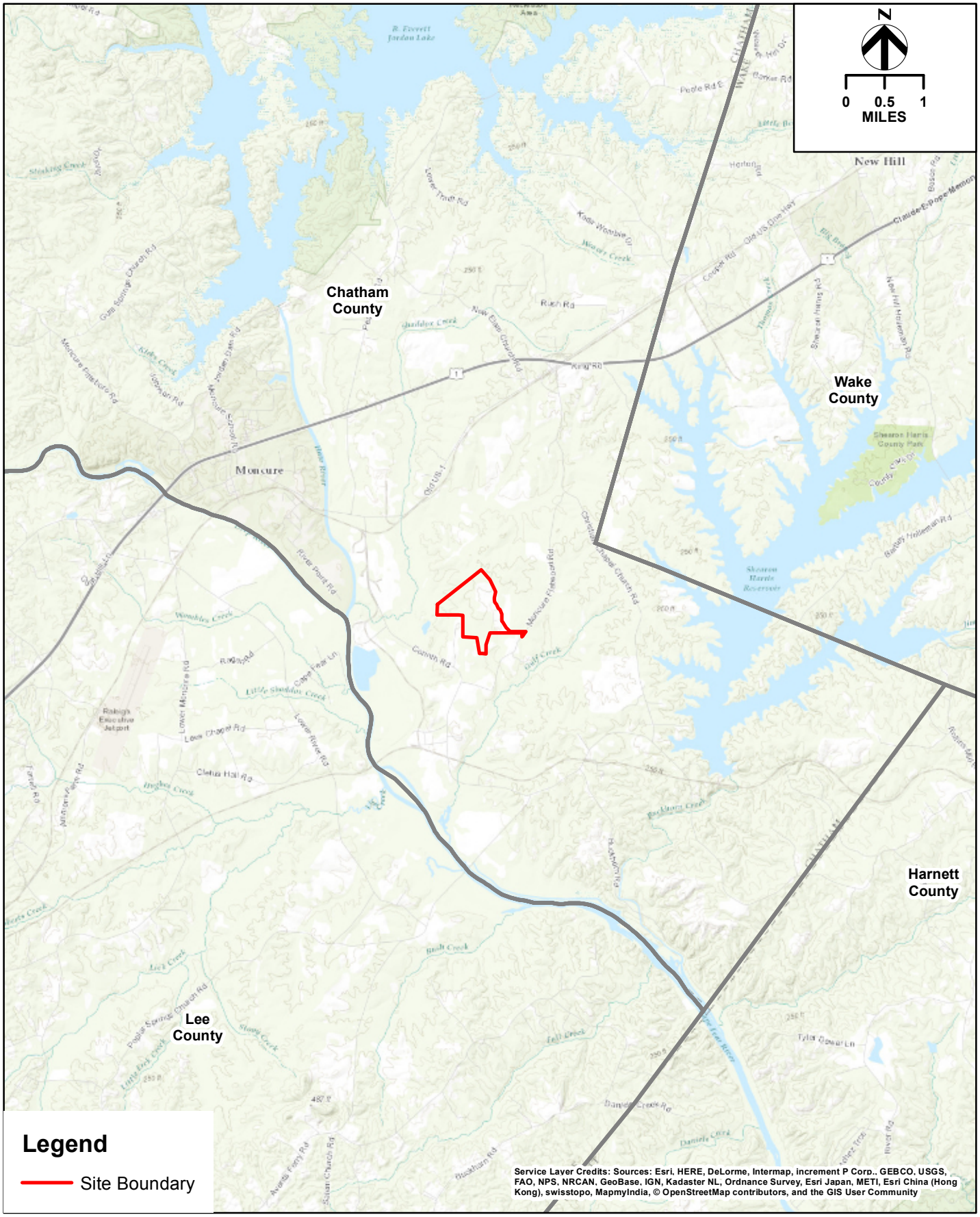

REGIONAL SITE LOCATION MAP
CHARAH, LLC
MONCURE, NORTH CAROLINA

BRICKHAVEN NO. 2 MINE TRACT "A"

DATE

OCTOBER 2017

FIGURE

1

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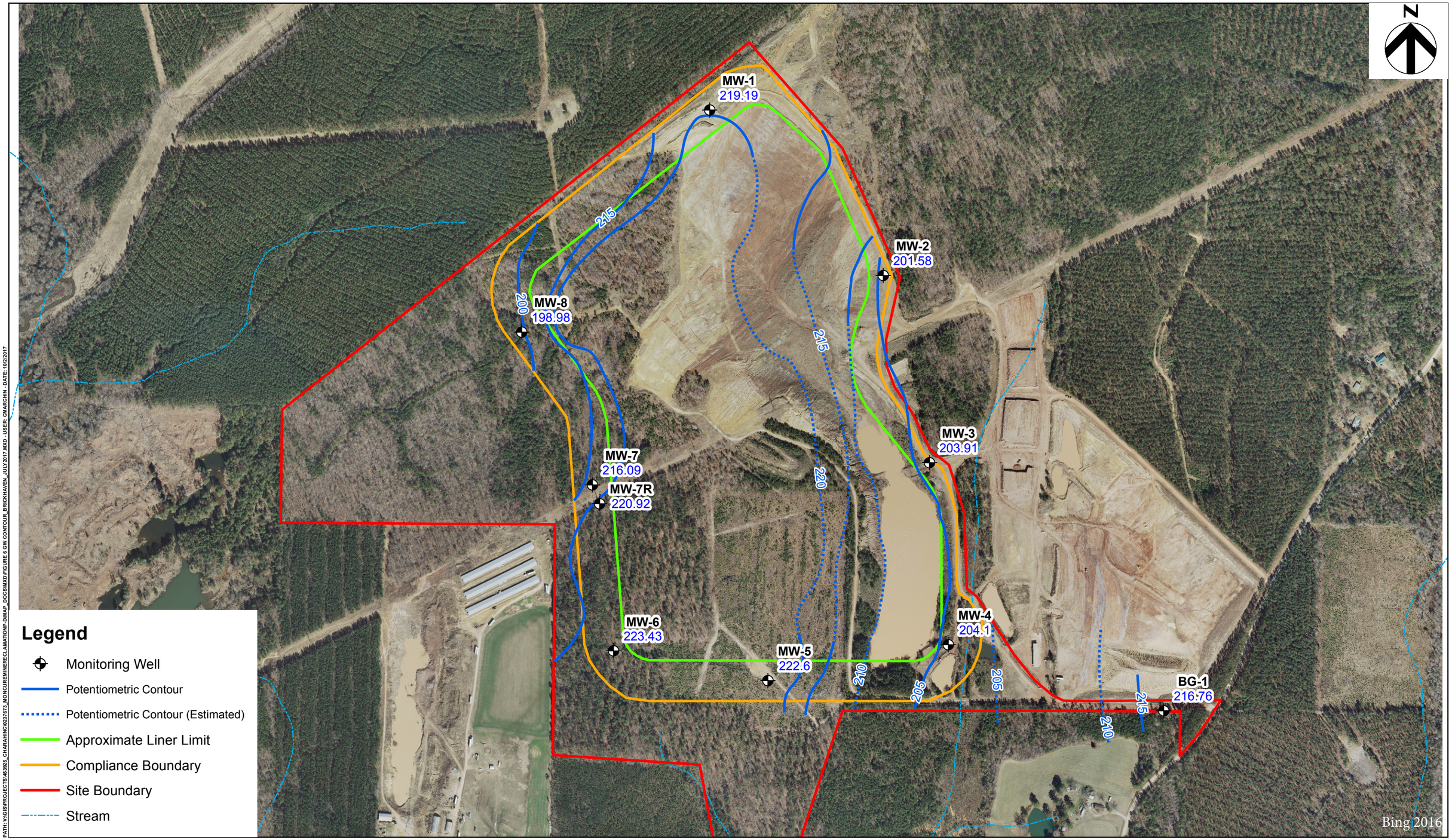

PATH: V:\GIS\PROJECTS\453925_CHARAHINC\0237673_MONCUREMINERECLAMATIONP-DMAP_DOCS\MXD\FIGURE 6 GW CONTOUR_BRICKHAVEN_JULY2017.MXD - USER: CMARCHIN - DATE: 10/2/2017

Note:
1. Groundwater data was collected by Buxton Environmental, Inc. on July 17, 2017.

0 125 250 500 750 1,000 Feet

HDR

WATER TABLE SURFACE MAP - JULY 2017
CHARAH, INC.
MONCURE, NORTH CAROLINA

BRICKHAVEN NO. 2 MINE TRACT "A"

DATE
OCTOBER 2017

FIGURE
2

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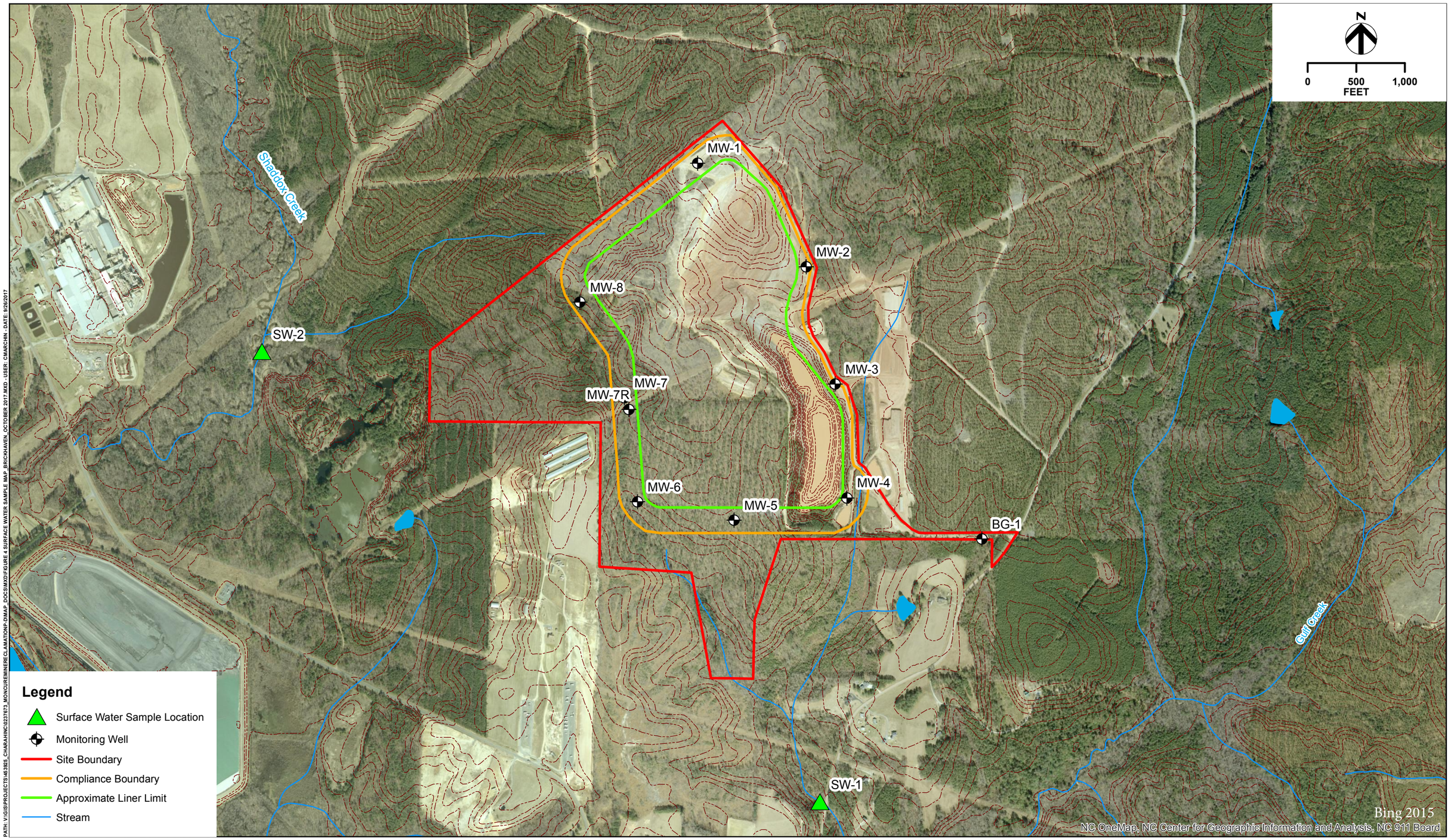

PATH: V:\GIS\PROJECTS\46385_CHARAHINC\0237673_MONCURERMINERECL.AMATION\P-DMAP_DOCS\MXD\FIGURE 4 SURFACE WATER SAMPLE MAP_BRICKHAVEN_OCTOBER 2017.MXD - USER: CMARCHIN - DATE: 9/26/2017

SURFACE WATER SAMPLE LOCATION MAP
CHARAH, INC.
MONCURE, NORTH CAROLINA

BRICKHAVEN NO. 2 MINE TRACT "A"

DATE
OCTOBER 2017

FIGURE
3

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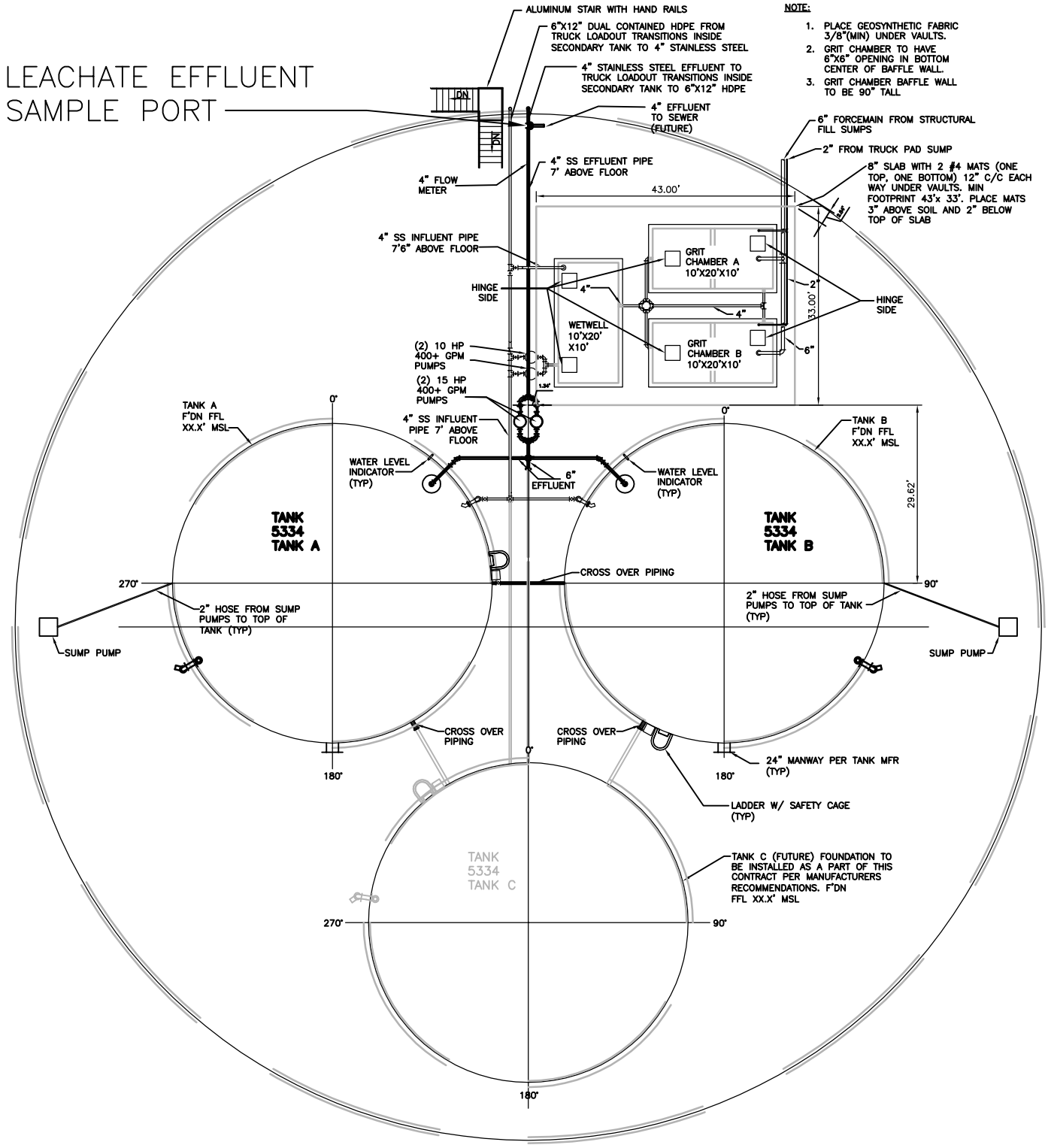

LEACHATE SAMPLE COLLECTION LOCATION
CHARAH, LLC
MONCURE, NORTH CAROLINA

BRICKHAVEN NO. 2 MINE TRACT "A"

DATE
OCTOBER 2017

FIGURE
4

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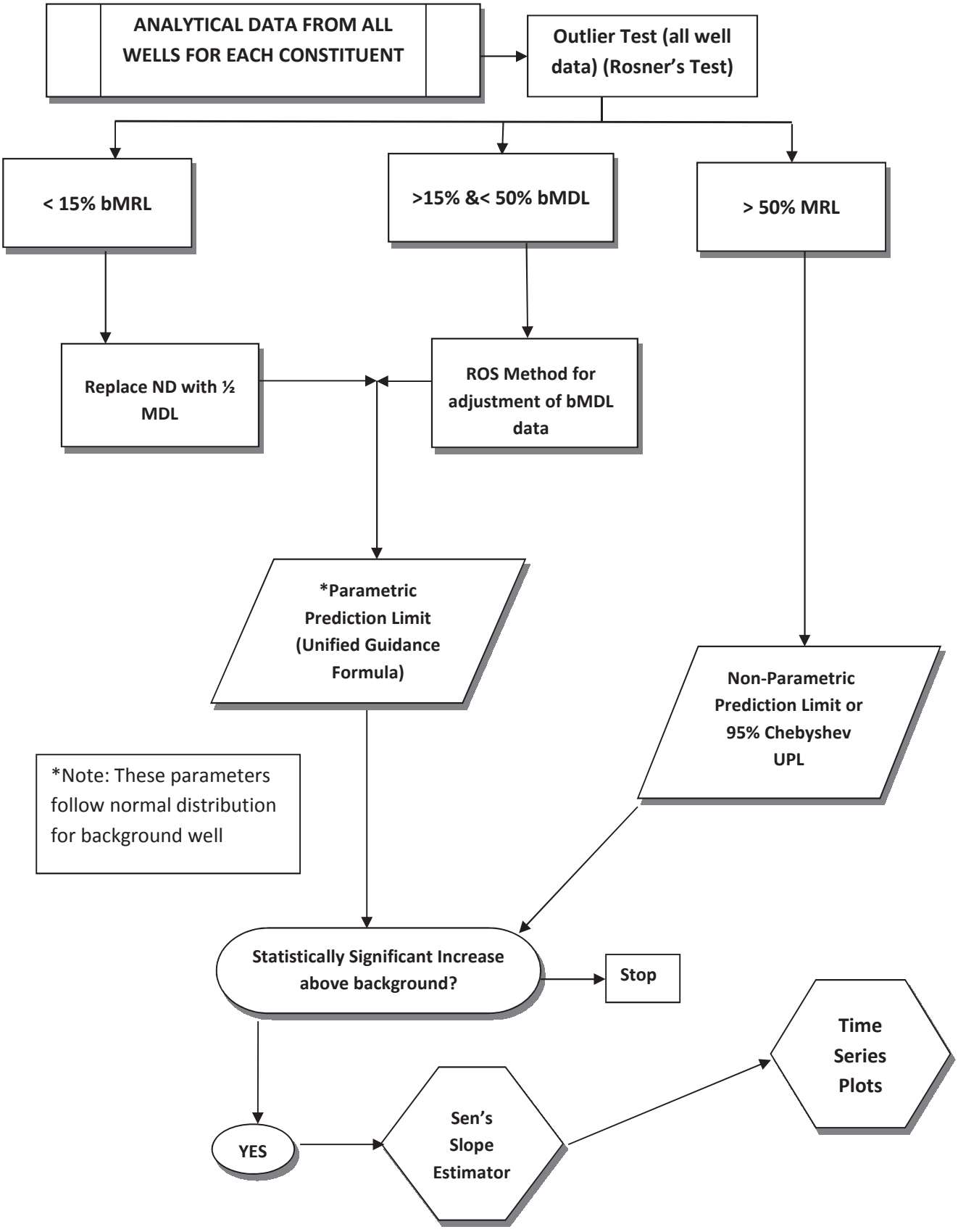
FIGURE 5 - **FLOW CHART 1**

INTERWELL COMPARISON CALCULATION

METHODS FOR DETECTED GROUNDWATER PARAMETERS



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A

Appendix A – Field Data Sheets

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	Document Number: F-CAR-FLD-001-rev.01	Issuing Authority: Pace Huntersville Quality Office

Field Data Sheet

Client: HDR/CHARAH Location: MONCURE NC Project #: BRICKHAVEN Q3

Name and Afiliation (Sampler(s): JFA - WBT

Name and Afiliation (Inspector):

Well Information

Well ID: BG-1

Well Diameter: 2

Total Well Depth: 43.78 ft

Static Water Level: 11.43 ft

Height of Water Column: 32.35 ft

Well Locked: (YES/NO)

Construction: (PVC/Steel/Stainless Steel)

Multi Factor*: .163 [*(Radius/12)2 x 3.14 x 7.48]

Casing Volume: 5.27 gallons

Cal. 3 Volumes: 15.81 gallons

Pump Intake: 41 ft

Purge Information

Date Purged: 7/17/17 Start: 1025 Finish: 1040 Purge Rate: 100 ml/m

Purging Method: PERISTALTIC PUMP Total Volume Purged: 1500 (gallons/mls)

Sampling Information

Date Collected: 7/17/17 Time Collected: 1045 (am/pm)

Sampling Equipment Used: Peristaltic Instrument ID: YSI # 3470

Bottle Type	Preservation	Analysis Required
		SUPPLIED KIT

Field Measurements/Observations

Sample Temp (°C): 23.9 Time: 1045 Turbidity (ntu): 1.6 Time: 1045

Diss Oxy (mg/L): 0.9 Time: 1045 Fe 2+ mg/L: ND Time: 1045

Specific Cond. (uS): 1133 Time: 1045 Res. Cl (mg/L)/(µg/L) — Time: —

Sample pH (s.u.): 6.5 Time: 1045 Odor: N/A Time: 1045

ReDox (mV): 102.0 Time: 1045 Appearance: Clear Time: 1045

ReDox (EH value): YSI ProPlus +200mV 302.0 Other: — Time: —

General/Weather Observations:

(sunny/cloudy/rainy) Temp. 80 (°F) Wind — (mph)

Sampler Signature: [signature] Date: 7/17/17

Stabilization Test

Time Purged	Temp. (°C)	Diss Oxy. (mg/L)	Spec. Cond. (uS)	pH (s.u.)	ReDox (mV)	Turbidity (ntu)	Volume removed (gallons/mls)	Water level (ft)	Other
1030	21.7	1.1	1138	6.5	88.1	2.1	500	11.96	
1035	22.9	0.9	1137	6.5	98.2	2.3	1000	12.00	
1040	23.8	0.9	1135	6.5	100.3	1.6	1500	12.00	

Field Data Sheet

Client: HDR/CHARAH Location: MONCURE NC Project #: BRICKHAUSEN 3Q

Name and Affiliation (Sampler(s)): JFA - WBJ PACE ANALYTICAL

Name and Affiliation (Inspector): NA

Well Information

Well ID: MW-1 Well Locked: (YES / NO)

Well Diameter: 2" Construction: (PVC/Steel/Stainless Steel)

Total Well Depth: 75.55 ft Multi Factor*: .163 [*(Radius/12)2 x 3.14 x 7.48]

Static Water Level: 60.89 ft Casing Volume: 2.39 gallons

Height of Water Column: 14.66 ft Cal. 3 Volumes: 7.17 gallons

Pump Intake: 73.5 ft

Purge Information

Date Purged: 7/18/17 Start: 0955 Finish: 1245 Purge Rate: 150 mL/min

Purging Method: Mega Monsoon Total Volume Purged: 25500 (gallons/mls)

Sampling Information

Date Collected: 7/18/17 Time Collected: 1250 (am/pm)

Sampling Equipment Used: Instrument ID: YSI PRO PLUS 3470

Bottle Type	Preservation	Analysis Required
		SUPPLIED ICL

Field Measurements/Observations

Sample Temp (°C): 23.6 Time: 1250 Turbidity (ntu): 8.5 Time: 1250

Diss Oxy (mg/L): 0.5 Time: 1250 Fe 2+ mg/L: NO Time: 1250

Specific Cond. (uS): 1855 Time: 1250 Res. Cl (mg/L)/(µg/L): — Time: —

Sample pH (s.u.): 6.6 Time: 1250 Odor: NO Time: 1250

ReDox (mV): 45.8 Time: 1250 Appearance: CLEAR Time: 1250

ReDox (EH value):YSI ProPlus +200mV 245.8 Other: — Time: —

General/Weather Observations: (sunny/cloudy/rainy) Temp. 83 (°F) Wind 0-5 (mph)

Sampler Signature: Date: 7-18-17

Stabilization Test

Time Purged	Temp. (°C)	Diss Oxy. (mg/L)	Spec. Cond. (uS)	pH (s.u.)	ReDox (mV)	Turbidity (ntu)	Volume removed (gallons/mls)	Water level (ft)	Other
1000	23.0	1.1	1196	6.9	-97.3	392.8	750	61.02	
1005	23.0	0.9	1119	6.9	-92.1	353.8	1500	—	
1010	22.8	0.8	1020	6.9	-86.1	399.3	2250	61.02	
1015	22.4	0.8	951	6.9	-82.0	360.0	3000	61.02	
1020	23.3	0.7	908	6.9	-70.4	302.8	3750	61.01	

Pace Analytical	Document Name: Field Data Sheet	Document Issued: July 28, 2016 Page 2 of 2
	Document Number: F-CAR-FLD-001.rev.01	Issueing Authority: Pace Huntersville Quality Office

Client: HDR/CHARAH

Location: MOA CORE LC.

Project: BRICKHAVEN 3Q

Well ID: MW 1

Well Diameter	Multiplication Factor*
1	0.0408
1.2	0.0918
1.625	0.1080
2	0.1630
3	0.3670
4	0.6530
6	1.4680
8	2.6100

Stabilization Test

Time Purged	Temp. (°C)	Diss Oxy. (mg/L)	Spec. Cond. (uS)	pH (s.u.)	ReDox (mV)	Turbidity (ntu)	Volume Removed (gallons/mls) circle one	Water level (ft)	Other
1030	24.0	0.6	843	6.9	-63.0	202.9	5250	61.0	10 MIN PURGE
1040	24.7	0.6	801	6.9	-54.3	195.3	~~6000~~ 6750	—	TURB
1050	25.1	0.6	773	7.0	-62.5	174.7	~~6750~~ 8250	61.0	
1100	25.3	0.6	741	7.0	-57.8	102.3	~~7500~~ 9750	61.0	
1110	24.8	0.5	713	7.0	-50.6	90.5	11250	61.0	
1120	22.1	0.5	642	7.0	-40.8	55.4	12750	61.07	
1130	21.6	0.5	744	7.0	-32.3	30.6	14250	61.07	
1140	21.3	0.5	948	6.9	-14.4	29.5	15750	61.08	
1150	21.7	0.5	1158	6.8	0.3	21.2	17250	61.08	
1200	21.7	0.5	1316	6.8	11.9	17.9	18750	61.07	
1210	23.2	0.6	1452	6.7	21.4	14.2	20,250	61.08	
1220	22.7	0.6	1594	6.7	29.1	13.8	21750	—	
1230	23.8	0.6	1659	6.6	33.2	11.1	23250	61.06	5 MIN
1235	24.3	0.5	169	6.6	36.2	9.3	24000	—	
1240	23.4	0.5	1749	6.6	39.5	8.8	24750	61.06	
1245	23.7	0.6	1800	6.6	42.4	9.9	25500	61.07	

Field Data Sheet

Client: HDR, CHARMIT Location: MOORESVILLE NC Project #: BRICKYARD 3Q

Name and Afiliation (Sampler(s): JFA - WBJ PACE ANALYTICAL

Name and Afiliation (Inspector): NA

Well Information

Well ID: MW 2 Well Locked: (YES) / NO)

Well Diameter: 2 Construction: (PVC)/Steel/Stainless Steel)

Total Well Depth: 50.15 ft Multi Factor*: .163 [*(Radius/12)2 x 3.14 x 7.48]

Static Water Level: 30.18 ft Casing Volume: 3.26 gallons

Height of Water Column: 19.97 ft Cal. 3 Volumes: 9.78 gallons

Pump Intake: 48.0 ft

Purge Information

Date Purged: 7 / 18 / 17 Start: 1355 Finish: 1640 Purge Rate: 75

Purging Method: SS SUB PUMP Total Volume Purged: 12375 (gallons/mls)

Sampling Information

Date Collected: 7 / 18 / 17 Time Collected: 1645 (am/pm)

Sampling Equipment Used: SS SUB PUMP Instrument ID: YSI PRO PLUS 9470

Bottle Type	Preservation	Analysis Required
		SUPPLIED ICE

Field Measurements/Observations

Sample Temp (°C): 25.2 Time: 1645 Turbidity (ntu): 8.6 Time: 1645

Diss Oxy (mg/L): 3.3 Time: 1645 Fe 2+ mg/L: NO Time: 1645

Specific Cond. (uS): 4501 Time: 1645 Res. Cl (mg/L)/(µg/L): — Time: —

Sample pH (s.u.): 7.5 Time: 1645 Odor: NO Time: 1645

ReDox (mV): 133.8 Time: 1645 Appearance: CLEAR Time: 1645

ReDox (EH value): YSI ProPlus +200mV 333.8 Other: — Time: —

General/Weather Observations:

(sunny/cloudy/rainy) Temp. 85 (°F) Wind 3-5 (mph)

Sampler Signature: [signature] Date: 7-18-17

Stabilization Test

Time Purged	Temp. (°C)	Diss Oxy. (mg/L)	Spec. Cond. (uS)	pH (s.u.)	ReDox (mV)	Turbidity (ntu)	Volume removed (gallons/mls)	Water level (ft) 30.09	Other
1400	23.2	4.7	4487	7.5	141.7	30.0	375	~~DRY~~	
1405	25.4	4.0	4488	7.5	135.5	36.2	750	—	
1410	26.1	3.3	4496	7.5	133.3	39.9	1125	31.55	
1415	27.2	3.2	4480	7.5	132.0	—	~~1500~~ 1500	31.15	
1420	27.8	3.0	4489	7.5	132.0	42.2	1875	~~DRY~~ 31.95	

Pace Analytical®	Document Name: Field Data Sheet	Document Issued: July 28, 2016 Page 2 of 2
	Document Number: F-CAR-FLD-001.rev.01	Issueing Authority: Pace Huntersville Quality Office

Client: HDR, CHARLOTTE

Location: MONCURE N.C.

Project: BRICKHAVEN 3Q

Well ID: MW 2

Well Diameter	Multiplication Factor*
1	0.0408
1.2	0.0918
1.625	0.1080
2	0.1630
3	0.3670
4	0.6530
6	1.4680
8	2.6100

Stabilization Test

Time Purged	Temp. (°C)	Diss Oxy. (mg/L)	Spec. Cond. (uS)	pH (s.u.)	ReDox (mV)	Turbidity (ntu)	Volume Removed (gallons/mls) circle one	Water level (ft)	Other
1425	28.6	2.8	4499	7.5	132.8	39.3	2250	—	
1430	27.4	3.0	4448	7.5	134.3	43.4	2625	BATTERY	
1435	28.4	2.7	4493	7.5	134.7	44.6	3000	32.98	
1440	28.9	2.9	4497	7.5	135.1	58.3	3375	33.19	
1445	26.2	2.9	4500	7.5	136.9	77.6	3750	33.53	
1455	27.9	3.0	4471	7.5	137.8	62.2	4500	35.01	
1505	28.5	3.5	4469	7.5	138.2	44.5	5250	35.20	
1515	23.8	3.7	4447	7.5	136.7	38.8	6000	35.89	
1525	23.4	4.2	4454	7.5	132.6	35.8	6750	36.81	
1535	24.8	4.2	4489	7.5	127.4	45.3	7500	37.10	
1545	26.1	3.5	4486	7.5	127.6	44.6	8250	37.42	
1555	25.2	3.7	4471	7.5	129.1	37.2	9000	37.83	
1605	25.0	3.7	4501	7.5	129.4	41.2	9750	38.12	
1615	25.7	3.5	4485	7.5	130.6	33.0	10500	—	
1625	26.3	3.6	4489	7.5	131.1	12.2	11250	38.68	5 mL
~~1640~~ 1630	25.8	3.2	4504	7.5	132.2	10.6	11625	38.55	
1635	25.8	3.2	4499	7.5	132.7	9.8	12000	—	
1640	26.1	3.3	4497	7.5	133.2	6.8	12375	38.98	

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Field Data Sheet

Client: HDR, CHARAH Location: MONCURE NC Project #: BRICKHAVEN 3Q

Name and Afiliation (Sampler(s): JFA - WBT PACE ANALYTICAL

Name and Afiliation (Inspector): NA

Well Information

Well ID: MW 3

Well Locked: (YES / NO)

Well Diameter: 2

Construction: (PVC/Steel/Stainless Steel)

Total Well Depth: 43.6 ft

Multi Factor*: .163 [*(Radius/12)2 x 3.14 x 7.48]

Static Water Level: 18.65 ft

Casing Volume: 4.07 gallons

Height of Water Column: 24.95 ft

Cal. 3 Volumes: 12.21 gallons

Pump Intake: 41.0 ft

Purge Information

Date Purged: 7/19/17 Start: 1640 Finish: 1705 Purge Rate: 100 ml/m

Purging Method: PERISTALTIC PUMP Total Volume Purged: 2500 (gallons/mls)

Sampling Information

Date Collected: 7/19/17 Time Collected: 1710 (am/pm)

Sampling Equipment Used: PERISTALTIC PUMP Instrument ID: YSI PRO PLUS 3478

Bottle Type	Preservation	Analysis Required
		SUPPLIED NXT

Field Measurements/Observations

Sample Temp (°C): 23.9 Time: 1710 Turbidity (ntu): 4.3 Time: 1710

Diss Oxy (mg/L): 1.4 Time: 1710 Fe 2+ mg/L: ND Time: 1710

Specific Cond. (uS): 4011 Time: 1710 Res. Cl (mg/L)/(µg/L): — Time: ~~1710~~ 29

Sample pH (s.u.): 7.1 Time: 1710 Odor: ND Time: 1710

ReDox (mV): -13.4 Time: 1710 Appearance: CLEAR Time: 1710

ReDox (EH value): YSI ProPlus +200mV 186.6 Other: — Time: —

General/Weather Observations:

(sunny/cloudy/rainy) Temp. 90 (°F) Wind 3-5 (mph)

Sampler Signature: [signature] Date: 7-19-17

Stabilization Test

Time Purged	Temp. (°C)	Diss Oxy. (mg/L)	Spec. Cond. (uS)	pH (s.u.)	ReDox (mV)	Turbidity (ntu)	Volume removed (gallons/mls)	Water level (ft)	Other
1645	25.8	3.5	3917	7.2	176.3	5.3	500	—	
1650	24.0	1.5	4029	7.1	148.7	3.6	1000	19.64	
1655	24.3	1.4	4032	7.1	10.1	3.8	1500	20.32	
1700	24.0	1.2	4016	7.1	-17.3	5.1	2000	21.05	
1705	24.1	1.4	4016	7.1	-12.1	4.4	2500	21.44	

Field Data Sheet

Client: HDR, CHARLOTTE Location: MONROE NC Project #: BRICKHAVEN GW3

Name and Afiliation (Sampler(s): JFA PACE ANALYTICAL

Name and Afiliation (Inspector): NA

Well Information

Well ID: MW-4 Well Locked: (YES) / NO)

Well Diameter: 2 Construction: (PVC/Steel/Stainless Steel)

Total Well Depth: 25.74 ft Multi Factor*: .163 [*(Radius/12)2 x 3.14 x 7.48]

Static Water Level: 13.03 ft Casing Volume: 2.4 gallons

Height of Water Column: 14.71 ft Cal. 3 Volumes: 7.2 gallons

Pump Intake: 23.00 ft

Purge Information

Date Purged: 7/20/17 Start: 930 Finish: ~~950~~ 950 Purge Rate: 100 mL/m

Purging Method: PERISTALTIC PUMP Total Volume Purged: ~~100~~ 2000 (gallons/(mls))

Sampling Information

Date Collected: 7/20/17 Time Collected: 0955 (am/pm)

Sampling Equipment Used: PERISTALTIC PUMP Instrument ID: YSI PRO PLUS 14470

Bottle Type	Preservation	Analysis Required
		SUPPLIED BY LAB

Field Measurements/Observations

Sample Temp (°C): 23.0 Time: 955 Turbidity (ntu): 9.6 Time: 955

Diss Oxy (mg/L): 0.2 Time: 955 Fe 2+ mg/L: 2.0 Time: 955

Specific Cond. (uS): 1960 Time: 955 Res. Cl (mg/L)/(µg/L): — Time: —

Sample pH (s.u.): 6.2 Time: 955 Odor: ND Time: 955

ReDox (mV): -37.4 Time: 955 Appearance: FLAKES Time: 955

ReDox (EH value): YSI ProPlus +200mV 162.6 Other: ND Time: —

General/Weather Observations:

(sunny)/cloudy/rainy) Temp. 83 (°F) Wind 0-5 (mph)

Sampler Signature: [signature] Date: 7-20-17

Stabilization Test

Time Purged	Temp. (°C)	Diss Oxy. (mg/L)	Spec. Cond. (uS)	pH (s.u.)	ReDox (mV)	Turbidity (ntu)	Volume removed (gallons/(mls))	Water level (ft)	Other
935	22.4	0.5	1878	6.2	-43.4	37.0	500	~~13.63~~	13.63
940	22.8	0.4	1870	6.2	-39.8	21.4	1000	~~13.77~~	13.77
945	23.1	0.3	1872	6.2	-37.9	13.1	1500	13.85	
950	23.0	0.2	1952	6.2	-37.0	9.9	2000	13.88	

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Field Data Sheet

Client: HDR, CHARAH Location: MONCURE NC Project #: BRICKHAVEN 3Q

Name and Afiliation (Sampler(s): JFA - WBT PACE ANALYTICAL

Name and Afiliation (Inspector): NA

Well Information

Well ID: MW 5

Well Locked: (YES / NO)

Well Diameter: 2

Construction: (PVC/Steel/Stainless Steel)

Total Well Depth: 46.96 ft

Multi Factor*: .163 [*(Radius/12)2 x 3.14 x 7.48]

Static Water Level: 22.76 ft

Casing Volume: 3.94 gallons

Height of Water Column: 24.2 ft

Cal. 3 Volumes: 11.82 gallons

Pump Intake: 45.5 ft

Purge Information

Date Purged: 7/19/17 Start: 945 Finish: ~~95~~ 1125 Purge Rate: 100 ml/m

Purging Method: SS SUB PUMP Total Volume Purged: 10.000 (gallons/mls)

Sampling Information

Date Collected: 7/19/17 Time Collected: 1130 (am/pm)

Sampling Equipment Used: SS SUB PUMP Instrument ID: YSI PRO PLUS 3470

Bottle Type	Preservation	Analysis Required
		SUPPLIED KIT

Field Measurements/Observations

Sample Temp (°C): 25.3 Time: 1130 Turbidity (ntu): 9.4 Time: 1130

Diss Oxy (mg/L): 1.2 Time: 1130 Fe 2+ mg/L: ND Time: 1130

Specific Cond. (uS): 402.7 Time: 1130 Res. Cl (mg/L)/(µg/L): — Time: —

Sample pH (s.u.): 7.0 Time: 1130 Odor: ND Time: 1130

ReDox (mV): -28.2 Time: 1130 Appearance: CLEAR Time: 1130

ReDox (EH value): YSI ProPlus +200mV 171.8 Other: — Time: —

General/Weather Observations:

(sunny/cloudy/rainy) Temp. 82 (°F) Wind 5-10 (mph)

Sampler Signature: [signature] Date: 7-19-17

Stabilization Test

Time Purged	Temp. (°C)	Diss Oxy. (mg/L)	Spec. Cond. (uS)	pH (s.u.)	ReDox (mV)	Turbidity (ntu)	Volume removed (gallons/mls)	Water level (ft)	Other
950	22.7	0.9	593	7.2	-107.6	48.6	500	22.80	
955	23.1	0.6	574	7.2	-79.0	55.6	1000	23.42	
1000	22.6	0.4	530	7.2	-71.6	64.3	1500	23.97	
1005	23.5	0.4	502.8	7.1	-55.1	71.3	2000	24.45	
1010	24.2	0.4	470.3	7.1	-51.9	86.3	2500	25.25	

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Client: HDR, CHARLOTTE

Location: MONCURE NC

Project: BUCKHAVEN 3Q

Well ID: MW 5

Well Diameter	Multiplication Factor*
1	0.0408
1.2	0.0918
1.625	0.1080
2	0.1630
3	0.3670
4	0.6530
6	1.4680
8	2.6100

Stabilization Test

Time Purged	Temp. (°C)	Diss Oxy. (mg/L)	Spec. Cond. (uS)	pH (s.u.)	ReDox (mV)	Turbidity (ntu)	Volume Removed (gallons/mls) circle one	Water level (ft)	Other
1015	22.6	0.8	405.3	7.0	-32.6	16.2	3000	26.62	
1020	22.1	0.8	412.3	7.0	-43.7	137.4	3500	27.14	
1025	23.5	0.9	405.7	7.0	-38.6	137.5	4000	27.64	10 min
1035	23.1	1.1	386.2	7.0	-19.1	38.66	5000	28.95	
1045	23.3	1.3	379.2	7.0	-13.1	28.4	6000	29.95	
1055	24.0	1.4	379.1	6.9	-15.4	25.1	7000	30.95	
1105	24.3	1.4	382.1	6.9	-18.7	25.7	8000	32.08	
1115	24.9	1.3	386.5	7.0	-23.5	17.1	9000	32.80	
1125	26.8	1.2	393.1	7.0	-26.1	8.4	10000	33.60	

Field Data Sheet

Client: HDR, CHARAH Location: MOORE NC Project #: BRICKHAVEN 3 Q

Name and Affiliation (Sampler(s): JFA - WBT

Name and Affiliation (Inspector): NA

Well Information

Well ID: MW-6

Well Diameter: 2

Total Well Depth: 27.93 ft

Static Water Level: 7.52 ft

Height of Water Column: 20.4 ft

Well Locked: (YES / NO)

Construction: (PVC/Steel/Stainless Steel)

Multi Factor*: .163 [*(Radius/12)2 x 3.14 x 7.48]

Casing Volume: 3.33 gallons

Cal. 3 Volumes: 9.99 gallons

Pump Intake: 25.5 ft

Purge Information

Date Purged: 7/19/17 Start: 1330 Finish: 1355 Purge Rate: 100 mL/m

Purging Method: PERISTALTIC PUMP Total Volume Purged: 2500 (gallons/mls)

Sampling Information

Date Collected: 7/19/17 Time Collected: 1400 (am/pm)

Sampling Equipment Used: PERISTALTIC PUMP Instrument ID: YSI PRO Plus 3490

Bottle Type	Preservation	Analysis Required
		SUPPLIED KIT

Field Measurements/Observations

Sample Temp (°C): 32.1 Time: 1400 Turbidity (ntu): 3.6 Time: 1400

Diss Oxy (mg/L): 6.3 Time: 1400 Fe 2+ mg/L: ND Time: 1400

Specific Cond. (uS): 1398 Time: 1400 Res. Cl (mg/L)/(µg/L): — Time: —

Sample pH (s.u.): 6.5 Time: 1400 Odor: ND Time: 1400

ReDox (mV): 101.1 Time: 1400 Appearance: CLEAR Time: 1400

ReDox (EH value):YSI ProPlus +200mV 301.1 Other: — Time: —

General/Weather Observations: —

(sunny/cloudy/rainy) Temp. 88 (°F) Wind 0-5 (mph)

Sampler Signature: [signature] Date: 7-19-17

Stabilization Test

Time Purged	Temp. (°C)	Diss Oxy. (mg/L)	Spec. Cond. (uS)	pH (s.u.)	ReDox (mV)	Turbidity (ntu)	Volume removed (gallons/mls)	Water level (ft)	Other
1335	32.5	1.5	1501	6.5	132.4	9.3	500	8.03	
1340	32.2	0.5	1468	6.5	128.7	5.5	1000	—	
1345	32.5	0.4	1475	6.5	122.0	3.4	1500	8.22	
1350	32.4	0.3	1441	6.5	110.9	2.6	2000	—	
1355	32.4	0.3	1423	6.5	105.5	2.4	2500	8.27	

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Field Data Sheet

Client: HDR, CHARAH Location: MONCURE NC Project #: BRICKHAVEN 3Q

Name and Afiliation (Sampler(s): JFA PACE ANALYTICAL

Name and Afiliation (Inspector): NA

Well Information

Well ID: MW 7R

Well Locked: (YES / NO)

Well Diameter: 2

Construction: (PVC/Steel/Stainless Steel)

Total Well Depth: 39.94 ft

Multi Factor*: .163 [*(Radius/12)2 x 3.14 x 7.48]

Static Water Level: 21.30 ft

Casing Volume: 3.04 gallons

Height of Water Column: 18.64 ft

Cal. 3 Volumes: 9.12 gallons

Pump Intake: 36.5 ft

Purge Information

Date Purged: 7 / 20 / 17 Start: 1155 Finish: 1515 Purge Rate: 100 mL/m

Purging Method: SS SUB PUMP Total Volume Purged: 20500 (gallons/mls)

Sampling Information

Date Collected: 7 / 20 / 17 Time Collected: 1520 (am/pm)

Sampling Equipment Used: SS SUB PUMP Instrument ID: YSI PRO PLUS 3470

Bottle Type	Preservation	Analysis Required
		SUPPLIED KIT

Field Measurements/Observations

Sample Temp (°C): 31.7 Time: 1520 Turbidity (ntu): 9.3 Time: 1520

Diss Oxy (mg/L): 0.8 Time: 1520 Fe 2+ mg/L: ND Time: 1520

Specific Cond. (uS): 1236 Time: 1520 Res. Cl (mg/L)/(µg/L): — Time: —

Sample pH (s.u.): 9.6 Time: 1520 Odor: ND Time: 1520

ReDox (mV): 43.6 Time: 1520 Appearance: CLEAR Time: 1520

ReDox (EH value): YSI ProPlus +200mV 243.6 Other: — Time: —

General/Weather Observations:

(sunny/cloudy/rainy) Temp. 90 (°F) Wind 5-5 (mph)

Sampler Signature: [signature] Date: 7-20-17

Stabilization Test

Time Purged ~~1200~~	Temp. (°C)	Diss Oxy. (mg/L)	Spec. Cond. (uS)	pH (s.u.)	ReDox (mV)	Turbidity (ntu)	Volume removed (gallons/mls)	Water level (ft)	Other
1200	22.3	1.0	1235	10.3	51.8	656	500	21.62	
1205	24.9	0.8	1228	10.3	36.3	925	1000	22.50	10 min
1215	30.5	0.6	1238	10.2	78.4	749.5	2000	22.94	
1225	28.6	0.7	1240	10.2	8.6	XXY	3000	23.56	
1235	27.7	0.6	1248	10.2	8.9	636.5	4000	24.18	

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Client: HDR CHARAH

Location: MONCURE NC

Project: BRICKHAVEN 3Q

Well ID: MW 7R

Well Diameter	Multiplication Factor*
1	0.0408
1.2	0.0918
1.625	0.1080
2	0.1630
3	0.3670
4	0.6530
6	1.4680
8	2.6100

Stabilization Test

Time Purged	Temp. (°C)	Diss Oxy. (mg/L)	Spec. Cond. (uS)	pH (s.u.)	ReDox (mV)	Turbidity (ntu)	Volume Removed (gallons/mls) circle one	Water level (ft)	Other
1245	27.0	0.8	1220	10.20	14.7	261.4	5000	25.25	
1255	30.0	0.9	1231	10.1	19.8	188.2	6000	25.76	
1305	30	1.0	1234	10.0	27.7	121.4	7000	26.13	
1315	31.0	1.1	1236	9.9	34.9	75.6	8000	26.56	
1325	32.8	1.0	1245	9.9	40.9	68.7	9000	26.78	
1335	32.4	1.0	1241	9.9	40.9	44.5	10000	27.1	
1345	34.2	0.9	1246	9.8	43.1	15.4	11000	27.25	
1350	30.8	0.9	1244	9.9	43.6	12.9	12000	27.55	5 min
1355	29.8	0.8	1240	9.9	44.2	12.5	12500	27.75	10 min
1405	31.7	0.8	1242	9.8	44.7	17.2	13500	—	
1415	32.8	0.8	1244	9.8	45.1	28.6	14500	—	
1425	31.1	0.8	1240	9.8	44.6	22.5	15500	28.25	
1435	32.4	0.9	1242	9.7	45.5	18.4	16500	28.35	
1445	32.7	0.7	1244	9.6	45.3	15.6	17500	28.50	
1455	31.2	0.8	1239	9.6	46.3	14.4	18500	28.58	
1505	32.2	0.7	1240	9.6	45.8	11.4	19500	28.65	
1515	31.7	0.7	1239	9.6	43.6	9.3	20500	28.78	

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Field Data Sheet

Client: HPR CHARAH Location: MONCURE NC Project #: BRICKHAVEN Q3

Name and Afiliation (Sampler(s): JFA - WBT PACE ANALYTICAL

Name and Afiliation (Inspector): NA

Well Information

Well ID: MW8

Well Locked: (YES / NO)

Well Diameter: 2

Construction: (PVC/Steel/Stainless Steel)

Total Well Depth: 49.68 ft

Multi Factor*: .163 [*(Radius/12)2 x 3.14 x 7.48]

Static Water Level: 37.49 ft

Casing Volume: ~~436.57~~ 2.5 gallons

Height of Water Column: 12.19 ft

Cal. 3 Volumes: 7.5 gallons

Pump Intake: 47.5 ft

Purge Information

Date Purged: 7 / 17 / 17 Start: 1320 Finish: 1435 Purge Rate: 150 ↓ 100

Purging Method: SS SUB PUMP Total Volume Purged: 7750 (gallons/mls)

Sampling Information

Date Collected: 7 / 17 / 17 Time Collected: 1440 (am/pm)

Sampling Equipment Used: SS SUB PUMP Instrument ID: YSI PRO PLUS 3470

Bottle Type	Preservation	Analysis Required
		SUPPLIED KIT

Field Measurements/Observations

Sample Temp (°C): 32.8 Time: 1440 Turbidity (ntu): 8.5 Time: 1440

Diss Oxy (mg/L): 1.2 Time: 1440 Fe 2+ mg/L: ND Time: 1440

Specific Cond. (uS): 2113 Time: 1440 Res. Cl (mg/L)/(µg/L): — Time: —

Sample pH (s.u.): 6.9 Time: 1440 Odor: ND Time: 1440

ReDox (mV): 143.5 Time: 1440 Appearance: CLEAR Time: 1440

ReDox (EH value): YSI ProPlus +200mV 343.5 Other: — Time: —

General/Weather Observations:

(sunny/cloudy/rainy) Temp. 83 (°F) Wind 5-10 (mph)

Sampler Signature: [signature] Date: [signature] 7-17-17

Stabilization Test

Time Purged	Temp. (°C)	Diss Oxy. (mg/L)	Spec. Cond. (uS)	pH (s.u.)	ReDox (mV)	Turbidity (ntu)	Volume removed (gallons/mls)	Water level (ft)	Other
1325	25.7	3.8	2741	6.9	158.2	100.5	750	—	FLOW
1335	28.2	2.7	2709	6.9	150.9	70.0	1500	—	STOPPED
1340	28.5	2.5	2720	6.9	149.2	38.8	2250	38.08	
1345	28.8	2.4	2660	6.9	148.0	43.0	2750	38.10	↓500 mg/l
1350	30.1	2.1	2575	6.9	146.4	30.0	3250	38.10	

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Client: HOB. CHARLIT

Location: MONCURE N.C.

Project: BRICKHAVEN Q3

Well ID: MW 8

Well Diameter	Multiplication Factor*
1	0.0408
1.2	0.0918
1.625	0.1080
2	0.1630
3	0.3670
4	0.6530
6	1.4680
8	2.6100

Stabilization Test

Time Purged	Temp. (°C)	Diss Oxy. (mg/L)	Spec. Cond. (uS)	pH (s.u.)	ReDox (mV)	Turbidity (ntu)	Volume Removed (gallons/mls) circle one	Water level (ft)	Other
1355	31.8	1.8	2546	6.9	145.4	25.4	3750	38.11	
1400	31.0	1.7	2474	6.9	145.2	18.8	4250	38.11	
1405	31.4	1.6	2403	6.9	144.6	14.1	4750	38.11	
1410	29.6	1.6	2336	6.9	144.9	13.0	5250	38.12	
1415	29.6	1.5	2320	6.9	144.6	13.5	5750	38.12	
1420	29.1	1.4	2253	6.9	144.8	11.6	6250	38.12	
1425	29.2	1.3	2203	6.9	144.4	9.0	6750	38.12	
1430	30.9	1.2	2135	6.9	144.0	9.0	7250	38.11	
1435	33.4	1.2	2120	6.9	143.6	8.7	7750	38.11	

Field Data Sheet

Client: HDR CHARAH Location: MORGAN CO Project #: BRICKHAVEN Q3

Name and Afiliation (Sampler(s): JFA. WBT

Name and Afiliation (Inspector): NA

Well Information

Well ID: S1

Well Diameter: ____

Total Well Depth: ____ ft

Static Water Level: ____ ft

Height of Water Column: ____ ft

Well Locked: (YES / NO)

Construction: (PVC/Steel/Stainless Steel)

Multi Factor*: ____ [*(Radius/12)2 x 3.14 x 7.48]

Casing Volume: ____ gallons

Cal. 3 Volumes: ____ gallons

Pump Intake: ____ ft

Purge Information

Date Purged: ~/~/~ Start: ~ Finish: ~ Purge Rate: ~

Purging Method: ~ Total Volume Purged: ~ (gallons/mls)

Sampling Information

Date Collected: 7/17/17 Time Collected: 1645 (am/pm)

Sampling Equipment Used: GRAB Instrument ID: YSI PRO PLUS 13470

Bottle Type	Preservation	Analysis Required
		SAMPLING KIT

Field Measurements/Observations

Sample Temp (°C): 26.1 Time: 1645 Turbidity (ntu): ~ Time: 1645

Diss Oxy (mg/L): 5.1 Time: 1645 Fe 2+ mg/L: ~ Time: ~

Specific Cond. (uS): 68.5 Time: 1645 Res. Cl (mg/L)/(µg/L): ~ Time: ~

Sample pH (s.u.): 7.4 Time: 1645 Odor: ND Time: 1645

ReDox (mV): 96.8 Time: 1645 Appearance: MUDDY Time: 1645

ReDox (EH value):YSI ProPlus +200mV 296.8 Other: ~ Time: ~

General/Weather Observations: TOO MUDDY FOR TURB & FE 2+

(sunny/cloudy/rainy) Temp. 84 (°F) Wind 5-15 (mph)

Sampler Signature: [signature] Date: 7-17-17

Stabilization Test

Time Purged	Temp. (°C)	Diss Oxy. (mg/L)	Spec. Cond. (uS)	pH (s.u.)	ReDox (mV)	Turbidity (ntu)	Volume removed (gallons/mls)	Water level (ft)	Other

Field Data Sheet

Client: HDR/Chevron Location: Monroe Project #: Bickhaven Q3

Name and Affiliation (Sampler(s): JFA WBT

Name and Affiliation (Inspector):

Well Information

Well ID: S-2 Well Locked: (YES / NO)

Well Diameter: Construction: (PVC/Steel/Stainless Steel)

Total Well Depth: ft Multi Factor*: [*(Radius/12)2 x 3.14 x 7.48]

Static Water Level: ft Casing Volume: gallons

Height of Water Column: ft Cal. 3 Volumes: gallons

Pump Intake: ft

Purge Information

Date Purged: / / Start : Finish: Purge Rate:

Purging Method: Total Volume Purged: (gallons/mls)

Sampling Information

Date Collected: 7/18/17 Time Collected: 0850 (am/pm)

Sampling Equipment Used: Instrument ID:

Bottle Type	Preservation	Analysis Required
		DRY

Field Measurements/Observations

Sample Temp (°C): Time: Turbidity (ntu): Time:

Diss Oxy (mg/L): Time: Fe 2+ mg/L: Time:

Specific Cond. (uS): Time: Res. Cl (mg/L)/(µg/L): Time:

Sample pH (s.u.): Time: Odor: Time:

ReDox (mV): Time: Appearance: Time:

ReDox (EH value):YSI ProPlus +200mV Other: Time:

General/Weather Observations: DRY

(sunny/cloudy/rainy) Temp 80 (°F) Wind (mph)

Sampler Signature: Date: 7-18-17

Stabilization Test

Time Purged	Temp. (°C)	Diss Oxy. (mg/L)	Spec. Cond. (uS)	pH (s.u.)	ReDox (mV)	Turbidity (ntu)	Volume removed (gallons/mls)	Water level (ft)	Other

	Document Number: F-CAR-FED-001-rev.01	Issuing Authority: Pace Huntersville Quality Office

Field Data Sheet

Client: HDR/CHARAH Location: MONCURE NC Project #: BRICKHAVEN Q3

Name and Afiliation (Sampler(s): JFA WBT

Name and Afiliation (Inspector): N/A

Well Information

Well ID: LEACHATE

Well Locked: ~~(YES / NO)~~

Well Diameter: —

Construction: (~~PVC~~/Steel/Stainless Steel)

Total Well Depth: — ft

Multi Factor*: — [*(Radius/12)2 x 3.14 x 7.48]

Static Water Level: — ft

Casing Volume: — gallons

Height of Water Column: — ft

Cal. 3 Volumes: — gallons

Pump Intake: — ft

Purge Information

Date Purged: — / — / — Start: — Finish: — Purge Rate: —

Purging Method: — Total Volume Purged: — (gallons/mls)

Sampling Information

Date Collected: 7/17/17 Time Collected: 1600 (am/pm)

Sampling Equipment Used: GRAB Instrument ID: YSI PRO PLUS 3470

Bottle Type	Preservation	Analysis Required
		SUPPLIED KIT

Field Measurements/Observations

Sample Temp (°C): 27.3 Time: 1600 Turbidity (ntu): 68.6 Time: 1600

Diss Oxy (mg/L): 5.8 Time: 1600 Fe 2+ mg/L: ND Time: 1600

Specific Cond. (uS): 1358 Time: 1600 Res. Cl (mg/L)/(µg/L): — Time: —

Sample pH (s.u.): 7.3 Time: 1600 Odor: ND Time: 1600

ReDox (mV): 139.2 Time: 1600 Appearance: cloudy Time: 1600

ReDox (EH value):YSI ProPlus +200mV 339.2 Other: — Time: —

General/Weather Observations: GRAB LEACHATE

(sunny/cloudy/rainy) Temp 83 (°F) Wind 5-10 (mph)

Sampler Signature: [signature] Date: 7-17-17

Stabilization Test

Time Purged	Temp. (°C)	Diss Oxy. (mg/L)	Spec. Cond. (uS)	pH (s.u.)	ReDox (mV)	Turbidity (ntu)	Volume removed (gallons/mls)	Water level (ft)	Other

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B

Appendix B – Laboratory Reports, Chains of Custody, & Quality Control Data

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Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

August 03, 2017

Sean Quarry
HDR Engineering
440 South Church Street
Suite 1000
Charlotte, NC 28202

RE: Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348154

Dear Sean Quarry:
Enclosed are the analytical results for sample(s) received by the laboratory on July 18, 2017. The results relate only to the samples included in this report. Results reported herein conform to the most current, applicable TNI/NELAC standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Kevin Godwin
kevin.godwin@pacelabs.com
1(704)875-9092
Project Manager

Enclosures

cc: Mike Plummer, HDR

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CERTIFICATIONS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348154

Pennsylvania Certification IDs

1638 Roseytown Rd Suites 2,3&4, Greensburg, PA 15601
L-A-B DOD-ELAP Accreditation #: L2417
Alabama Certification #: 41590
Arizona Certification #: AZ0734
Arkansas Certification
California Certification #: 04222CA
Colorado Certification
Connecticut Certification #: PH-0694
Delaware Certification
Florida/TNI Certification #: E87683
Georgia Certification #: C040
Guam Certification
Hawaii Certification
Idaho Certification
Illinois Certification
Indiana Certification
Iowa Certification #: 391
Kansas/TNI Certification #: E-10358
Kentucky Certification #: 90133
Louisiana DHH/TNI Certification #: LA140008
Louisiana DEQ/TNI Certification #: 4086
Maine Certification #: PA00091
Maryland Certification #: 308
Massachusetts Certification #: M-PA1457
Michigan/PADEP Certification
Missouri Certification #: 235
Montana Certification #: Cert 0082
Nebraska Certification #: NE-05-29-14
Nevada Certification #: PA014572015-1
New Hampshire/TNI Certification #: 2976
New Jersey/TNI Certification #: PA 051
New Mexico Certification #: PA01457
New York/TNI Certification #: 10888
North Carolina Certification #: 42706
North Dakota Certification #: R-190
Oregon/TNI Certification #: PA200002
Pennsylvania/TNI Certification #: 65-00282
Puerto Rico Certification #: PA01457
Rhode Island Certification #: 65-00282
South Dakota Certification
Tennessee Certification #: TN2867
Texas/TNI Certification #: T104704188-14-8
Utah/TNI Certification #: PA014572015-5
USDA Soil Permit #: P330-14-00213
Vermont Dept. of Health: ID# VT-0282
Virgin Island/PADEP Certification
Virginia/VELAP Certification #: 460198
Washington Certification #: C868
West Virginia DEP Certification #: 143
West Virginia DHHR Certification #: 9964C
Wisconsin Certification
Wyoming Certification #: 8TMS-L

Charlotte Certification IDs

9800 Kincey Ave. Ste 100, Huntersville, NC 28078
North Carolina Drinking Water Certification #: 37706
North Carolina Field Services Certification #: 5342
North Carolina Wastewater Certification #: 12
South Carolina Certification #: 99006001
Florida/NELAP Certification #: E87627
Kentucky UST Certification #: 84
Virginia/VELAP Certification #: 460221

Asheville Certification IDs

2225 Riverside Drive, Asheville, NC 28804
Florida/NELAP Certification #: E87648
Massachusetts Certification #: M-NC030
North Carolina Drinking Water Certification #: 37712
North Carolina Wastewater Certification #: 40
South Carolina Certification #: 99030001
Virginia/VELAP Certification #: 460222

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SAMPLE SUMMARY

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348154

Lab ID	Sample ID	Matrix	Date Collected	Date Received
92348154001	**BG-1**	Water	07/17/17 10:45	07/18/17 12:30
92348154002	**MW-8**	Water	07/17/17 14:40	07/18/17 12:30
92348154003	**LEACHATE**	Water	07/17/17 16:00	07/18/17 12:30
92348154004	**S1**	Water	07/17/17 16:45	07/18/17 12:30
92348154005	**AMB**	Water	07/17/17 13:00	07/18/17 12:30
92348154006	**EQ BLANK**	Water	07/17/17 18:00	07/18/17 12:30
92348154007	**TRIP BLANK**	Water	07/17/17 00:00	07/18/17 12:30

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SAMPLE ANALYTE COUNT

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348154

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
92348154001	**BG-1**	EPA 6010	SER	16	PASI-A
		EPA 6020B	CDF	3	PASI-A
		EPA 7470	KAL	1	PASI-A
		EPA 8260	ZDO	48	PASI-C
		EPA 903.1	WRR	1	PASI-PA
		EPA 904.0	JLW	1	PASI-PA
		SM 2540C	SLB	1	PASI-A
		EPA 300.0	CDC	3	PASI-A
92348154002	**MW-8**	EPA 6010	SER, SH1	16	PASI-A
		EPA 6020B	CDF	3	PASI-A
		EPA 7470	KAL	1	PASI-A
		EPA 8260	ZDO	48	PASI-C
		EPA 903.1	WRR	1	PASI-PA
		EPA 904.0	JLW	1	PASI-PA
		SM 2540C	SLB	1	PASI-A
		EPA 300.0	CDC	3	PASI-A
92348154003	**LEACHATE**	EPA 6010	SER, SH1	16	PASI-A
		EPA 6020B	CDF	3	PASI-A
		EPA 7470	KAL	1	PASI-A
		EPA 8260	ZDO	48	PASI-C
		EPA 903.1	WRR	1	PASI-PA
		EPA 904.0	JLW	1	PASI-PA
		SM 2540C	SLB	1	PASI-A
		EPA 300.0	CDC	3	PASI-A
92348154004	**S1**	EPA 6010	SER	16	PASI-A
		EPA 6020B	CDF	3	PASI-A
		EPA 7470	KAL	1	PASI-A
		EPA 8260	ZDO	48	PASI-C
		EPA 903.1	WRR	1	PASI-PA
		EPA 904.0	JLW	1	PASI-PA
		SM 2540C	SLB	1	PASI-A
		EPA 300.0	CDC	3	PASI-A
92348154005	**AMB**	EPA 6010	SER	16	PASI-A
		EPA 6020B	CDF	3	PASI-A
		EPA 7470	KAL	1	PASI-A
		EPA 8260	ZDO	48	PASI-C
		EPA 903.1	WRR	1	PASI-PA

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SAMPLE ANALYTE COUNT

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348154

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
		EPA 904.0	JLW	1	PASI-PA
		SM 2540C	SLB	1	PASI-A
		EPA 300.0	CDC	3	PASI-A
92348154006	**EQ BLANK**	EPA 6010	SER	16	PASI-A
		EPA 6020B	CDF	3	PASI-A
		EPA 7470	KAL	1	PASI-A
		EPA 8260	ZDO	48	PASI-C
		EPA 903.1	WRR	1	PASI-PA
		EPA 904.0	JLW	1	PASI-PA
		SM 2540C	SLB	1	PASI-A
		EPA 300.0	CDC	3	PASI-A
92348154007	**TRIP BLANK**	EPA 8260	ZDO	48	PASI-C

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SUMMARY OF DETECTION

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348154

Lab Sample ID / Method	Client Sample ID / Parameters	Result	Units	Report Limit	Analyzed	Qualifiers
92348154001	**BG-1**					
EPA 6010	Barium	327	ug/L	5.0	07/25/17 02:29	
EPA 6010	Calcium	29000	ug/L	100	07/25/17 02:29	
EPA 6010	Vanadium	5.5	ug/L	5.0	07/25/17 02:29	
EPA 6020B	Lithium	19.8	ug/L	2.5	07/21/17 15:25	
EPA 903.1	Radium-226	0.151 ± 0.419 (0.812) C:NA T:87%	pCi/L		08/02/17 12:36	
EPA 904.0	Radium-228	0.132 ± 0.316 (0.702) C:80% T:85%	pCi/L		08/02/17 14:42	
SM 2540C	Total Dissolved Solids	606	mg/L	50.0	07/20/17 11:19	D6
EPA 300.0	Chloride	283	mg/L	5.0	07/20/17 16:21	
EPA 300.0	Fluoride	0.11	mg/L	0.10	07/19/17 22:11	
EPA 300.0	Sulfate	17.8	mg/L	1.0	07/19/17 22:11	
92348154002	**MW-8**					
EPA 6010	Barium	1190	ug/L	5.0	07/25/17 02:32	
EPA 6010	Calcium	117000	ug/L	1000	07/25/17 14:03	
EPA 6010	Zinc	50.7	ug/L	10.0	07/25/17 02:32	
EPA 6020B	Lithium	27.7	ug/L	2.5	07/21/17 15:27	
EPA 903.1	Radium-226	1.05 ± 0.610 (0.650) C:NA T:94%	pCi/L		08/02/17 12:36	
EPA 904.0	Radium-228	0.594 ± 0.382 (0.729) C:81% T:87%	pCi/L		08/02/17 14:42	
SM 2540C	Total Dissolved Solids	934	mg/L	50.0	07/20/17 11:20	
EPA 300.0	Chloride	473	mg/L	9.0	07/20/17 17:21	
EPA 300.0	Sulfate	6.3	mg/L	1.0	07/19/17 23:05	
92348154003	**LEACHATE**					
EPA 6010	Antimony	8.6	ug/L	5.0	07/25/17 02:35	
EPA 6010	Arsenic	33.4	ug/L	10.0	07/25/17 02:35	
EPA 6010	Barium	160	ug/L	5.0	07/25/17 02:35	
EPA 6010	Calcium	216000	ug/L	1000	07/25/17 14:06	
EPA 6010	Copper	5.7	ug/L	5.0	07/25/17 02:35	
EPA 6010	Molybdenum	288	ug/L	5.0	07/25/17 02:35	
EPA 6010	Nickel	14.6	ug/L	5.0	07/25/17 02:35	
EPA 6010	Selenium	11.1	ug/L	10.0	07/25/17 02:35	
EPA 6010	Vanadium	39.7	ug/L	5.0	07/25/17 02:35	
EPA 6010	Zinc	28.0	ug/L	10.0	07/25/17 02:35	
EPA 6020B	Boron	2120	ug/L	250	07/21/17 16:10	
EPA 6020B	Lithium	68.2	ug/L	25.0	07/21/17 16:10	
EPA 6020B	Thallium	0.66	ug/L	0.10	07/19/17 14:21	

REPORT OF LABORATORY ANALYSIS

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SUMMARY OF DETECTION

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348154

Lab Sample ID / Method	Client Sample ID / Parameters	Result	Units	Report Limit	Analyzed	Qualifiers
92348154003	**LEACHATE**					
EPA 903.1	Radium-226	0.626 ± 0.536 (0.727) C:NA T:85%	pCi/L		08/02/17 12:36	
EPA 904.0	Radium-228	0.372 ± 0.348 (0.708) C:79% T:80%	pCi/L		08/02/17 14:42	
SM 2540C	Total Dissolved Solids	1040	mg/L	50.0	07/20/17 11:20	
EPA 300.0	Chloride	12.7	mg/L	1.0	07/19/17 23:59	
EPA 300.0	Fluoride	0.18	mg/L	0.10	07/19/17 23:59	
EPA 300.0	Sulfate	477	mg/L	8.0	07/20/17 18:32	
92348154004	**S1**					
EPA 6010	Arsenic	18.0	ug/L	10.0	07/25/17 02:38	
EPA 6010	Barium	719	ug/L	5.0	07/25/17 02:38	
EPA 6010	Beryllium	3.3	ug/L	1.0	07/25/17 02:38	
EPA 6010	Calcium	10900	ug/L	100	07/25/17 02:38	
EPA 6010	Chromium	24.9	ug/L	5.0	07/25/17 02:38	
EPA 6010	Cobalt	10.6	ug/L	5.0	07/25/17 02:38	
EPA 6010	Copper	25.2	ug/L	5.0	07/25/17 02:38	
EPA 6010	Lead	56.4	ug/L	5.0	07/25/17 02:38	
EPA 6010	Molybdenum	5.8	ug/L	5.0	07/25/17 02:38	
EPA 6010	Nickel	12.8	ug/L	5.0	07/25/17 02:38	
EPA 6010	Vanadium	93.0	ug/L	5.0	07/25/17 02:38	
EPA 6010	Zinc	95.6	ug/L	10.0	07/25/17 02:38	
EPA 903.1	Radium-226	0.748 ± 0.587 (0.816) C:NA T:98%	pCi/L		08/02/17 12:36	
EPA 904.0	Radium-228	0.951 ± 0.430 (0.704) C:84% T:73%	pCi/L		08/02/17 14:43	
SM 2540C	Total Dissolved Solids	1690	mg/L	25.0	07/20/17 11:21	
EPA 300.0	Chloride	7.0	mg/L	1.0	07/20/17 00:17	
EPA 300.0	Fluoride	0.39	mg/L	0.10	07/20/17 00:17	M1
EPA 300.0	Sulfate	3.2	mg/L	1.0	07/20/17 00:17	
92348154005	**AMB**					
EPA 903.1	Radium-226	0.289 ± 0.349 (0.532) C:NA T:90%	pCi/L		08/02/17 12:57	
EPA 904.0	Radium-228	0.0533 ± 0.285 (0.652) C:82% T:83%	pCi/L		08/02/17 14:43	

REPORT OF LABORATORY ANALYSIS

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SUMMARY OF DETECTION

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348154

Lab Sample ID / Method	Client Sample ID / Parameters	Result	Units	Report Limit	Analyzed	Qualifiers
92348154006	**EQ BLANK**					
EPA 903.1	Radium-226	1.02 ± 0.679 (0.792) C:NA T:78%	pCi/L		08/02/17 12:57	
EPA 904.0	Radium-228	-0.112 ± 0.262 (0.640) C:80% T:88%	pCi/L		08/02/17 14:43	

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348154

Sample: BG-1 **Lab ID: 92348154001** Collected: 07/17/17 10:45 Received: 07/18/17 12:30 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP	Analytical Method: EPA 6010 Preparation Method: EPA 3010A							
Antimony	ND	ug/L	5.0	1	07/19/17 15:45	07/25/17 02:29	7440-36-0	
Arsenic	ND	ug/L	10.0	1	07/19/17 15:45	07/25/17 02:29	7440-38-2	
Barium	**327**	ug/L	5.0	1	07/19/17 15:45	07/25/17 02:29	7440-39-3	
Beryllium	ND	ug/L	1.0	1	07/19/17 15:45	07/25/17 02:29	7440-41-7	
Cadmium	ND	ug/L	1.0	1	07/19/17 15:45	07/25/17 02:29	7440-43-9	
Calcium	**29000**	ug/L	100	1	07/19/17 15:45	07/25/17 02:29	7440-70-2	
Chromium	ND	ug/L	5.0	1	07/19/17 15:45	07/25/17 02:29	7440-47-3	
Cobalt	ND	ug/L	5.0	1	07/19/17 15:45	07/25/17 02:29	7440-48-4	
Copper	ND	ug/L	5.0	1	07/19/17 15:45	07/25/17 02:29	7440-50-8	
Lead	ND	ug/L	5.0	1	07/19/17 15:45	07/25/17 02:29	7439-92-1	
Molybdenum	ND	ug/L	5.0	1	07/19/17 15:45	07/25/17 02:29	7439-98-7	
Nickel	ND	ug/L	5.0	1	07/19/17 15:45	07/25/17 02:29	7440-02-0	
Selenium	ND	ug/L	10.0	1	07/19/17 15:45	07/25/17 02:29	7782-49-2	
Silver	ND	ug/L	5.0	1	07/19/17 15:45	07/25/17 02:29	7440-22-4	
Vanadium	**5.5**	ug/L	5.0	1	07/19/17 15:45	07/25/17 02:29	7440-62-2	
Zinc	ND	ug/L	10.0	1	07/19/17 15:45	07/25/17 02:29	7440-66-6	
6020 MET ICPMS	Analytical Method: EPA 6020B Preparation Method: EPA 3010A							
Boron	ND	ug/L	25.0	1	07/19/17 03:45	07/21/17 15:25	7440-42-8	
Lithium	**19.8**	ug/L	2.5	1	07/19/17 03:45	07/21/17 15:25	7439-93-2	
Thallium	ND	ug/L	0.10	1	07/19/17 03:45	07/19/17 14:11	7440-28-0	
7470 Mercury	Analytical Method: EPA 7470 Preparation Method: EPA 7470							
Mercury	ND	ug/L	0.20	1	07/19/17 13:09	07/20/17 04:13	7439-97-6	
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
Acetone	ND	ug/L	25.0	1		07/19/17 14:57	67-64-1	L1,M0
Acrylonitrile	ND	ug/L	10.0	1		07/19/17 14:57	107-13-1	
Benzene	ND	ug/L	1.0	1		07/19/17 14:57	71-43-2	
Bromochloromethane	ND	ug/L	1.0	1		07/19/17 14:57	74-97-5	
Bromodichloromethane	ND	ug/L	1.0	1		07/19/17 14:57	75-27-4	
Bromoform	ND	ug/L	1.0	1		07/19/17 14:57	75-25-2	
Bromomethane	ND	ug/L	2.0	1		07/19/17 14:57	74-83-9	
2-Butanone (MEK)	ND	ug/L	5.0	1		07/19/17 14:57	78-93-3	L1
Carbon disulfide	ND	ug/L	2.0	1		07/19/17 14:57	75-15-0	
Carbon tetrachloride	ND	ug/L	1.0	1		07/19/17 14:57	56-23-5	
Chlorobenzene	ND	ug/L	1.0	1		07/19/17 14:57	108-90-7	
Chloroethane	ND	ug/L	1.0	1		07/19/17 14:57	75-00-3	
Chloroform	ND	ug/L	1.0	1		07/19/17 14:57	67-66-3	
Chloromethane	ND	ug/L	1.0	1		07/19/17 14:57	74-87-3	
Dibromochloromethane	ND	ug/L	1.0	1		07/19/17 14:57	124-48-1	
Dibromomethane	ND	ug/L	1.0	1		07/19/17 14:57	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	1.0	1		07/19/17 14:57	95-50-1	
1,4-Dichlorobenzene	ND	ug/L	1.0	1		07/19/17 14:57	106-46-7	
trans-1,4-Dichloro-2-butene	ND	ug/L	1.0	1		07/19/17 14:57	110-57-6	L1
1,1-Dichloroethane	ND	ug/L	1.0	1		07/19/17 14:57	75-34-3	

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(704)875-9092

ANALYTICAL RESULTS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348154

Sample: BG-1 **Lab ID: 92348154001** Collected: 07/17/17 10:45 Received: 07/18/17 12:30 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
1,2-Dichloroethane	ND	ug/L	1.0	1		07/19/17 14:57	107-06-2	
1,1-Dichloroethene	ND	ug/L	1.0	1		07/19/17 14:57	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	1.0	1		07/19/17 14:57	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	1.0	1		07/19/17 14:57	156-60-5	
1,2-Dichloropropane	ND	ug/L	1.0	1		07/19/17 14:57	78-87-5	
cis-1,3-Dichloropropene	ND	ug/L	1.0	1		07/19/17 14:57	10061-01-5	
trans-1,3-Dichloropropene	ND	ug/L	1.0	1		07/19/17 14:57	10061-02-6	
Ethylbenzene	ND	ug/L	1.0	1		07/19/17 14:57	100-41-4	
2-Hexanone	ND	ug/L	5.0	1		07/19/17 14:57	591-78-6	
Iodomethane	ND	ug/L	5.0	1		07/19/17 14:57	74-88-4	
Methylene Chloride	ND	ug/L	1.0	1		07/19/17 14:57	75-09-2	
4-Methyl-2-pentanone (MIBK)	ND	ug/L	5.0	1		07/19/17 14:57	108-10-1	
Styrene	ND	ug/L	1.0	1		07/19/17 14:57	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0	1		07/19/17 14:57	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0	1		07/19/17 14:57	79-34-5	
Tetrachloroethene	ND	ug/L	1.0	1		07/19/17 14:57	127-18-4	
Toluene	ND	ug/L	1.0	1		07/19/17 14:57	108-88-3	
1,1,1-Trichloroethane	ND	ug/L	1.0	1		07/19/17 14:57	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	1.0	1		07/19/17 14:57	79-00-5	
Trichloroethene	ND	ug/L	1.0	1		07/19/17 14:57	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0	1		07/19/17 14:57	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0	1		07/19/17 14:57	96-18-4	
Vinyl acetate	ND	ug/L	2.0	1		07/19/17 14:57	108-05-4	
Vinyl chloride	ND	ug/L	1.0	1		07/19/17 14:57	75-01-4	
Xylene (Total)	ND	ug/L	1.0	1		07/19/17 14:57	1330-20-7	
Surrogates								
4-Bromofluorobenzene (S)	103	%	70-130	1		07/19/17 14:57	460-00-4	
1,2-Dichloroethane-d4 (S)	105	%	70-130	1		07/19/17 14:57	17060-07-0	
Toluene-d8 (S)	105	%	70-130	1		07/19/17 14:57	2037-26-5	
2540C Total Dissolved Solids	Analytical Method: SM 2540C							
Total Dissolved Solids	**606**	mg/L	50.0	1		07/20/17 11:19		D6
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0							
Chloride	**283**	mg/L	5.0	5		07/20/17 16:21	16887-00-6	
Fluoride	**0.11**	mg/L	0.10	1		07/19/17 22:11	16984-48-8	
Sulfate	**17.8**	mg/L	1.0	1		07/19/17 22:11	14808-79-8	

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(704)875-9092

ANALYTICAL RESULTS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348154

Sample: MW-8 **Lab ID: 92348154002** Collected: 07/17/17 14:40 Received: 07/18/17 12:30 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP	Analytical Method: EPA 6010 Preparation Method: EPA 3010A							
Antimony	ND	ug/L	5.0	1	07/19/17 15:45	07/25/17 02:32	7440-36-0	
Arsenic	ND	ug/L	10.0	1	07/19/17 15:45	07/25/17 02:32	7440-38-2	
Barium	**1190**	ug/L	5.0	1	07/19/17 15:45	07/25/17 02:32	7440-39-3	
Beryllium	ND	ug/L	1.0	1	07/19/17 15:45	07/25/17 02:32	7440-41-7	
Cadmium	ND	ug/L	1.0	1	07/19/17 15:45	07/25/17 02:32	7440-43-9	
Calcium	**117000**	ug/L	1000	10	07/19/17 15:45	07/25/17 14:03	7440-70-2	
Chromium	ND	ug/L	5.0	1	07/19/17 15:45	07/25/17 02:32	7440-47-3	
Cobalt	ND	ug/L	5.0	1	07/19/17 15:45	07/25/17 02:32	7440-48-4	
Copper	ND	ug/L	5.0	1	07/19/17 15:45	07/25/17 02:32	7440-50-8	
Lead	ND	ug/L	5.0	1	07/19/17 15:45	07/25/17 02:32	7439-92-1	
Molybdenum	ND	ug/L	5.0	1	07/19/17 15:45	07/25/17 02:32	7439-98-7	
Nickel	ND	ug/L	5.0	1	07/19/17 15:45	07/25/17 02:32	7440-02-0	
Selenium	ND	ug/L	10.0	1	07/19/17 15:45	07/25/17 02:32	7782-49-2	
Silver	ND	ug/L	5.0	1	07/19/17 15:45	07/25/17 02:32	7440-22-4	
Vanadium	ND	ug/L	5.0	1	07/19/17 15:45	07/25/17 02:32	7440-62-2	
Zinc	**50.7**	ug/L	10.0	1	07/19/17 15:45	07/25/17 02:32	7440-66-6	
6020 MET ICPMS	Analytical Method: EPA 6020B Preparation Method: EPA 3010A							
Boron	ND	ug/L	25.0	1	07/19/17 03:45	07/21/17 15:27	7440-42-8	
Lithium	**27.7**	ug/L	2.5	1	07/19/17 03:45	07/21/17 15:27	7439-93-2	
Thallium	ND	ug/L	0.10	1	07/19/17 03:45	07/19/17 14:13	7440-28-0	
7470 Mercury	Analytical Method: EPA 7470 Preparation Method: EPA 7470							
Mercury	ND	ug/L	0.20	1	07/19/17 13:09	07/20/17 04:15	7439-97-6	
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
Acetone	ND	ug/L	25.0	1		07/19/17 15:14	67-64-1	L1
Acrylonitrile	ND	ug/L	10.0	1		07/19/17 15:14	107-13-1	
Benzene	ND	ug/L	1.0	1		07/19/17 15:14	71-43-2	
Bromochloromethane	ND	ug/L	1.0	1		07/19/17 15:14	74-97-5	
Bromodichloromethane	ND	ug/L	1.0	1		07/19/17 15:14	75-27-4	
Bromoform	ND	ug/L	1.0	1		07/19/17 15:14	75-25-2	
Bromomethane	ND	ug/L	2.0	1		07/19/17 15:14	74-83-9	
2-Butanone (MEK)	ND	ug/L	5.0	1		07/19/17 15:14	78-93-3	L1
Carbon disulfide	ND	ug/L	2.0	1		07/19/17 15:14	75-15-0	
Carbon tetrachloride	ND	ug/L	1.0	1		07/19/17 15:14	56-23-5	
Chlorobenzene	ND	ug/L	1.0	1		07/19/17 15:14	108-90-7	
Chloroethane	ND	ug/L	1.0	1		07/19/17 15:14	75-00-3	
Chloroform	ND	ug/L	1.0	1		07/19/17 15:14	67-66-3	
Chloromethane	ND	ug/L	1.0	1		07/19/17 15:14	74-87-3	
Dibromochloromethane	ND	ug/L	1.0	1		07/19/17 15:14	124-48-1	
Dibromomethane	ND	ug/L	1.0	1		07/19/17 15:14	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	1.0	1		07/19/17 15:14	95-50-1	
1,4-Dichlorobenzene	ND	ug/L	1.0	1		07/19/17 15:14	106-46-7	
trans-1,4-Dichloro-2-butene	ND	ug/L	1.0	1		07/19/17 15:14	110-57-6	L1
1,1-Dichloroethane	ND	ug/L	1.0	1		07/19/17 15:14	75-34-3	

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ANALYTICAL RESULTS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348154

Sample: MW-8 **Lab ID: 92348154002** Collected: 07/17/17 14:40 Received: 07/18/17 12:30 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
1,2-Dichloroethane	ND	ug/L	1.0	1		07/19/17 15:14	107-06-2	
1,1-Dichloroethene	ND	ug/L	1.0	1		07/19/17 15:14	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	1.0	1		07/19/17 15:14	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	1.0	1		07/19/17 15:14	156-60-5	
1,2-Dichloropropane	ND	ug/L	1.0	1		07/19/17 15:14	78-87-5	
cis-1,3-Dichloropropene	ND	ug/L	1.0	1		07/19/17 15:14	10061-01-5	
trans-1,3-Dichloropropene	ND	ug/L	1.0	1		07/19/17 15:14	10061-02-6	
Ethylbenzene	ND	ug/L	1.0	1		07/19/17 15:14	100-41-4	
2-Hexanone	ND	ug/L	5.0	1		07/19/17 15:14	591-78-6	
Iodomethane	ND	ug/L	5.0	1		07/19/17 15:14	74-88-4	
Methylene Chloride	ND	ug/L	1.0	1		07/19/17 15:14	75-09-2	
4-Methyl-2-pentanone (MIBK)	ND	ug/L	5.0	1		07/19/17 15:14	108-10-1	
Styrene	ND	ug/L	1.0	1		07/19/17 15:14	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0	1		07/19/17 15:14	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0	1		07/19/17 15:14	79-34-5	
Tetrachloroethene	ND	ug/L	1.0	1		07/19/17 15:14	127-18-4	
Toluene	ND	ug/L	1.0	1		07/19/17 15:14	108-88-3	
1,1,1-Trichloroethane	ND	ug/L	1.0	1		07/19/17 15:14	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	1.0	1		07/19/17 15:14	79-00-5	
Trichloroethene	ND	ug/L	1.0	1		07/19/17 15:14	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0	1		07/19/17 15:14	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0	1		07/19/17 15:14	96-18-4	
Vinyl acetate	ND	ug/L	2.0	1		07/19/17 15:14	108-05-4	
Vinyl chloride	ND	ug/L	1.0	1		07/19/17 15:14	75-01-4	
Xylene (Total)	ND	ug/L	1.0	1		07/19/17 15:14	1330-20-7	
Surrogates								
4-Bromofluorobenzene (S)	100	%	70-130	1		07/19/17 15:14	460-00-4	
1,2-Dichloroethane-d4 (S)	103	%	70-130	1		07/19/17 15:14	17060-07-0	
Toluene-d8 (S)	103	%	70-130	1		07/19/17 15:14	2037-26-5	
2540C Total Dissolved Solids	Analytical Method: SM 2540C							
Total Dissolved Solids	**934**	mg/L	50.0	1		07/20/17 11:20		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0							
Chloride	**473**	mg/L	9.0	9		07/20/17 17:21	16887-00-6	
Fluoride	ND	mg/L	0.10	1		07/19/17 23:05	16984-48-8	
Sulfate	**6.3**	mg/L	1.0	1		07/19/17 23:05	14808-79-8	

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ANALYTICAL RESULTS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348154

Sample: LEACHATE **Lab ID: 92348154003** Collected: 07/17/17 16:00 Received: 07/18/17 12:30 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP	Analytical Method: EPA 6010 Preparation Method: EPA 3010A							
Antimony	**8.6**	ug/L	5.0	1	07/19/17 15:45	07/25/17 02:35	7440-36-0	
Arsenic	**33.4**	ug/L	10.0	1	07/19/17 15:45	07/25/17 02:35	7440-38-2	
Barium	**160**	ug/L	5.0	1	07/19/17 15:45	07/25/17 02:35	7440-39-3	
Beryllium	ND	ug/L	1.0	1	07/19/17 15:45	07/25/17 02:35	7440-41-7	
Cadmium	ND	ug/L	1.0	1	07/19/17 15:45	07/25/17 02:35	7440-43-9	
Calcium	**216000**	ug/L	1000	10	07/19/17 15:45	07/25/17 14:06	7440-70-2	
Chromium	ND	ug/L	5.0	1	07/19/17 15:45	07/25/17 02:35	7440-47-3	
Cobalt	ND	ug/L	5.0	1	07/19/17 15:45	07/25/17 02:35	7440-48-4	
Copper	**5.7**	ug/L	5.0	1	07/19/17 15:45	07/25/17 02:35	7440-50-8	
Lead	ND	ug/L	5.0	1	07/19/17 15:45	07/25/17 02:35	7439-92-1	
Molybdenum	**288**	ug/L	5.0	1	07/19/17 15:45	07/25/17 02:35	7439-98-7	
Nickel	**14.6**	ug/L	5.0	1	07/19/17 15:45	07/25/17 02:35	7440-02-0	
Selenium	**11.1**	ug/L	10.0	1	07/19/17 15:45	07/25/17 02:35	7782-49-2	
Silver	ND	ug/L	5.0	1	07/19/17 15:45	07/25/17 02:35	7440-22-4	
Vanadium	**39.7**	ug/L	5.0	1	07/19/17 15:45	07/25/17 02:35	7440-62-2	
Zinc	**28.0**	ug/L	10.0	1	07/19/17 15:45	07/25/17 02:35	7440-66-6	
6020 MET ICPMS	Analytical Method: EPA 6020B Preparation Method: EPA 3010A							
Boron	**2120**	ug/L	250	10	07/19/17 03:45	07/21/17 16:10	7440-42-8	
Lithium	**68.2**	ug/L	25.0	10	07/19/17 03:45	07/21/17 16:10	7439-93-2	
Thallium	**0.66**	ug/L	0.10	1	07/19/17 03:45	07/19/17 14:21	7440-28-0	
7470 Mercury	Analytical Method: EPA 7470 Preparation Method: EPA 7470							
Mercury	ND	ug/L	0.20	1	07/19/17 13:09	07/20/17 04:18	7439-97-6	
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
Acetone	ND	ug/L	25.0	1		07/19/17 15:49	67-64-1	L1
Acrylonitrile	ND	ug/L	10.0	1		07/19/17 15:49	107-13-1	
Benzene	ND	ug/L	1.0	1		07/19/17 15:49	71-43-2	
Bromochloromethane	ND	ug/L	1.0	1		07/19/17 15:49	74-97-5	
Bromodichloromethane	ND	ug/L	1.0	1		07/19/17 15:49	75-27-4	
Bromoform	ND	ug/L	1.0	1		07/19/17 15:49	75-25-2	
Bromomethane	ND	ug/L	2.0	1		07/19/17 15:49	74-83-9	
2-Butanone (MEK)	ND	ug/L	5.0	1		07/19/17 15:49	78-93-3	L1
Carbon disulfide	ND	ug/L	2.0	1		07/19/17 15:49	75-15-0	
Carbon tetrachloride	ND	ug/L	1.0	1		07/19/17 15:49	56-23-5	
Chlorobenzene	ND	ug/L	1.0	1		07/19/17 15:49	108-90-7	
Chloroethane	ND	ug/L	1.0	1		07/19/17 15:49	75-00-3	
Chloroform	ND	ug/L	1.0	1		07/19/17 15:49	67-66-3	
Chloromethane	ND	ug/L	1.0	1		07/19/17 15:49	74-87-3	
Dibromochloromethane	ND	ug/L	1.0	1		07/19/17 15:49	124-48-1	
Dibromomethane	ND	ug/L	1.0	1		07/19/17 15:49	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	1.0	1		07/19/17 15:49	95-50-1	
1,4-Dichlorobenzene	ND	ug/L	1.0	1		07/19/17 15:49	106-46-7	
trans-1,4-Dichloro-2-butene	ND	ug/L	1.0	1		07/19/17 15:49	110-57-6	L1
1,1-Dichloroethane	ND	ug/L	1.0	1		07/19/17 15:49	75-34-3	

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ANALYTICAL RESULTS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348154

Sample: LEACHATE **Lab ID: 92348154003** Collected: 07/17/17 16:00 Received: 07/18/17 12:30 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
1,2-Dichloroethane	ND	ug/L	1.0	1		07/19/17 15:49	107-06-2	
1,1-Dichloroethene	ND	ug/L	1.0	1		07/19/17 15:49	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	1.0	1		07/19/17 15:49	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	1.0	1		07/19/17 15:49	156-60-5	
1,2-Dichloropropane	ND	ug/L	1.0	1		07/19/17 15:49	78-87-5	
cis-1,3-Dichloropropene	ND	ug/L	1.0	1		07/19/17 15:49	10061-01-5	
trans-1,3-Dichloropropene	ND	ug/L	1.0	1		07/19/17 15:49	10061-02-6	
Ethylbenzene	ND	ug/L	1.0	1		07/19/17 15:49	100-41-4	
2-Hexanone	ND	ug/L	5.0	1		07/19/17 15:49	591-78-6	
Iodomethane	ND	ug/L	5.0	1		07/19/17 15:49	74-88-4	
Methylene Chloride	ND	ug/L	1.0	1		07/19/17 15:49	75-09-2	
4-Methyl-2-pentanone (MIBK)	ND	ug/L	5.0	1		07/19/17 15:49	108-10-1	
Styrene	ND	ug/L	1.0	1		07/19/17 15:49	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0	1		07/19/17 15:49	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0	1		07/19/17 15:49	79-34-5	
Tetrachloroethene	ND	ug/L	1.0	1		07/19/17 15:49	127-18-4	
Toluene	ND	ug/L	1.0	1		07/19/17 15:49	108-88-3	
1,1,1-Trichloroethane	ND	ug/L	1.0	1		07/19/17 15:49	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	1.0	1		07/19/17 15:49	79-00-5	
Trichloroethene	ND	ug/L	1.0	1		07/19/17 15:49	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0	1		07/19/17 15:49	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0	1		07/19/17 15:49	96-18-4	
Vinyl acetate	ND	ug/L	2.0	1		07/19/17 15:49	108-05-4	
Vinyl chloride	ND	ug/L	1.0	1		07/19/17 15:49	75-01-4	
Xylene (Total)	ND	ug/L	1.0	1		07/19/17 15:49	1330-20-7	
Surrogates								
4-Bromofluorobenzene (S)	100	%	70-130	1		07/19/17 15:49	460-00-4	
1,2-Dichloroethane-d4 (S)	101	%	70-130	1		07/19/17 15:49	17060-07-0	
Toluene-d8 (S)	104	%	70-130	1		07/19/17 15:49	2037-26-5	
2540C Total Dissolved Solids	Analytical Method: SM 2540C							
Total Dissolved Solids	**1040**	mg/L	50.0	1		07/20/17 11:20		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0							
Chloride	**12.7**	mg/L	1.0	1		07/19/17 23:59	16887-00-6	
Fluoride	**0.18**	mg/L	0.10	1		07/19/17 23:59	16984-48-8	
Sulfate	**477**	mg/L	8.0	8		07/20/17 18:32	14808-79-8	

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Huntersville, NC 28078
(704)875-9092

ANALYTICAL RESULTS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348154

Sample: S1 **Lab ID: 92348154004** Collected: 07/17/17 16:45 Received: 07/18/17 12:30 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP	Analytical Method: EPA 6010 Preparation Method: EPA 3010A							
Antimony	ND	ug/L	5.0	1	07/19/17 15:45	07/25/17 02:38	7440-36-0	
Arsenic	**18.0**	ug/L	10.0	1	07/19/17 15:45	07/25/17 02:38	7440-38-2	
Barium	**719**	ug/L	5.0	1	07/19/17 15:45	07/25/17 02:38	7440-39-3	
Beryllium	**3.3**	ug/L	1.0	1	07/19/17 15:45	07/25/17 02:38	7440-41-7	
Cadmium	ND	ug/L	1.0	1	07/19/17 15:45	07/25/17 02:38	7440-43-9	
Calcium	**10900**	ug/L	100	1	07/19/17 15:45	07/25/17 02:38	7440-70-2	
Chromium	**24.9**	ug/L	5.0	1	07/19/17 15:45	07/25/17 02:38	7440-47-3	
Cobalt	**10.6**	ug/L	5.0	1	07/19/17 15:45	07/25/17 02:38	7440-48-4	
Copper	**25.2**	ug/L	5.0	1	07/19/17 15:45	07/25/17 02:38	7440-50-8	
Lead	**56.4**	ug/L	5.0	1	07/19/17 15:45	07/25/17 02:38	7439-92-1	
Molybdenum	**5.8**	ug/L	5.0	1	07/19/17 15:45	07/25/17 02:38	7439-98-7	
Nickel	**12.8**	ug/L	5.0	1	07/19/17 15:45	07/25/17 02:38	7440-02-0	
Selenium	ND	ug/L	10.0	1	07/19/17 15:45	07/25/17 02:38	7782-49-2	
Silver	ND	ug/L	5.0	1	07/19/17 15:45	07/25/17 02:38	7440-22-4	
Vanadium	**93.0**	ug/L	5.0	1	07/19/17 15:45	07/25/17 02:38	7440-62-2	
Zinc	**95.6**	ug/L	10.0	1	07/19/17 15:45	07/25/17 02:38	7440-66-6	
6020 MET ICPMS	Analytical Method: EPA 6020B Preparation Method: EPA 3010A							
Boron	ND	ug/L	250	10	07/19/17 03:45	07/21/17 16:12	7440-42-8	
Lithium	ND	ug/L	25.0	10	07/19/17 03:45	07/21/17 16:12	7439-93-2	
Thallium	ND	ug/L	1.0	10	07/19/17 03:45	07/21/17 16:12	7440-28-0	
7470 Mercury	Analytical Method: EPA 7470 Preparation Method: EPA 7470							
Mercury	ND	ug/L	0.20	1	07/19/17 13:09	07/20/17 04:20	7439-97-6	
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
Acetone	ND	ug/L	25.0	1		07/19/17 16:06	67-64-1	L1
Acrylonitrile	ND	ug/L	10.0	1		07/19/17 16:06	107-13-1	
Benzene	ND	ug/L	1.0	1		07/19/17 16:06	71-43-2	
Bromochloromethane	ND	ug/L	1.0	1		07/19/17 16:06	74-97-5	
Bromodichloromethane	ND	ug/L	1.0	1		07/19/17 16:06	75-27-4	
Bromoform	ND	ug/L	1.0	1		07/19/17 16:06	75-25-2	
Bromomethane	ND	ug/L	2.0	1		07/19/17 16:06	74-83-9	
2-Butanone (MEK)	ND	ug/L	5.0	1		07/19/17 16:06	78-93-3	L1
Carbon disulfide	ND	ug/L	2.0	1		07/19/17 16:06	75-15-0	
Carbon tetrachloride	ND	ug/L	1.0	1		07/19/17 16:06	56-23-5	
Chlorobenzene	ND	ug/L	1.0	1		07/19/17 16:06	108-90-7	
Chloroethane	ND	ug/L	1.0	1		07/19/17 16:06	75-00-3	
Chloroform	ND	ug/L	1.0	1		07/19/17 16:06	67-66-3	
Chloromethane	ND	ug/L	1.0	1		07/19/17 16:06	74-87-3	
Dibromochloromethane	ND	ug/L	1.0	1		07/19/17 16:06	124-48-1	
Dibromomethane	ND	ug/L	1.0	1		07/19/17 16:06	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	1.0	1		07/19/17 16:06	95-50-1	
1,4-Dichlorobenzene	ND	ug/L	1.0	1		07/19/17 16:06	106-46-7	
trans-1,4-Dichloro-2-butene	ND	ug/L	1.0	1		07/19/17 16:06	110-57-6	L1
1,1-Dichloroethane	ND	ug/L	1.0	1		07/19/17 16:06	75-34-3	

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ANALYTICAL RESULTS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348154

Sample: S1 **Lab ID: 92348154004** Collected: 07/17/17 16:45 Received: 07/18/17 12:30 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
1,2-Dichloroethane	ND	ug/L	1.0	1		07/19/17 16:06	107-06-2	
1,1-Dichloroethene	ND	ug/L	1.0	1		07/19/17 16:06	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	1.0	1		07/19/17 16:06	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	1.0	1		07/19/17 16:06	156-60-5	
1,2-Dichloropropane	ND	ug/L	1.0	1		07/19/17 16:06	78-87-5	
cis-1,3-Dichloropropene	ND	ug/L	1.0	1		07/19/17 16:06	10061-01-5	
trans-1,3-Dichloropropene	ND	ug/L	1.0	1		07/19/17 16:06	10061-02-6	
Ethylbenzene	ND	ug/L	1.0	1		07/19/17 16:06	100-41-4	
2-Hexanone	ND	ug/L	5.0	1		07/19/17 16:06	591-78-6	
Iodomethane	ND	ug/L	5.0	1		07/19/17 16:06	74-88-4	
Methylene Chloride	ND	ug/L	1.0	1		07/19/17 16:06	75-09-2	
4-Methyl-2-pentanone (MIBK)	ND	ug/L	5.0	1		07/19/17 16:06	108-10-1	
Styrene	ND	ug/L	1.0	1		07/19/17 16:06	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0	1		07/19/17 16:06	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0	1		07/19/17 16:06	79-34-5	
Tetrachloroethene	ND	ug/L	1.0	1		07/19/17 16:06	127-18-4	
Toluene	ND	ug/L	1.0	1		07/19/17 16:06	108-88-3	
1,1,1-Trichloroethane	ND	ug/L	1.0	1		07/19/17 16:06	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	1.0	1		07/19/17 16:06	79-00-5	
Trichloroethene	ND	ug/L	1.0	1		07/19/17 16:06	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0	1		07/19/17 16:06	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0	1		07/19/17 16:06	96-18-4	
Vinyl acetate	ND	ug/L	2.0	1		07/19/17 16:06	108-05-4	
Vinyl chloride	ND	ug/L	1.0	1		07/19/17 16:06	75-01-4	
Xylene (Total)	ND	ug/L	1.0	1		07/19/17 16:06	1330-20-7	
Surrogates								
4-Bromofluorobenzene (S)	99	%	70-130	1		07/19/17 16:06	460-00-4	
1,2-Dichloroethane-d4 (S)	103	%	70-130	1		07/19/17 16:06	17060-07-0	
Toluene-d8 (S)	111	%	70-130	1		07/19/17 16:06	2037-26-5	
2540C Total Dissolved Solids	Analytical Method: SM 2540C							
Total Dissolved Solids	**1690**	mg/L	25.0	1		07/20/17 11:21		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0							
Chloride	**7.0**	mg/L	1.0	1		07/20/17 00:17	16887-00-6	
Fluoride	**0.39**	mg/L	0.10	1		07/20/17 00:17	16984-48-8	M1
Sulfate	**3.2**	mg/L	1.0	1		07/20/17 00:17	14808-79-8	

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ANALYTICAL RESULTS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348154

Sample: AMB **Lab ID: 92348154005** Collected: 07/17/17 13:00 Received: 07/18/17 12:30 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP	Analytical Method: EPA 6010 Preparation Method: EPA 3010A							
Antimony	ND	ug/L	5.0	1	07/19/17 15:45	07/25/17 02:41	7440-36-0	
Arsenic	ND	ug/L	10.0	1	07/19/17 15:45	07/25/17 02:41	7440-38-2	
Barium	ND	ug/L	5.0	1	07/19/17 15:45	07/25/17 02:41	7440-39-3	
Beryllium	ND	ug/L	1.0	1	07/19/17 15:45	07/25/17 02:41	7440-41-7	
Cadmium	ND	ug/L	1.0	1	07/19/17 15:45	07/25/17 02:41	7440-43-9	
Calcium	ND	ug/L	100	1	07/19/17 15:45	07/25/17 02:41	7440-70-2	
Chromium	ND	ug/L	5.0	1	07/19/17 15:45	07/25/17 02:41	7440-47-3	
Cobalt	ND	ug/L	5.0	1	07/19/17 15:45	07/25/17 02:41	7440-48-4	
Copper	ND	ug/L	5.0	1	07/19/17 15:45	07/25/17 02:41	7440-50-8	
Lead	ND	ug/L	5.0	1	07/19/17 15:45	07/25/17 02:41	7439-92-1	
Molybdenum	ND	ug/L	5.0	1	07/19/17 15:45	07/25/17 02:41	7439-98-7	
Nickel	ND	ug/L	5.0	1	07/19/17 15:45	07/25/17 02:41	7440-02-0	
Selenium	ND	ug/L	10.0	1	07/19/17 15:45	07/25/17 02:41	7782-49-2	
Silver	ND	ug/L	5.0	1	07/19/17 15:45	07/25/17 02:41	7440-22-4	
Vanadium	ND	ug/L	5.0	1	07/19/17 15:45	07/25/17 02:41	7440-62-2	
Zinc	ND	ug/L	10.0	1	07/19/17 15:45	07/25/17 02:41	7440-66-6	
6020 MET ICPMS	Analytical Method: EPA 6020B Preparation Method: EPA 3010A							
Boron	ND	ug/L	25.0	1	07/19/17 03:45	07/21/17 16:14	7440-42-8	
Lithium	ND	ug/L	2.5	1	07/19/17 03:45	07/21/17 16:14	7439-93-2	
Thallium	ND	ug/L	0.10	1	07/19/17 03:45	07/19/17 14:24	7440-28-0	
7470 Mercury	Analytical Method: EPA 7470 Preparation Method: EPA 7470							
Mercury	ND	ug/L	0.20	1	07/19/17 13:09	07/20/17 04:22	7439-97-6	
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
Acetone	ND	ug/L	25.0	1		07/19/17 16:24	67-64-1	L1
Acrylonitrile	ND	ug/L	10.0	1		07/19/17 16:24	107-13-1	
Benzene	ND	ug/L	1.0	1		07/19/17 16:24	71-43-2	
Bromochloromethane	ND	ug/L	1.0	1		07/19/17 16:24	74-97-5	
Bromodichloromethane	ND	ug/L	1.0	1		07/19/17 16:24	75-27-4	
Bromoform	ND	ug/L	1.0	1		07/19/17 16:24	75-25-2	
Bromomethane	ND	ug/L	2.0	1		07/19/17 16:24	74-83-9	
2-Butanone (MEK)	ND	ug/L	5.0	1		07/19/17 16:24	78-93-3	L1
Carbon disulfide	ND	ug/L	2.0	1		07/19/17 16:24	75-15-0	
Carbon tetrachloride	ND	ug/L	1.0	1		07/19/17 16:24	56-23-5	
Chlorobenzene	ND	ug/L	1.0	1		07/19/17 16:24	108-90-7	
Chloroethane	ND	ug/L	1.0	1		07/19/17 16:24	75-00-3	
Chloroform	ND	ug/L	1.0	1		07/19/17 16:24	67-66-3	
Chloromethane	ND	ug/L	1.0	1		07/19/17 16:24	74-87-3	
Dibromochloromethane	ND	ug/L	1.0	1		07/19/17 16:24	124-48-1	
Dibromomethane	ND	ug/L	1.0	1		07/19/17 16:24	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	1.0	1		07/19/17 16:24	95-50-1	
1,4-Dichlorobenzene	ND	ug/L	1.0	1		07/19/17 16:24	106-46-7	
trans-1,4-Dichloro-2-butene	ND	ug/L	1.0	1		07/19/17 16:24	110-57-6	L1
1,1-Dichloroethane	ND	ug/L	1.0	1		07/19/17 16:24	75-34-3	

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ANALYTICAL RESULTS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348154

Sample: AMB **Lab ID: 92348154005** Collected: 07/17/17 13:00 Received: 07/18/17 12:30 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
1,2-Dichloroethane	ND	ug/L	1.0	1		07/19/17 16:24	107-06-2	
1,1-Dichloroethene	ND	ug/L	1.0	1		07/19/17 16:24	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	1.0	1		07/19/17 16:24	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	1.0	1		07/19/17 16:24	156-60-5	
1,2-Dichloropropane	ND	ug/L	1.0	1		07/19/17 16:24	78-87-5	
cis-1,3-Dichloropropene	ND	ug/L	1.0	1		07/19/17 16:24	10061-01-5	
trans-1,3-Dichloropropene	ND	ug/L	1.0	1		07/19/17 16:24	10061-02-6	
Ethylbenzene	ND	ug/L	1.0	1		07/19/17 16:24	100-41-4	
2-Hexanone	ND	ug/L	5.0	1		07/19/17 16:24	591-78-6	
Iodomethane	ND	ug/L	5.0	1		07/19/17 16:24	74-88-4	
Methylene Chloride	ND	ug/L	1.0	1		07/19/17 16:24	75-09-2	
4-Methyl-2-pentanone (MIBK)	ND	ug/L	5.0	1		07/19/17 16:24	108-10-1	
Styrene	ND	ug/L	1.0	1		07/19/17 16:24	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0	1		07/19/17 16:24	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0	1		07/19/17 16:24	79-34-5	
Tetrachloroethene	ND	ug/L	1.0	1		07/19/17 16:24	127-18-4	
Toluene	ND	ug/L	1.0	1		07/19/17 16:24	108-88-3	
1,1,1-Trichloroethane	ND	ug/L	1.0	1		07/19/17 16:24	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	1.0	1		07/19/17 16:24	79-00-5	
Trichloroethene	ND	ug/L	1.0	1		07/19/17 16:24	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0	1		07/19/17 16:24	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0	1		07/19/17 16:24	96-18-4	
Vinyl acetate	ND	ug/L	2.0	1		07/19/17 16:24	108-05-4	
Vinyl chloride	ND	ug/L	1.0	1		07/19/17 16:24	75-01-4	
Xylene (Total)	ND	ug/L	1.0	1		07/19/17 16:24	1330-20-7	
Surrogates								
4-Bromofluorobenzene (S)	102	%	70-130	1		07/19/17 16:24	460-00-4	
1,2-Dichloroethane-d4 (S)	104	%	70-130	1		07/19/17 16:24	17060-07-0	
Toluene-d8 (S)	105	%	70-130	1		07/19/17 16:24	2037-26-5	
2540C Total Dissolved Solids	Analytical Method: SM 2540C							
Total Dissolved Solids	ND	mg/L	25.0	1		07/20/17 11:21		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0							
Chloride	ND	mg/L	1.0	1		07/20/17 01:10	16887-00-6	
Fluoride	ND	mg/L	0.10	1		07/20/17 01:10	16984-48-8	
Sulfate	ND	mg/L	1.0	1		07/20/17 01:10	14808-79-8	

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ANALYTICAL RESULTS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348154

Sample: EQ BLANK **Lab ID: 92348154006** Collected: 07/17/17 18:00 Received: 07/18/17 12:30 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP	Analytical Method: EPA 6010 Preparation Method: EPA 3010A							
Antimony	ND	ug/L	5.0	1	07/19/17 15:45	07/25/17 02:45	7440-36-0	
Arsenic	ND	ug/L	10.0	1	07/19/17 15:45	07/25/17 02:45	7440-38-2	
Barium	ND	ug/L	5.0	1	07/19/17 15:45	07/25/17 02:45	7440-39-3	
Beryllium	ND	ug/L	1.0	1	07/19/17 15:45	07/25/17 02:45	7440-41-7	
Cadmium	ND	ug/L	1.0	1	07/19/17 15:45	07/25/17 02:45	7440-43-9	
Calcium	ND	ug/L	100	1	07/19/17 15:45	07/25/17 02:45	7440-70-2	
Chromium	ND	ug/L	5.0	1	07/19/17 15:45	07/25/17 02:45	7440-47-3	
Cobalt	ND	ug/L	5.0	1	07/19/17 15:45	07/25/17 02:45	7440-48-4	
Copper	ND	ug/L	5.0	1	07/19/17 15:45	07/25/17 02:45	7440-50-8	
Lead	ND	ug/L	5.0	1	07/19/17 15:45	07/25/17 02:45	7439-92-1	
Molybdenum	ND	ug/L	5.0	1	07/19/17 15:45	07/25/17 02:45	7439-98-7	
Nickel	ND	ug/L	5.0	1	07/19/17 15:45	07/25/17 02:45	7440-02-0	
Selenium	ND	ug/L	10.0	1	07/19/17 15:45	07/25/17 02:45	7782-49-2	
Silver	ND	ug/L	5.0	1	07/19/17 15:45	07/25/17 02:45	7440-22-4	
Vanadium	ND	ug/L	5.0	1	07/19/17 15:45	07/25/17 02:45	7440-62-2	
Zinc	ND	ug/L	10.0	1	07/19/17 15:45	07/25/17 02:45	7440-66-6	
6020 MET ICPMS	Analytical Method: EPA 6020B Preparation Method: EPA 3010A							
Boron	ND	ug/L	25.0	1	07/19/17 03:45	07/21/17 16:16	7440-42-8	
Lithium	ND	ug/L	2.5	1	07/19/17 03:45	07/21/17 16:16	7439-93-2	
Thallium	ND	ug/L	0.10	1	07/19/17 03:45	07/19/17 14:26	7440-28-0	
7470 Mercury	Analytical Method: EPA 7470 Preparation Method: EPA 7470							
Mercury	ND	ug/L	0.20	1	07/19/17 13:09	07/20/17 04:25	7439-97-6	
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
Acetone	ND	ug/L	25.0	1		07/19/17 16:41	67-64-1	L1
Acrylonitrile	ND	ug/L	10.0	1		07/19/17 16:41	107-13-1	
Benzene	ND	ug/L	1.0	1		07/19/17 16:41	71-43-2	
Bromochloromethane	ND	ug/L	1.0	1		07/19/17 16:41	74-97-5	
Bromodichloromethane	ND	ug/L	1.0	1		07/19/17 16:41	75-27-4	
Bromoform	ND	ug/L	1.0	1		07/19/17 16:41	75-25-2	
Bromomethane	ND	ug/L	2.0	1		07/19/17 16:41	74-83-9	
2-Butanone (MEK)	ND	ug/L	5.0	1		07/19/17 16:41	78-93-3	L1
Carbon disulfide	ND	ug/L	2.0	1		07/19/17 16:41	75-15-0	
Carbon tetrachloride	ND	ug/L	1.0	1		07/19/17 16:41	56-23-5	
Chlorobenzene	ND	ug/L	1.0	1		07/19/17 16:41	108-90-7	
Chloroethane	ND	ug/L	1.0	1		07/19/17 16:41	75-00-3	
Chloroform	ND	ug/L	1.0	1		07/19/17 16:41	67-66-3	
Chloromethane	ND	ug/L	1.0	1		07/19/17 16:41	74-87-3	
Dibromochloromethane	ND	ug/L	1.0	1		07/19/17 16:41	124-48-1	
Dibromomethane	ND	ug/L	1.0	1		07/19/17 16:41	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	1.0	1		07/19/17 16:41	95-50-1	
1,4-Dichlorobenzene	ND	ug/L	1.0	1		07/19/17 16:41	106-46-7	
trans-1,4-Dichloro-2-butene	ND	ug/L	1.0	1		07/19/17 16:41	110-57-6	L1
1,1-Dichloroethane	ND	ug/L	1.0	1		07/19/17 16:41	75-34-3	

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ANALYTICAL RESULTS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348154

Sample: EQ BLANK **Lab ID: 92348154006** Collected: 07/17/17 18:00 Received: 07/18/17 12:30 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
1,2-Dichloroethane	ND	ug/L	1.0	1		07/19/17 16:41	107-06-2	
1,1-Dichloroethene	ND	ug/L	1.0	1		07/19/17 16:41	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	1.0	1		07/19/17 16:41	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	1.0	1		07/19/17 16:41	156-60-5	
1,2-Dichloropropane	ND	ug/L	1.0	1		07/19/17 16:41	78-87-5	
cis-1,3-Dichloropropene	ND	ug/L	1.0	1		07/19/17 16:41	10061-01-5	
trans-1,3-Dichloropropene	ND	ug/L	1.0	1		07/19/17 16:41	10061-02-6	
Ethylbenzene	ND	ug/L	1.0	1		07/19/17 16:41	100-41-4	
2-Hexanone	ND	ug/L	5.0	1		07/19/17 16:41	591-78-6	
Iodomethane	ND	ug/L	5.0	1		07/19/17 16:41	74-88-4	
Methylene Chloride	ND	ug/L	1.0	1		07/19/17 16:41	75-09-2	
4-Methyl-2-pentanone (MIBK)	ND	ug/L	5.0	1		07/19/17 16:41	108-10-1	
Styrene	ND	ug/L	1.0	1		07/19/17 16:41	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0	1		07/19/17 16:41	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0	1		07/19/17 16:41	79-34-5	
Tetrachloroethene	ND	ug/L	1.0	1		07/19/17 16:41	127-18-4	
Toluene	ND	ug/L	1.0	1		07/19/17 16:41	108-88-3	
1,1,1-Trichloroethane	ND	ug/L	1.0	1		07/19/17 16:41	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	1.0	1		07/19/17 16:41	79-00-5	
Trichloroethene	ND	ug/L	1.0	1		07/19/17 16:41	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0	1		07/19/17 16:41	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0	1		07/19/17 16:41	96-18-4	
Vinyl acetate	ND	ug/L	2.0	1		07/19/17 16:41	108-05-4	
Vinyl chloride	ND	ug/L	1.0	1		07/19/17 16:41	75-01-4	
Xylene (Total)	ND	ug/L	1.0	1		07/19/17 16:41	1330-20-7	
Surrogates								
4-Bromofluorobenzene (S)	104	%	70-130	1		07/19/17 16:41	460-00-4	
1,2-Dichloroethane-d4 (S)	102	%	70-130	1		07/19/17 16:41	17060-07-0	
Toluene-d8 (S)	113	%	70-130	1		07/19/17 16:41	2037-26-5	
2540C Total Dissolved Solids	Analytical Method: SM 2540C							
Total Dissolved Solids	ND	mg/L	25.0	1		07/20/17 11:22		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0							
Chloride	ND	mg/L	1.0	1		07/20/17 01:28	16887-00-6	
Fluoride	ND	mg/L	0.10	1		07/20/17 01:28	16984-48-8	
Sulfate	ND	mg/L	1.0	1		07/20/17 01:28	14808-79-8	

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ANALYTICAL RESULTS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348154

Sample: TRIP BLANK **Lab ID: 92348154007** Collected: 07/17/17 00:00 Received: 07/18/17 12:30 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
Acetone	ND	ug/L	25.0	1		07/19/17 14:39	67-64-1	L1
Acrylonitrile	ND	ug/L	10.0	1		07/19/17 14:39	107-13-1	
Benzene	ND	ug/L	1.0	1		07/19/17 14:39	71-43-2	
Bromochloromethane	ND	ug/L	1.0	1		07/19/17 14:39	74-97-5	
Bromodichloromethane	ND	ug/L	1.0	1		07/19/17 14:39	75-27-4	
Bromoform	ND	ug/L	1.0	1		07/19/17 14:39	75-25-2	
Bromomethane	ND	ug/L	2.0	1		07/19/17 14:39	74-83-9	
2-Butanone (MEK)	ND	ug/L	5.0	1		07/19/17 14:39	78-93-3	L1
Carbon disulfide	ND	ug/L	2.0	1		07/19/17 14:39	75-15-0	
Carbon tetrachloride	ND	ug/L	1.0	1		07/19/17 14:39	56-23-5	
Chlorobenzene	ND	ug/L	1.0	1		07/19/17 14:39	108-90-7	
Chloroethane	ND	ug/L	1.0	1		07/19/17 14:39	75-00-3	
Chloroform	ND	ug/L	1.0	1		07/19/17 14:39	67-66-3	
Chloromethane	ND	ug/L	1.0	1		07/19/17 14:39	74-87-3	
Dibromochloromethane	ND	ug/L	1.0	1		07/19/17 14:39	124-48-1	
Dibromomethane	ND	ug/L	1.0	1		07/19/17 14:39	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	1.0	1		07/19/17 14:39	95-50-1	
1,4-Dichlorobenzene	ND	ug/L	1.0	1		07/19/17 14:39	106-46-7	
trans-1,4-Dichloro-2-butene	ND	ug/L	1.0	1		07/19/17 14:39	110-57-6	L1
1,1-Dichloroethane	ND	ug/L	1.0	1		07/19/17 14:39	75-34-3	
1,2-Dichloroethane	ND	ug/L	1.0	1		07/19/17 14:39	107-06-2	
1,1-Dichloroethene	ND	ug/L	1.0	1		07/19/17 14:39	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	1.0	1		07/19/17 14:39	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	1.0	1		07/19/17 14:39	156-60-5	
1,2-Dichloropropane	ND	ug/L	1.0	1		07/19/17 14:39	78-87-5	
cis-1,3-Dichloropropene	ND	ug/L	1.0	1		07/19/17 14:39	10061-01-5	
trans-1,3-Dichloropropene	ND	ug/L	1.0	1		07/19/17 14:39	10061-02-6	
Ethylbenzene	ND	ug/L	1.0	1		07/19/17 14:39	100-41-4	
2-Hexanone	ND	ug/L	5.0	1		07/19/17 14:39	591-78-6	
Iodomethane	ND	ug/L	5.0	1		07/19/17 14:39	74-88-4	
Methylene Chloride	ND	ug/L	1.0	1		07/19/17 14:39	75-09-2	
4-Methyl-2-pentanone (MIBK)	ND	ug/L	5.0	1		07/19/17 14:39	108-10-1	
Styrene	ND	ug/L	1.0	1		07/19/17 14:39	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0	1		07/19/17 14:39	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0	1		07/19/17 14:39	79-34-5	
Tetrachloroethene	ND	ug/L	1.0	1		07/19/17 14:39	127-18-4	
Toluene	ND	ug/L	1.0	1		07/19/17 14:39	108-88-3	
1,1,1-Trichloroethane	ND	ug/L	1.0	1		07/19/17 14:39	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	1.0	1		07/19/17 14:39	79-00-5	
Trichloroethene	ND	ug/L	1.0	1		07/19/17 14:39	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0	1		07/19/17 14:39	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0	1		07/19/17 14:39	96-18-4	
Vinyl acetate	ND	ug/L	2.0	1		07/19/17 14:39	108-05-4	
Vinyl chloride	ND	ug/L	1.0	1		07/19/17 14:39	75-01-4	
Xylene (Total)	ND	ug/L	1.0	1		07/19/17 14:39	1330-20-7	
Surrogates								
4-Bromofluorobenzene (S)	101	%	70-130	1		07/19/17 14:39	460-00-4	

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ANALYTICAL RESULTS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348154

Sample: TRIP BLANK **Lab ID: 92348154007** Collected: 07/17/17 00:00 Received: 07/18/17 12:30 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
Surrogates								
1,2-Dichloroethane-d4 (S)	102	%	70-130	1		07/19/17 14:39	17060-07-0	
Toluene-d8 (S)	103	%	70-130	1		07/19/17 14:39	2037-26-5	

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QUALITY CONTROL DATA

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348154

QC Batch: 369633 Analysis Method: EPA 7470
QC Batch Method: EPA 7470 Analysis Description: 7470 Mercury
Associated Lab Samples: 92348154001, 92348154002, 92348154003, 92348154004, 92348154005, 92348154006

METHOD BLANK: 2048080 Matrix: Water
Associated Lab Samples: 92348154001, 92348154002, 92348154003, 92348154004, 92348154005, 92348154006

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Mercury	ug/L	ND	0.20	07/20/17 03:39	

LABORATORY CONTROL SAMPLE: 2048081

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Mercury	ug/L	2.5	2.6	104	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2048082 2048083

Parameter	Units	92347970001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Mercury	ug/L	ND	2.5	2.5	2.6	2.6	103	106	75-125	3	25	

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QUALITY CONTROL DATA

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348154

QC Batch: 369584 Analysis Method: EPA 6010
QC Batch Method: EPA 3010A Analysis Description: 6010 MET
Associated Lab Samples: 92348154001, 92348154002, 92348154003, 92348154004, 92348154005, 92348154006

METHOD BLANK: 2047921 Matrix: Water
Associated Lab Samples: 92348154001, 92348154002, 92348154003, 92348154004, 92348154005, 92348154006

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Antimony	ug/L	ND	5.0	07/25/17 01:17	
Arsenic	ug/L	ND	10.0	07/25/17 01:17	
Barium	ug/L	ND	5.0	07/25/17 01:17	
Beryllium	ug/L	ND	1.0	07/25/17 01:17	
Cadmium	ug/L	ND	1.0	07/25/17 01:17	
Calcium	ug/L	ND	100	07/25/17 01:17	
Chromium	ug/L	ND	5.0	07/25/17 01:17	
Cobalt	ug/L	ND	5.0	07/25/17 01:17	
Copper	ug/L	ND	5.0	07/25/17 01:17	
Lead	ug/L	ND	5.0	07/25/17 01:17	
Molybdenum	ug/L	ND	5.0	07/25/17 01:17	
Nickel	ug/L	ND	5.0	07/25/17 01:17	
Selenium	ug/L	ND	10.0	07/25/17 01:17	
Silver	ug/L	ND	5.0	07/25/17 01:17	
Vanadium	ug/L	ND	5.0	07/25/17 01:17	
Zinc	ug/L	ND	10.0	07/25/17 01:17	

LABORATORY CONTROL SAMPLE: 2047922

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Antimony	ug/L	500	507	101	80-120	
Arsenic	ug/L	500	465	93	80-120	
Barium	ug/L	500	475	95	80-120	
Beryllium	ug/L	500	489	98	80-120	
Cadmium	ug/L	500	473	95	80-120	
Calcium	ug/L	5000	5020	100	80-120	
Chromium	ug/L	500	478	96	80-120	
Cobalt	ug/L	500	479	96	80-120	
Copper	ug/L	500	485	97	80-120	
Lead	ug/L	500	470	94	80-120	
Molybdenum	ug/L	500	519	104	80-120	
Nickel	ug/L	500	466	93	80-120	
Selenium	ug/L	500	484	97	80-120	
Silver	ug/L	250	258	103	80-120	
Vanadium	ug/L	500	477	95	80-120	
Zinc	ug/L	500	491	98	80-120	

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QUALITY CONTROL DATA

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348154

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2047923 2047924

Parameter	Units	92347961002 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Antimony	ug/L	ND	500	500	512	508	102	102	75-125	1	20	
Arsenic	ug/L	ND	500	500	474	470	95	94	75-125	1	20	
Barium	ug/L	20.0	500	500	503	497	97	95	75-125	1	20	
Beryllium	ug/L	ND	500	500	498	494	100	99	75-125	1	20	
Cadmium	ug/L	ND	500	500	478	475	96	95	75-125	1	20	
Calcium	ug/L	544	5000	5000	5610	5550	101	100	75-125	1	20	
Chromium	ug/L	ND	500	500	482	479	96	96	75-125	1	20	
Cobalt	ug/L	ND	500	500	485	482	97	96	75-125	1	20	
Copper	ug/L	ND	500	500	488	487	98	97	75-125	0	20	
Lead	ug/L	ND	500	500	477	473	95	94	75-125	1	20	
Molybdenum	ug/L	ND	500	500	527	525	105	105	75-125	0	20	
Nickel	ug/L	ND	500	500	471	468	94	94	75-125	1	20	
Selenium	ug/L	ND	500	500	485	482	97	96	75-125	1	20	
Silver	ug/L	ND	250	250	260	258	104	103	75-125	1	20	
Vanadium	ug/L	ND	500	500	484	479	97	96	75-125	1	20	
Zinc	ug/L	ND	500	500	498	494	98	98	75-125	1	20	

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QUALITY CONTROL DATA

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348154

QC Batch: 369599 Analysis Method: EPA 6020B
QC Batch Method: EPA 3010A Analysis Description: 6020 MET
Associated Lab Samples: 92348154001, 92348154002, 92348154003, 92348154004, 92348154005, 92348154006

METHOD BLANK: 2047936 Matrix: Water
Associated Lab Samples: 92348154001, 92348154002, 92348154003, 92348154004, 92348154005, 92348154006

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Boron	ug/L	ND	25.0	07/21/17 14:04	
Lithium	ug/L	ND	2.5	07/19/17 13:03	
Thallium	ug/L	ND	0.10	07/19/17 13:03	

LABORATORY CONTROL SAMPLE: 2047937

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Boron	ug/L	100	96.7	97	80-120	
Lithium	ug/L	100	95.4	95	80-120	
Thallium	ug/L	100	92.8	93	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2047938 2047939

Parameter	Units	92347981001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Boron	ug/L	9280	100	100	9580	9370	306	96	75-125	2	20	M1
Lithium	ug/L	21.0	100	100	106	104	85	83	75-125	1	20	
Thallium	ug/L	0.22	100	100	84.2	87.0	84	87	75-125	3	20	

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QUALITY CONTROL DATA

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348154

QC Batch: 369672 Analysis Method: EPA 8260
QC Batch Method: EPA 8260 Analysis Description: 8260 MSV Low Level Landfill
Associated Lab Samples: 92348154001, 92348154002, 92348154003, 92348154004, 92348154005, 92348154006, 92348154007

METHOD BLANK: 2048414 Matrix: Water
Associated Lab Samples: 92348154001, 92348154002, 92348154003, 92348154004, 92348154005, 92348154006, 92348154007

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
1,1,1,2-Tetrachloroethane	ug/L	ND	1.0	07/19/17 13:47	
1,1,1-Trichloroethane	ug/L	ND	1.0	07/19/17 13:47	
1,1,2,2-Tetrachloroethane	ug/L	ND	1.0	07/19/17 13:47	
1,1,2-Trichloroethane	ug/L	ND	1.0	07/19/17 13:47	
1,1-Dichloroethane	ug/L	ND	1.0	07/19/17 13:47	
1,1-Dichloroethene	ug/L	ND	1.0	07/19/17 13:47	
1,2,3-Trichloropropane	ug/L	ND	1.0	07/19/17 13:47	
1,2-Dichlorobenzene	ug/L	ND	1.0	07/19/17 13:47	
1,2-Dichloroethane	ug/L	ND	1.0	07/19/17 13:47	
1,2-Dichloropropane	ug/L	ND	1.0	07/19/17 13:47	
1,4-Dichlorobenzene	ug/L	ND	1.0	07/19/17 13:47	
2-Butanone (MEK)	ug/L	ND	5.0	07/19/17 13:47	
2-Hexanone	ug/L	ND	5.0	07/19/17 13:47	
4-Methyl-2-pentanone (MIBK)	ug/L	ND	5.0	07/19/17 13:47	
Acetone	ug/L	ND	25.0	07/19/17 13:47	
Acrylonitrile	ug/L	ND	10.0	07/19/17 13:47	
Benzene	ug/L	ND	1.0	07/19/17 13:47	
Bromochloromethane	ug/L	ND	1.0	07/19/17 13:47	
Bromodichloromethane	ug/L	ND	1.0	07/19/17 13:47	
Bromoform	ug/L	ND	1.0	07/19/17 13:47	
Bromomethane	ug/L	ND	2.0	07/19/17 13:47	
Carbon disulfide	ug/L	ND	2.0	07/19/17 13:47	
Carbon tetrachloride	ug/L	ND	1.0	07/19/17 13:47	
Chlorobenzene	ug/L	ND	1.0	07/19/17 13:47	
Chloroethane	ug/L	ND	1.0	07/19/17 13:47	
Chloroform	ug/L	ND	1.0	07/19/17 13:47	
Chloromethane	ug/L	ND	1.0	07/19/17 13:47	
cis-1,2-Dichloroethene	ug/L	ND	1.0	07/19/17 13:47	
cis-1,3-Dichloropropene	ug/L	ND	1.0	07/19/17 13:47	
Dibromochloromethane	ug/L	ND	1.0	07/19/17 13:47	
Dibromomethane	ug/L	ND	1.0	07/19/17 13:47	
Ethylbenzene	ug/L	ND	1.0	07/19/17 13:47	
Iodomethane	ug/L	ND	5.0	07/19/17 13:47	
Methylene Chloride	ug/L	ND	1.0	07/19/17 13:47	
Styrene	ug/L	ND	1.0	07/19/17 13:47	
Tetrachloroethene	ug/L	ND	1.0	07/19/17 13:47	
Toluene	ug/L	ND	1.0	07/19/17 13:47	
trans-1,2-Dichloroethene	ug/L	ND	1.0	07/19/17 13:47	
trans-1,3-Dichloropropene	ug/L	ND	1.0	07/19/17 13:47	
trans-1,4-Dichloro-2-butene	ug/L	ND	1.0	07/19/17 13:47	
Trichloroethene	ug/L	ND	1.0	07/19/17 13:47	

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QUALITY CONTROL DATA

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348154

METHOD BLANK: 2048414 Matrix: Water
Associated Lab Samples: 92348154001, 92348154002, 92348154003, 92348154004, 92348154005, 92348154006, 92348154007

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Trichlorofluoromethane	ug/L	ND	1.0	07/19/17 13:47	
Vinyl acetate	ug/L	ND	2.0	07/19/17 13:47	
Vinyl chloride	ug/L	ND	1.0	07/19/17 13:47	
Xylene (Total)	ug/L	ND	1.0	07/19/17 13:47	
1,2-Dichloroethane-d4 (S)	%	102	70-130	07/19/17 13:47	
4-Bromofluorobenzene (S)	%	101	70-130	07/19/17 13:47	
Toluene-d8 (S)	%	104	70-130	07/19/17 13:47	

LABORATORY CONTROL SAMPLE: 2048415

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
1,1,1,2-Tetrachloroethane	ug/L	50	49.6	99	80-125	
1,1,1-Trichloroethane	ug/L	50	49.9	100	71-129	
1,1,2,2-Tetrachloroethane	ug/L	50	51.3	103	79-124	
1,1,2-Trichloroethane	ug/L	50	53.8	108	85-125	
1,1-Dichloroethane	ug/L	50	51.5	103	73-126	
1,1-Dichloroethene	ug/L	50	53.3	107	66-135	
1,2,3-Trichloropropane	ug/L	50	53.7	107	75-130	
1,2-Dichlorobenzene	ug/L	50	47.8	96	80-133	
1,2-Dichloroethane	ug/L	50	47.9	96	67-128	
1,2-Dichloropropane	ug/L	50	52.9	106	75-132	
1,4-Dichlorobenzene	ug/L	50	48.2	96	78-130	
2-Butanone (MEK)	ug/L	100	149	149	61-144	L1
2-Hexanone	ug/L	100	138	138	68-143	
4-Methyl-2-pentanone (MIBK)	ug/L	100	124	124	72-135	
Acetone	ug/L	100	190	190	48-146	L1
Acrylonitrile	ug/L	250	312	125	40-160	
Benzene	ug/L	50	54.0	108	80-125	
Bromochloromethane	ug/L	50	53.5	107	71-125	
Bromodichloromethane	ug/L	50	51.7	103	78-124	
Bromoform	ug/L	50	43.6	87	71-128	
Bromomethane	ug/L	50	55.2	110	40-160	
Carbon disulfide	ug/L	50	56.7	113	50-160	
Carbon tetrachloride	ug/L	50	48.8	98	69-131	
Chlorobenzene	ug/L	50	50.6	101	81-122	
Chloroethane	ug/L	50	45.8	92	39-148	
Chloroform	ug/L	50	49.8	100	73-127	
Chloromethane	ug/L	50	51.9	104	44-146	
cis-1,2-Dichloroethene	ug/L	50	51.7	103	74-124	
cis-1,3-Dichloropropene	ug/L	50	55.3	111	72-132	
Dibromochloromethane	ug/L	50	50.7	101	78-125	
Dibromomethane	ug/L	50	49.9	100	82-120	
Ethylbenzene	ug/L	50	49.4	99	79-121	
Iodomethane	ug/L	100	107	107	39-154	

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QUALITY CONTROL DATA

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348154

LABORATORY CONTROL SAMPLE: 2048415

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Methylene Chloride	ug/L	50	48.8	98	64-133	
Styrene	ug/L	50	51.1	102	84-126	
Tetrachloroethene	ug/L	50	46.9	94	78-122	
Toluene	ug/L	50	50.5	101	80-121	
trans-1,2-Dichloroethene	ug/L	50	51.8	104	71-127	
trans-1,3-Dichloropropene	ug/L	50	53.8	108	69-141	
trans-1,4-Dichloro-2-butene	ug/L	50	85.9	172	40-160	L1
Trichloroethene	ug/L	50	50.9	102	78-122	
Trichlorofluoromethane	ug/L	50	49.9	100	53-137	
Vinyl acetate	ug/L	100	109	109	40-160	
Vinyl chloride	ug/L	50	49.7	99	58-137	
Xylene (Total)	ug/L	150	145	97	81-126	
1,2-Dichloroethane-d4 (S)	%			103	70-130	
4-Bromofluorobenzene (S)	%			95	70-130	
Toluene-d8 (S)	%			98	70-130	

MATRIX SPIKE SAMPLE: 2048416

Parameter	Units	92348154001 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
1,1,1,2-Tetrachloroethane	ug/L	ND	20	20.3	102	70-130	
1,1,1-Trichloroethane	ug/L	ND	20	21.4	107	70-130	
1,1,2,2-Tetrachloroethane	ug/L	ND	20	22.0	110	70-130	
1,1,2-Trichloroethane	ug/L	ND	20	21.8	109	70-130	
1,1-Dichloroethane	ug/L	ND	20	22.4	112	70-130	
1,1-Dichloroethene	ug/L	ND	20	23.2	116	70-166	
1,2,3-Trichloropropane	ug/L	ND	20	22.0	110	70-130	
1,2-Dichlorobenzene	ug/L	ND	20	20.6	103	70-130	
1,2-Dichloroethane	ug/L	ND	20	21.3	106	70-130	
1,2-Dichloropropane	ug/L	ND	20	22.6	113	70-130	
1,4-Dichlorobenzene	ug/L	ND	20	21.1	105	70-130	
2-Butanone (MEK)	ug/L	ND	40	49.4	124	70-130	
2-Hexanone	ug/L	ND	40	50.6	126	70-130	
4-Methyl-2-pentanone (MIBK)	ug/L	ND	40	47.5	119	70-130	
Acetone	ug/L	ND	40	60.2	150	70-130	M0
Acrylonitrile	ug/L	ND	100	118	118	70-130	
Benzene	ug/L	ND	20	23.0	115	70-148	
Bromochloromethane	ug/L	ND	20	22.4	112	70-130	
Bromodichloromethane	ug/L	ND	20	22.3	112	70-130	
Bromoform	ug/L	ND	20	16.3	82	70-130	
Bromomethane	ug/L	ND	20	20.8	104	70-130	
Carbon disulfide	ug/L	ND	20	23.1	115	70-130	
Carbon tetrachloride	ug/L	ND	20	20.6	103	70-130	
Chlorobenzene	ug/L	ND	20	22.2	111	70-146	
Chloroethane	ug/L	ND	20	20.7	104	70-130	
Chloroform	ug/L	ND	20	21.4	107	70-130	

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QUALITY CONTROL DATA

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348154

MATRIX SPIKE SAMPLE: 2048416

Parameter	Units	92348154001 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Chloromethane	ug/L	ND	20	21.8	109	70-130	
cis-1,2-Dichloroethene	ug/L	ND	20	22.3	112	70-130	
cis-1,3-Dichloropropene	ug/L	ND	20	20.9	105	70-130	
Dibromochloromethane	ug/L	ND	20	20.2	101	70-130	
Dibromomethane	ug/L	ND	20	21.2	106	70-130	
Ethylbenzene	ug/L	ND	20	21.5	108	70-130	
Iodomethane	ug/L	ND	40	35.8	90	70-130	
Methylene Chloride	ug/L	ND	20	18.1	91	70-130	
Styrene	ug/L	ND	20	21.8	109	70-130	
Tetrachloroethene	ug/L	ND	20	20.1	101	70-130	
Toluene	ug/L	ND	20	22.3	112	70-155	
trans-1,2-Dichloroethene	ug/L	ND	20	22.7	113	70-130	
trans-1,3-Dichloropropene	ug/L	ND	20	19.9	99	70-130	
trans-1,4-Dichloro-2-butene	ug/L	ND	20	16.4	82	70-130	
Trichloroethene	ug/L	ND	20	21.3	106	69-151	
Trichlorofluoromethane	ug/L	ND	20	21.4	107	70-130	
Vinyl acetate	ug/L	ND	40	40.1	100	70-130	
Vinyl chloride	ug/L	ND	20	21.5	107	70-130	
1,2-Dichloroethane-d4 (S)	%				96	70-130	
4-Bromofluorobenzene (S)	%				101	70-130	
Toluene-d8 (S)	%				98	70-130	

SAMPLE DUPLICATE: 2048417

Parameter	Units	92348154002 Result	Dup Result	RPD	Max RPD	Qualifiers
1,1,1,2-Tetrachloroethane	ug/L	ND	ND		30	
1,1,1-Trichloroethane	ug/L	ND	ND		30	
1,1,2,2-Tetrachloroethane	ug/L	ND	ND		30	
1,1,2-Trichloroethane	ug/L	ND	ND		30	
1,1-Dichloroethane	ug/L	ND	ND		30	
1,1-Dichloroethene	ug/L	ND	ND		30	
1,2,3-Trichloropropane	ug/L	ND	ND		30	
1,2-Dichlorobenzene	ug/L	ND	ND		30	
1,2-Dichloroethane	ug/L	ND	ND		30	
1,2-Dichloropropane	ug/L	ND	ND		30	
1,4-Dichlorobenzene	ug/L	ND	ND		30	
2-Butanone (MEK)	ug/L	ND	ND		30	
2-Hexanone	ug/L	ND	ND		30	
4-Methyl-2-pentanone (MIBK)	ug/L	ND	ND		30	
Acetone	ug/L	ND	ND		30	
Acrylonitrile	ug/L	ND	ND		30	
Benzene	ug/L	ND	ND		30	
Bromochloromethane	ug/L	ND	ND		30	
Bromodichloromethane	ug/L	ND	ND		30	
Bromoform	ug/L	ND	ND		30	

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QUALITY CONTROL DATA

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348154

SAMPLE DUPLICATE: 2048417

Parameter	Units	92348154002 Result	Dup Result	RPD	Max RPD	Qualifiers
Bromomethane	ug/L	ND	ND		30	
Carbon disulfide	ug/L	ND	ND		30	
Carbon tetrachloride	ug/L	ND	ND		30	
Chlorobenzene	ug/L	ND	ND		30	
Chloroethane	ug/L	ND	ND		30	
Chloroform	ug/L	ND	ND		30	
Chloromethane	ug/L	ND	ND		30	
cis-1,2-Dichloroethene	ug/L	ND	ND		30	
cis-1,3-Dichloropropene	ug/L	ND	ND		30	
Dibromochloromethane	ug/L	ND	ND		30	
Dibromomethane	ug/L	ND	ND		30	
Ethylbenzene	ug/L	ND	ND		30	
Iodomethane	ug/L	ND	ND		30	
Methylene Chloride	ug/L	ND	ND		30	
Styrene	ug/L	ND	ND		30	
Tetrachloroethene	ug/L	ND	ND		30	
Toluene	ug/L	ND	ND		30	
trans-1,2-Dichloroethene	ug/L	ND	ND		30	
trans-1,3-Dichloropropene	ug/L	ND	ND		30	
trans-1,4-Dichloro-2-butene	ug/L	ND	ND		30	
Trichloroethene	ug/L	ND	ND		30	
Trichlorofluoromethane	ug/L	ND	ND		30	
Vinyl acetate	ug/L	ND	ND		30	
Vinyl chloride	ug/L	ND	ND		30	
Xylene (Total)	ug/L	ND	ND		30	
1,2-Dichloroethane-d4 (S)	%	103	106	3		
4-Bromofluorobenzene (S)	%	100	99	1		
Toluene-d8 (S)	%	103	104	1		

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QUALITY CONTROL DATA

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348154

QC Batch: 369835 Analysis Method: SM 2540C
QC Batch Method: SM 2540C Analysis Description: 2540C Total Dissolved Solids
Associated Lab Samples: 92348154001, 92348154002, 92348154003, 92348154004, 92348154005, 92348154006

METHOD BLANK: 2049353 Matrix: Water
Associated Lab Samples: 92348154001, 92348154002, 92348154003, 92348154004, 92348154005, 92348154006

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Total Dissolved Solids	mg/L	ND	25.0	07/20/17 11:14	

LABORATORY CONTROL SAMPLE: 2049354

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Total Dissolved Solids	mg/L	250	240	96	90-110	

SAMPLE DUPLICATE: 2049355

Parameter	Units	92347960004 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	73.0	60.0	20	5	D6

SAMPLE DUPLICATE: 2049356

Parameter	Units	92348154001 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	606	560	8	5	D6

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QUALITY CONTROL DATA

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348154

QC Batch: 369657 Analysis Method: EPA 300.0
QC Batch Method: EPA 300.0 Analysis Description: 300.0 IC Anions
Associated Lab Samples: 92348154001, 92348154002, 92348154003, 92348154004, 92348154005, 92348154006

METHOD BLANK: 2048312 Matrix: Water
Associated Lab Samples: 92348154001, 92348154002, 92348154003, 92348154004, 92348154005, 92348154006

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Chloride	mg/L	ND	1.0	07/19/17 19:26	
Fluoride	mg/L	ND	0.10	07/19/17 19:26	
Sulfate	mg/L	ND	1.0	07/19/17 19:26	

LABORATORY CONTROL SAMPLE: 2048313

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Chloride	mg/L	50	47.7	95	90-110	
Fluoride	mg/L	2.5	2.3	90	90-110	
Sulfate	mg/L	50	46.5	93	90-110	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2048314 2048315

Parameter	Units	92348154002 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Chloride	mg/L	473	50	50	527	528	106	109	90-110	0	10	
Fluoride	mg/L	ND	2.5	2.5	2.4	2.5	93	98	90-110	4	10	
Sulfate	mg/L	6.3	50	50	55.4	57.9	98	103	90-110	4	10	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2048316 2048317

Parameter	Units	92348154004 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Chloride	mg/L	7.0	50	50	56.5	56.7	99	99	90-110	0	10	
Fluoride	mg/L	0.39	2.5	2.5	2.5	2.5	85	83	90-110	2	10	M1
Sulfate	mg/L	3.2	50	50	51.9	52.1	98	98	90-110	0	10	

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348154

Sample: BG-1 **Lab ID: 92348154001** Collected: 07/17/17 10:45 Received: 07/18/17 12:30 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**0.151 ± 0.419 (0.812) C:NA T:87%**	pCi/L	08/02/17 12:36	13982-63-3	
Radium-228	EPA 904.0	**0.132 ± 0.316 (0.702) C:80% T:85%**	pCi/L	08/02/17 14:42	15262-20-1	

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348154

Sample: MW-8 **Lab ID: 92348154002** Collected: 07/17/17 14:40 Received: 07/18/17 12:30 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**1.05 ± 0.610 (0.650) C:NA T:94%**	pCi/L	08/02/17 12:36	13982-63-3	
Radium-228	EPA 904.0	**0.594 ± 0.382 (0.729) C:81% T:87%**	pCi/L	08/02/17 14:42	15262-20-1	

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348154

Sample: LEACHATE **Lab ID: 92348154003** Collected: 07/17/17 16:00 Received: 07/18/17 12:30 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**0.626 ± 0.536 (0.727) C:NA T:85%**	pCi/L	08/02/17 12:36	13982-63-3	
Radium-228	EPA 904.0	**0.372 ± 0.348 (0.708) C:79% T:80%**	pCi/L	08/02/17 14:42	15262-20-1	

REPORT OF LABORATORY ANALYSIS

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Huntersville, NC 28078
(704)875-9092

ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348154

Sample: S1 **Lab ID: 92348154004** Collected: 07/17/17 16:45 Received: 07/18/17 12:30 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**0.748 ± 0.587 (0.816) C:NA T:98%**	pCi/L	08/02/17 12:36	13982-63-3	
Radium-228	EPA 904.0	**0.951 ± 0.430 (0.704) C:84% T:73%**	pCi/L	08/02/17 14:43	15262-20-1	

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348154

Sample: AMB **Lab ID: 92348154005** Collected: 07/17/17 13:00 Received: 07/18/17 12:30 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**0.289 ± 0.349 (0.532) C:NA T:90%**	pCi/L	08/02/17 12:57	13982-63-3	
Radium-228	EPA 904.0	**0.0533 ± 0.285 (0.652) C:82% T:83%**	pCi/L	08/02/17 14:43	15262-20-1	

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348154

Sample: EQ BLANK **Lab ID: 92348154006** Collected: 07/17/17 18:00 Received: 07/18/17 12:30 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**1.02 ± 0.679 (0.792) C:NA T:78%**	pCi/L	08/02/17 12:57	13982-63-3	
Radium-228	EPA 904.0	**-0.112 ± 0.262 (0.640) C:80% T:88%**	pCi/L	08/02/17 14:43	15262-20-1	

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QUALITY CONTROL - RADIOCHEMISTRY

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348154

QC Batch: 265794 Analysis Method: EPA 903.1
QC Batch Method: EPA 903.1 Analysis Description: 903.1 Radium-226
Associated Lab Samples: 92348154001, 92348154002, 92348154003, 92348154004, 92348154005, 92348154006

METHOD BLANK: 1308981 Matrix: Water
Associated Lab Samples: 92348154001, 92348154002, 92348154003, 92348154004, 92348154005, 92348154006

Parameter	Act ± Unc (MDC) Carr Trac	Units	Analyzed	Qualifiers
Radium-226	0.452 ± 0.339 (0.175) C:NA T:101%	pCi/L	08/02/17 12:36	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

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QUALITY CONTROL - RADIOCHEMISTRY

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348154

QC Batch: 265795 Analysis Method: EPA 904.0
QC Batch Method: EPA 904.0 Analysis Description: 904.0 Radium 228
Associated Lab Samples: 92348154001, 92348154002, 92348154003, 92348154004, 92348154005, 92348154006

METHOD BLANK: 1308982 Matrix: Water
Associated Lab Samples: 92348154001, 92348154002, 92348154003, 92348154004, 92348154005, 92348154006

Parameter	Act ± Unc (MDC) Carr Trac	Units	Analyzed	Qualifiers
Radium-228	-0.00716 ± 0.281 (0.654) C:82% T:89%	pCi/L	08/02/17 11:09	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

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QUALIFIERS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348154

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above adjusted reporting limit.

TNTC - Too Numerous To Count

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

Acid preservation may not be appropriate for 2 Chloroethylvinyl ether.

A separate vial preserved to a pH of 4-5 is recommended in SW846 Chapter 4 for the analysis of Acrolein and Acrylonitrile by EPA Method 8260.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Act - Activity

Unc - Uncertainty: SDWA = 1.96 sigma count uncertainty, all other matrices = Expanded Uncertainty (95% confidence interval). Gamma Spec = Expanded Uncertainty (95.4% Confidence Interval)

(MDC) - Minimum Detectable Concentration

Trac - Tracer Recovery (%)

Carr - Carrier Recovery (%)

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

LABORATORIES

PASI-A	Pace Analytical Services - Asheville
PASI-C	Pace Analytical Services - Charlotte
PASI-PA	Pace Analytical Services - Greensburg

ANALYTE QUALIFIERS

D6	The precision between the sample and sample duplicate exceeded laboratory control limits.
L1	Analyte recovery in the laboratory control sample (LCS) was above QC limits. Results for this analyte in associated samples may be biased high.
M0	Matrix spike recovery and/or matrix spike duplicate recovery was outside laboratory control limits.
M1	Matrix spike recovery exceeded QC limits. Batch accepted based on laboratory control sample (LCS) recovery.

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QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348154

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
92348154001	**BG-1**	EPA 3010A	369584	EPA 6010	370084
92348154002	**MW-8**	EPA 3010A	369584	EPA 6010	370084
92348154003	**LEACHATE**	EPA 3010A	369584	EPA 6010	370084
92348154004	**S1**	EPA 3010A	369584	EPA 6010	370084
92348154005	**AMB**	EPA 3010A	369584	EPA 6010	370084
92348154006	**EQ BLANK**	EPA 3010A	369584	EPA 6010	370084
92348154001	**BG-1**	EPA 3010A	369599	EPA 6020B	369658
92348154002	**MW-8**	EPA 3010A	369599	EPA 6020B	369658
92348154003	**LEACHATE**	EPA 3010A	369599	EPA 6020B	369658
92348154004	**S1**	EPA 3010A	369599	EPA 6020B	369658
92348154005	**AMB**	EPA 3010A	369599	EPA 6020B	369658
92348154006	**EQ BLANK**	EPA 3010A	369599	EPA 6020B	369658
92348154001	**BG-1**	EPA 7470	369633	EPA 7470	369758
92348154002	**MW-8**	EPA 7470	369633	EPA 7470	369758
92348154003	**LEACHATE**	EPA 7470	369633	EPA 7470	369758
92348154004	**S1**	EPA 7470	369633	EPA 7470	369758
92348154005	**AMB**	EPA 7470	369633	EPA 7470	369758
92348154006	**EQ BLANK**	EPA 7470	369633	EPA 7470	369758
92348154001	**BG-1**	EPA 8260	369672		
92348154002	**MW-8**	EPA 8260	369672		
92348154003	**LEACHATE**	EPA 8260	369672		
92348154004	**S1**	EPA 8260	369672		
92348154005	**AMB**	EPA 8260	369672		
92348154006	**EQ BLANK**	EPA 8260	369672		
92348154007	**TRIP BLANK**	EPA 8260	369672		
92348154001	**BG-1**	EPA 903.1	265794		
92348154002	**MW-8**	EPA 903.1	265794		
92348154003	**LEACHATE**	EPA 903.1	265794		
92348154004	**S1**	EPA 903.1	265794		
92348154005	**AMB**	EPA 903.1	265794		
92348154006	**EQ BLANK**	EPA 903.1	265794		
92348154001	**BG-1**	EPA 904.0	265795		
92348154002	**MW-8**	EPA 904.0	265795		
92348154003	**LEACHATE**	EPA 904.0	265795		
92348154004	**S1**	EPA 904.0	265795		
92348154005	**AMB**	EPA 904.0	265795		
92348154006	**EQ BLANK**	EPA 904.0	265795		
92348154001	**BG-1**	SM 2540C	369835		
92348154002	**MW-8**	SM 2540C	369835		
92348154003	**LEACHATE**	SM 2540C	369835		
92348154004	**S1**	SM 2540C	369835		
92348154005	**AMB**	SM 2540C	369835		
92348154006	**EQ BLANK**	SM 2540C	369835		
92348154001	**BG-1**	EPA 300.0	369657		
92348154002	**MW-8**	EPA 300.0	369657		

REPORT OF LABORATORY ANALYSIS

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(704)875-9092

QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348154

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
92348154003	**LEACHATE**	EPA 300.0	369657		
92348154004	**S1**	EPA 300.0	369657		
92348154005	**AMB**	EPA 300.0	369657		
92348154006	**EQ BLANK**	EPA 300.0	369657		

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Laboratory receiving samples:
Asheville ☐ Eden ☐ Greenwood ☐ Huntersville ☑ Raleigh ☐ Mechanicsville ☐

Sample Condition Upon Receipt

WO# : 92348154

92348154

Client Name: HDR Engineering **Project #:**

Courier: ☐ Commercial ☐ Fed Ex ☑ Pace ☐ UPS ☐ USPS ☐ Other:____ ☐ Client

Custody Seal Present? ☐ Yes ☑ No **Seals Intact?** ☐ Yes ☑ No

Packing Material: ☐ Bubble Wrap ☑ Bubble Bags ☐ None ☐ Other:____

Date/Initials Person Examining Contents: 7-18-17 SA

Thermometer: ☐ IR Gun ID: T1603

Type of Ice: ☑ Wet ☐ Blue ☐ None ☑ Samples on ice, cooling process has begun

Correction Factor: **Cooler Temp Corrected (°C):** 4.6 **Biological Tissue Frozen?** ☐ Yes ☑ No ☐ N/A

Temp should be above freezing to 6°C

USDA Regulated Soil (☑ N/A, water sample)

Did samples originate in a quarantine zone within the United States: CA, NY, or SC (check maps)? ☐ Yes ☑ No

Did samples originate from a foreign source (internationally, including Hawaii and Puerto Rico)? ☐ Yes ☑ No

				Comments/Discrepancy:
Chain of Custody Present?	☑ Yes	☐ No	☐ N/A	1.
Samples Arrived within Hold Time?	☐ Yes	☐ No	☐ N/A	2.
Short Hold Time Analysis (<72 hr.)?	☐ Yes	☑ No	☐ N/A	3.
Rush Turn Around Time Requested?	☐ Yes	☑ No	☐ N/A	4.
Sufficient Volume?	☑ Yes	☐ No	☐ N/A	5.
Correct Containers Used?	☑ Yes	☐ No	☐ N/A	6.
-Pace Containers Used?	☑ Yes	☐ No	☐ N/A	
Containers Intact?	☑ Yes	☐ No	☐ N/A	7.
Samples Field Filtered?	☐ Yes	☑ No	☐ N/A	8. Note if sediment is visible in the dissolved container
Sample Labels Match COC?	☐ Yes	☐ No	☐ N/A	9.
-Includes Date/Time/ID/Analysis Matrix: WT				
Headspace in VOA Vials (>5-6mm)?	☐ Yes	☑ No	☐ N/A	10.
Trip Blank Present?	☑ Yes	☐ No	☐ N/A	11.
Trip Blank Custody Seals Present?	☑ Yes	☐ No	☐ N/A	

CLIENT NOTIFICATION/RESOLUTION **Field Data Required?** ☐ Yes ☐ No

Person Contacted: _____ Date/Time: _____

Comments/Sample Discrepancy: _____

Project Manager SCURF Review: PW **Date:** 7/18

Project Manager SRF Review: PW **Date:** 7/18

Note: Whenever there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office (i.e. Out of hold, incorrect preservative, out of temp, incorrect containers)

*Check mark top half of box if pH and/or dechlorination is verified and within the acceptance range for preservation samples.

**Bottom half of box is to list number of bottles

Project #

WO#: 92348154

PM: KRG Due Date: 07/25/17

CLIENT: 92-HDR

Item#	BP4U-125 mL Plastic Unpreserved (N/A) (Cl-)	BP3U-250 mL Plastic Unpreserved (N/A)	BP2U-500 mL Plastic Unpreserved (N/A)	BP1U-1 liter Plastic Unpreserved (N/A)	BP3S-250 mL Plastic H2SO4 (pH < 2) (Cl-)	BP3N-250 mL plastic HNO3 (pH < 2)	BP3Z-250 mL Plastic ZN Acetate & NaOH (>9)	BP3C-250 mL Plastic NaOH (pH > 12) (Cl-)	WGFU-Wide-mouthed Glass jar Unpreserved	AG1U-1 liter Amber Unpreserved (N/A) (Cl-)	AG1H-1 liter Amber HCl (pH < 2)	AG3U-250 mL Amber Unpreserved (N/A) (Cl-)	AG1S-1 liter Amber H2SO4 (pH < 2)	AG3S-250 mL Amber H2SO4 (pH < 2)	AG3A(DG3A)-250 mL Amber NH4Cl (N/A)(Cl-)	DG9H-40 mL VOA HCl (N/A)	VG9T-40 mL VOA Na2S2O3 (N/A)	VG9U-40 mL VOA Unp (N/A)	DG9P-40 mL VOA H3PO4 (N/A)	VOAK (6 vials per kit)-5035 kit (N/A)	V/GK (3 vials per kit)-VPH/Gas kit (N/A)	SP5T-125 mL Sterile Plastic (N/A – lab)	SP2T-250 mL Sterile Plastic (N/A – lab)	BP1N 1 liter HNO3	BP3A-250 mL Plastic (NH2)2SO4 (9.3-9.7)	Cubitainer	VSGU-20 mL Scintillation vials (N/A)	GN
1		1	1			2 ✓										3									3				
2		1	1			2 ✓										3									3				
3		1	1			2 ✓										3									3				
4		1	1			2 ✓										3									3				
5																													
6		1	1			2 ✓										3									3				
7		1	1			2 ✓										3									3				
8																2													
9																													
10																													
11																													
12																													

pH Adjustment Log for Preserved Samples

Sample ID	Type of Preservative	pH upon receipt	Date preservation adjusted	Time preservation adjusted	Amount of Preservative added	Lot #

Pace Analytical

CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

Page : 1 Of 1

Section A Required Client Information:		Section B Required Project Information:		Section C Invoice Information:	
Company:	HDR Engineering	Report To:	Sean Quarry	Attention:	
Address:	440 South Church Street	Copy To:		Company Name:	
Charlotte, NC 28202				Address:	
Email:	sean.quarry@hdrinc.com	Purchase Order #:		Pace Quote:	
Phone:	(704)248-3632 Fax	Project Name:	Charrah-Brickhaven	Pace Project Manager:	kevin.godwin@pacelabs.com,
Requested Due Date:		Project #:		Pace Profile #:	7672-1

Regulatory Agency:

State / Location: NC

Requested Analysis Filtered (Y/N)

ITEM #	SAMPLE ID (One Character per box. (A-Z, 0-9 / , -) Sample Ids must be unique)	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED START DATE	COLLECTED START TIME	COLLECTED END DATE	COLLECTED END TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Unpreserved	H2SO4	HNO3	HCl	NaOH	Na2S2O3	Methanol	Other	Analyses Test Y/N	Trip BLANK	8260	300.0-Cl,F,Sulfate	TDS	Radium 226/228	6010/7470	6020 (B, Li)	Residual Chlorine (Y/N)	92348154
1	BG-1		X	/	/	7/17/17	1045		10	2		5	3							3	1	1	3	1	1		001
2	MW 8		X	/	/	7/17/17	1440		10	2		5	3							3	1	1	3	1	1		002
3	LEACHATE		X	/	/	7/17/17	1600		10	2		5	3							3	1	1	3	1	1		003
4	S1		X	/	/	7/17/17	1645		10	2		5	3							3	1	1	3	1	1		004
5																											C
6	AMB		X	/	/	7/17/17	1300		10	2		5	3							3	1	1	3	1	1		005
7	EQ BLANK		X	/	/	7/17/17	1800		10	2		5	3							3	1	1	3	1	1		006
8	TRIP BLANK			/	/	7/17/17	/												2								007
9																											
10																											
11																											
12																											

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	SAMPLE CONDITIONS: TEMP in C	Received on Ice (Y/N)	Custody Sealed Cooler (Y/N)	Samples Intact (Y/N)
	Jesse Allred PACE	7/17/17	1830	[signature] Pace HDR	7-18-17	1230	4.6	Y	N	Y

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER: JESSE ALLRED

SIGNATURE of SAMPLER: [signature] DATE Signed: 7-17-17

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

August 07, 2017

Sean Quarry
HDR Engineering
440 South Church Street
Suite 1000
Charlotte, NC 28202

RE: Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348315

Dear Sean Quarry:
Enclosed are the analytical results for sample(s) received by the laboratory on July 19, 2017. The results relate only to the samples included in this report. Results reported herein conform to the most current, applicable TNI/NELAC standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Kevin Godwin
kevin.godwin@pacelabs.com
1(704)875-9092
Project Manager

Enclosures

cc: Mike Plummer, HDR

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CERTIFICATIONS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348315

Pennsylvania Certification IDs

1638 Roseytown Rd Suites 2,3&4, Greensburg, PA 15601
L-A-B DOD-ELAP Accreditation #: L2417
Alabama Certification #: 41590
Arizona Certification #: AZ0734
Arkansas Certification
California Certification #: 04222CA
Colorado Certification
Connecticut Certification #: PH-0694
Delaware Certification
Florida/TNI Certification #: E87683
Georgia Certification #: C040
Guam Certification
Hawaii Certification
Idaho Certification
Illinois Certification
Indiana Certification
Iowa Certification #: 391
Kansas/TNI Certification #: E-10358
Kentucky Certification #: 90133
Louisiana DHH/TNI Certification #: LA140008
Louisiana DEQ/TNI Certification #: 4086
Maine Certification #: PA00091
Maryland Certification #: 308
Massachusetts Certification #: M-PA1457
Michigan/PADEP Certification
Missouri Certification #: 235
Montana Certification #: Cert 0082
Nebraska Certification #: NE-05-29-14
Nevada Certification #: PA014572015-1
New Hampshire/TNI Certification #: 2976
New Jersey/TNI Certification #: PA 051
New Mexico Certification #: PA01457
New York/TNI Certification #: 10888
North Carolina Certification #: 42706
North Dakota Certification #: R-190
Oregon/TNI Certification #: PA200002
Pennsylvania/TNI Certification #: 65-00282
Puerto Rico Certification #: PA01457
Rhode Island Certification #: 65-00282
South Dakota Certification
Tennessee Certification #: TN2867
Texas/TNI Certification #: T104704188-14-8
Utah/TNI Certification #: PA014572015-5
USDA Soil Permit #: P330-14-00213
Vermont Dept. of Health: ID# VT-0282
Virgin Island/PADEP Certification
Virginia/VELAP Certification #: 460198
Washington Certification #: C868
West Virginia DEP Certification #: 143
West Virginia DHHR Certification #: 9964C
Wisconsin Certification
Wyoming Certification #: 8TMS-L

Charlotte Certification IDs

9800 Kincey Ave. Ste 100, Huntersville, NC 28078
North Carolina Drinking Water Certification #: 37706
North Carolina Field Services Certification #: 5342
North Carolina Wastewater Certification #: 12
South Carolina Certification #: 99006001
Florida/NELAP Certification #: E87627
Kentucky UST Certification #: 84
Virginia/VELAP Certification #: 460221

Asheville Certification IDs

2225 Riverside Drive, Asheville, NC 28804
Florida/NELAP Certification #: E87648
Massachusetts Certification #: M-NC030
North Carolina Drinking Water Certification #: 37712
North Carolina Wastewater Certification #: 40
South Carolina Certification #: 99030001
Virginia/VELAP Certification #: 460222

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SAMPLE SUMMARY

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348315

Lab ID	Sample ID	Matrix	Date Collected	Date Received
92348315001	**MW-2**	Water	07/18/17 16:45	07/19/17 09:17
92348315002	**MW-1**	Water	07/18/17 12:50	07/19/17 09:17
92348315003	**EQ BLANK**	Water	07/18/17 19:00	07/19/17 09:17
92348315004	**AMB**	Water	07/18/17 12:30	07/19/17 09:17
92348315005	**TRIP BLANK**	Water	07/18/17 00:00	07/19/17 09:17

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SAMPLE ANALYTE COUNT

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348315

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
92348315001	**MW-2**	EPA 6010	SER	16	PASI-A
		EPA 6020B	CDF	3	PASI-A
		EPA 7470	KAL	1	PASI-A
		EPA 8260	ZDO	48	PASI-C
		EPA 903.1	WRR	1	PASI-PA
		EPA 904.0	JLW	1	PASI-PA
		SM 2540C	NAL	1	PASI-A
		EPA 300.0	CDC	3	PASI-A
92348315002	**MW-1**	EPA 6010	SER	16	PASI-A
		EPA 6020B	CDF	3	PASI-A
		EPA 7470	KAL	1	PASI-A
		EPA 8260	ZDO	48	PASI-C
		EPA 903.1	WRR	1	PASI-PA
		EPA 904.0	JLW	1	PASI-PA
		SM 2540C	NAL	1	PASI-A
		EPA 300.0	CDC	3	PASI-A
92348315003	**EQ BLANK**	EPA 6010	SER	16	PASI-A
		EPA 6020B	CDF	3	PASI-A
		EPA 7470	KAL	1	PASI-A
		EPA 8260	ZDO	48	PASI-C
		EPA 903.1	WRR	1	PASI-PA
		EPA 904.0	JLW	1	PASI-PA
		SM 2540C	NAL	1	PASI-A
		EPA 300.0	CDC	3	PASI-A
92348315004	**AMB**	EPA 6010	SER	16	PASI-A
		EPA 6020B	CDF	3	PASI-A
		EPA 7470	KAL	1	PASI-A
		EPA 8260	ZDO	48	PASI-C
		EPA 903.1	WRR	1	PASI-PA
		EPA 904.0	JLW	1	PASI-PA
		SM 2540C	NAL	1	PASI-A
		EPA 300.0	CDC	3	PASI-A
92348315005	**TRIP BLANK**	EPA 8260	ZDO	48	PASI-C

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SUMMARY OF DETECTION

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348315

Lab Sample ID / Method	Client Sample ID / Parameters	Result	Units	Report Limit	Analyzed	Qualifiers
92348315001	**MW-2**					
EPA 6010	Barium	177	ug/L	5.0	07/22/17 17:44	
EPA 6010	Calcium	208000	ug/L	1000	07/24/17 13:21	
EPA 6010	Molybdenum	9.3	ug/L	5.0	07/22/17 17:44	
EPA 6010	Zinc	10.7	ug/L	10.0	07/22/17 17:44	
EPA 6020B	Boron	50.2	ug/L	25.0	07/21/17 16:39	
EPA 6020B	Lithium	154	ug/L	2.5	07/21/17 16:39	
EPA 903.1	Radium-226	0.740 ± 0.549 (0.687) C:NA T:104%	pCi/L		08/04/17 12:35	
EPA 904.0	Radium-228	1.54 ± 0.521 (0.735) C:76% T:85%	pCi/L		08/04/17 11:23	
SM 2540C	Total Dissolved Solids	2670	mg/L	50.0	07/21/17 18:56	
EPA 300.0	Chloride	1280	mg/L	50.0	07/23/17 14:25	
EPA 300.0	Fluoride	0.40	mg/L	0.10	07/22/17 13:56	
EPA 300.0	Sulfate	226	mg/L	4.0	07/23/17 14:09	
92348315002	**MW-1**					
EPA 6010	Barium	171	ug/L	5.0	07/22/17 17:48	
EPA 6010	Calcium	159000	ug/L	1000	07/24/17 13:25	
EPA 6010	Zinc	28.0	ug/L	10.0	07/22/17 17:48	
EPA 6020B	Lithium	36.1	ug/L	2.5	07/21/17 16:41	
EPA 903.1	Radium-226	0.601 ± 0.510 (0.632) C:NA T:90%	pCi/L		08/04/17 12:35	
EPA 904.0	Radium-228	0.508 ± 0.363 (0.714) C:76% T:96%	pCi/L		08/04/17 11:23	
SM 2540C	Total Dissolved Solids	1060	mg/L	50.0	07/21/17 18:57	
EPA 300.0	Chloride	603	mg/L	12.0	07/23/17 14:41	
EPA 300.0	Fluoride	0.17	mg/L	0.10	07/22/17 14:12	
EPA 300.0	Sulfate	9.3	mg/L	1.0	07/22/17 14:12	
92348315003	**EQ BLANK**					
EPA 903.1	Radium-226	0.161 ± 0.548 (1.06) C:NA T:94%	pCi/L		08/04/17 12:35	
EPA 904.0	Radium-228	0.454 ± 0.382 (0.767) C:80% T:75%	pCi/L		08/04/17 11:23	

REPORT OF LABORATORY ANALYSIS

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SUMMARY OF DETECTION

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348315

Lab Sample ID / Method	Client Sample ID / Parameters	Result	Units	Report Limit	Analyzed	Qualifiers
92348315004	**AMB**					
EPA 903.1	Radium-226	0.730 ± 0.572 (0.672) C:NA T:85%	pCi/L		08/04/17 12:35	
EPA 904.0	Radium-228	0.255 ± 0.350 (0.751) C:78% T:83%	pCi/L		08/04/17 11:23	

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ANALYTICAL RESULTS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348315

Sample: MW-2 **Lab ID: 92348315001** Collected: 07/18/17 16:45 Received: 07/19/17 09:17 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP	Analytical Method: EPA 6010 Preparation Method: EPA 3010A							
Antimony	ND	ug/L	5.0	1	07/20/17 21:50	07/22/17 17:44	7440-36-0	
Arsenic	ND	ug/L	10.0	1	07/20/17 21:50	07/22/17 17:44	7440-38-2	
Barium	**177**	ug/L	5.0	1	07/20/17 21:50	07/22/17 17:44	7440-39-3	
Beryllium	ND	ug/L	1.0	1	07/20/17 21:50	07/22/17 17:44	7440-41-7	
Cadmium	ND	ug/L	1.0	1	07/20/17 21:50	07/22/17 17:44	7440-43-9	
Calcium	**208000**	ug/L	1000	10	07/20/17 21:50	07/24/17 13:21	7440-70-2	
Chromium	ND	ug/L	5.0	1	07/20/17 21:50	07/22/17 17:44	7440-47-3	
Cobalt	ND	ug/L	5.0	1	07/20/17 21:50	07/22/17 17:44	7440-48-4	
Copper	ND	ug/L	5.0	1	07/20/17 21:50	07/22/17 17:44	7440-50-8	
Lead	ND	ug/L	5.0	1	07/20/17 21:50	07/22/17 17:44	7439-92-1	
Molybdenum	**9.3**	ug/L	5.0	1	07/20/17 21:50	07/22/17 17:44	7439-98-7	
Nickel	ND	ug/L	5.0	1	07/20/17 21:50	07/22/17 17:44	7440-02-0	
Selenium	ND	ug/L	10.0	1	07/20/17 21:50	07/22/17 17:44	7782-49-2	
Silver	ND	ug/L	5.0	1	07/20/17 21:50	07/22/17 17:44	7440-22-4	
Vanadium	ND	ug/L	5.0	1	07/20/17 21:50	07/22/17 17:44	7440-62-2	
Zinc	**10.7**	ug/L	10.0	1	07/20/17 21:50	07/22/17 17:44	7440-66-6	
6020 MET ICPMS	Analytical Method: EPA 6020B Preparation Method: EPA 3010A							
Boron	**50.2**	ug/L	25.0	1	07/20/17 03:35	07/21/17 16:39	7440-42-8	
Lithium	**154**	ug/L	2.5	1	07/20/17 03:35	07/21/17 16:39	7439-93-2	
Thallium	ND	ug/L	0.10	1	07/20/17 03:35	07/21/17 16:39	7440-28-0	
7470 Mercury	Analytical Method: EPA 7470 Preparation Method: EPA 7470							
Mercury	ND	ug/L	0.20	1	07/20/17 14:22	07/21/17 04:41	7439-97-6	
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
Acetone	ND	ug/L	25.0	1		07/20/17 13:41	67-64-1	L1,M0
Acrylonitrile	ND	ug/L	10.0	1		07/20/17 13:41	107-13-1	M1
Benzene	ND	ug/L	1.0	1		07/20/17 13:41	71-43-2	
Bromochloromethane	ND	ug/L	1.0	1		07/20/17 13:41	74-97-5	
Bromodichloromethane	ND	ug/L	1.0	1		07/20/17 13:41	75-27-4	
Bromoform	ND	ug/L	1.0	1		07/20/17 13:41	75-25-2	
Bromomethane	ND	ug/L	2.0	1		07/20/17 13:41	74-83-9	
2-Butanone (MEK)	ND	ug/L	5.0	1		07/20/17 13:41	78-93-3	
Carbon disulfide	ND	ug/L	2.0	1		07/20/17 13:41	75-15-0	
Carbon tetrachloride	ND	ug/L	1.0	1		07/20/17 13:41	56-23-5	
Chlorobenzene	ND	ug/L	1.0	1		07/20/17 13:41	108-90-7	
Chloroethane	ND	ug/L	1.0	1		07/20/17 13:41	75-00-3	
Chloroform	ND	ug/L	1.0	1		07/20/17 13:41	67-66-3	
Chloromethane	ND	ug/L	1.0	1		07/20/17 13:41	74-87-3	
Dibromochloromethane	ND	ug/L	1.0	1		07/20/17 13:41	124-48-1	
Dibromomethane	ND	ug/L	1.0	1		07/20/17 13:41	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	1.0	1		07/20/17 13:41	95-50-1	
1,4-Dichlorobenzene	ND	ug/L	1.0	1		07/20/17 13:41	106-46-7	
trans-1,4-Dichloro-2-butene	ND	ug/L	1.0	1		07/20/17 13:41	110-57-6	L1
1,1-Dichloroethane	ND	ug/L	1.0	1		07/20/17 13:41	75-34-3	

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ANALYTICAL RESULTS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348315

Sample: MW-2 **Lab ID: 92348315001** Collected: 07/18/17 16:45 Received: 07/19/17 09:17 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
1,2-Dichloroethane	ND	ug/L	1.0	1		07/20/17 13:41	107-06-2	
1,1-Dichloroethene	ND	ug/L	1.0	1		07/20/17 13:41	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	1.0	1		07/20/17 13:41	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	1.0	1		07/20/17 13:41	156-60-5	
1,2-Dichloropropane	ND	ug/L	1.0	1		07/20/17 13:41	78-87-5	
cis-1,3-Dichloropropene	ND	ug/L	1.0	1		07/20/17 13:41	10061-01-5	
trans-1,3-Dichloropropene	ND	ug/L	1.0	1		07/20/17 13:41	10061-02-6	
Ethylbenzene	ND	ug/L	1.0	1		07/20/17 13:41	100-41-4	
2-Hexanone	ND	ug/L	5.0	1		07/20/17 13:41	591-78-6	M1
Iodomethane	ND	ug/L	5.0	1		07/20/17 13:41	74-88-4	
Methylene Chloride	ND	ug/L	1.0	1		07/20/17 13:41	75-09-2	
4-Methyl-2-pentanone (MIBK)	ND	ug/L	5.0	1		07/20/17 13:41	108-10-1	
Styrene	ND	ug/L	1.0	1		07/20/17 13:41	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0	1		07/20/17 13:41	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0	1		07/20/17 13:41	79-34-5	
Tetrachloroethene	ND	ug/L	1.0	1		07/20/17 13:41	127-18-4	
Toluene	ND	ug/L	1.0	1		07/20/17 13:41	108-88-3	
1,1,1-Trichloroethane	ND	ug/L	1.0	1		07/20/17 13:41	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	1.0	1		07/20/17 13:41	79-00-5	
Trichloroethene	ND	ug/L	1.0	1		07/20/17 13:41	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0	1		07/20/17 13:41	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0	1		07/20/17 13:41	96-18-4	
Vinyl acetate	ND	ug/L	2.0	1		07/20/17 13:41	108-05-4	
Vinyl chloride	ND	ug/L	1.0	1		07/20/17 13:41	75-01-4	
Xylene (Total)	ND	ug/L	1.0	1		07/20/17 13:41	1330-20-7	
Surrogates								
4-Bromofluorobenzene (S)	101	%	70-130	1		07/20/17 13:41	460-00-4	
1,2-Dichloroethane-d4 (S)	99	%	70-130	1		07/20/17 13:41	17060-07-0	
Toluene-d8 (S)	103	%	70-130	1		07/20/17 13:41	2037-26-5	
2540C Total Dissolved Solids	Analytical Method: SM 2540C							
Total Dissolved Solids	**2670**	mg/L	50.0	1		07/21/17 18:56		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0							
Chloride	**1280**	mg/L	50.0	50		07/23/17 14:25	16887-00-6	
Fluoride	**0.40**	mg/L	0.10	1		07/22/17 13:56	16984-48-8	
Sulfate	**226**	mg/L	4.0	4		07/23/17 14:09	14808-79-8	

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ANALYTICAL RESULTS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348315

Sample: MW-1 **Lab ID: 92348315002** Collected: 07/18/17 12:50 Received: 07/19/17 09:17 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP	Analytical Method: EPA 6010 Preparation Method: EPA 3010A							
Antimony	ND	ug/L	5.0	1	07/20/17 21:50	07/22/17 17:48	7440-36-0	
Arsenic	ND	ug/L	10.0	1	07/20/17 21:50	07/22/17 17:48	7440-38-2	
Barium	**171**	ug/L	5.0	1	07/20/17 21:50	07/22/17 17:48	7440-39-3	
Beryllium	ND	ug/L	1.0	1	07/20/17 21:50	07/22/17 17:48	7440-41-7	
Cadmium	ND	ug/L	1.0	1	07/20/17 21:50	07/22/17 17:48	7440-43-9	
Calcium	**159000**	ug/L	1000	10	07/20/17 21:50	07/24/17 13:25	7440-70-2	
Chromium	ND	ug/L	5.0	1	07/20/17 21:50	07/22/17 17:48	7440-47-3	
Cobalt	ND	ug/L	5.0	1	07/20/17 21:50	07/22/17 17:48	7440-48-4	
Copper	ND	ug/L	5.0	1	07/20/17 21:50	07/22/17 17:48	7440-50-8	
Lead	ND	ug/L	5.0	1	07/20/17 21:50	07/22/17 17:48	7439-92-1	
Molybdenum	ND	ug/L	5.0	1	07/20/17 21:50	07/22/17 17:48	7439-98-7	
Nickel	ND	ug/L	5.0	1	07/20/17 21:50	07/22/17 17:48	7440-02-0	
Selenium	ND	ug/L	10.0	1	07/20/17 21:50	07/22/17 17:48	7782-49-2	
Silver	ND	ug/L	5.0	1	07/20/17 21:50	07/22/17 17:48	7440-22-4	
Vanadium	ND	ug/L	5.0	1	07/20/17 21:50	07/22/17 17:48	7440-62-2	
Zinc	**28.0**	ug/L	10.0	1	07/20/17 21:50	07/22/17 17:48	7440-66-6	
6020 MET ICPMS	Analytical Method: EPA 6020B Preparation Method: EPA 3010A							
Boron	ND	ug/L	25.0	1	07/20/17 03:35	07/21/17 16:41	7440-42-8	
Lithium	**36.1**	ug/L	2.5	1	07/20/17 03:35	07/21/17 16:41	7439-93-2	
Thallium	ND	ug/L	0.10	1	07/20/17 03:35	07/21/17 16:41	7440-28-0	
7470 Mercury	Analytical Method: EPA 7470 Preparation Method: EPA 7470							
Mercury	ND	ug/L	0.20	1	07/20/17 14:22	07/21/17 04:44	7439-97-6	
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
Acetone	ND	ug/L	25.0	1		07/20/17 13:58	67-64-1	L1
Acrylonitrile	ND	ug/L	10.0	1		07/20/17 13:58	107-13-1	
Benzene	ND	ug/L	1.0	1		07/20/17 13:58	71-43-2	
Bromochloromethane	ND	ug/L	1.0	1		07/20/17 13:58	74-97-5	
Bromodichloromethane	ND	ug/L	1.0	1		07/20/17 13:58	75-27-4	
Bromoform	ND	ug/L	1.0	1		07/20/17 13:58	75-25-2	
Bromomethane	ND	ug/L	2.0	1		07/20/17 13:58	74-83-9	
2-Butanone (MEK)	ND	ug/L	5.0	1		07/20/17 13:58	78-93-3	
Carbon disulfide	ND	ug/L	2.0	1		07/20/17 13:58	75-15-0	
Carbon tetrachloride	ND	ug/L	1.0	1		07/20/17 13:58	56-23-5	
Chlorobenzene	ND	ug/L	1.0	1		07/20/17 13:58	108-90-7	
Chloroethane	ND	ug/L	1.0	1		07/20/17 13:58	75-00-3	
Chloroform	ND	ug/L	1.0	1		07/20/17 13:58	67-66-3	
Chloromethane	ND	ug/L	1.0	1		07/20/17 13:58	74-87-3	
Dibromochloromethane	ND	ug/L	1.0	1		07/20/17 13:58	124-48-1	
Dibromomethane	ND	ug/L	1.0	1		07/20/17 13:58	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	1.0	1		07/20/17 13:58	95-50-1	
1,4-Dichlorobenzene	ND	ug/L	1.0	1		07/20/17 13:58	106-46-7	
trans-1,4-Dichloro-2-butene	ND	ug/L	1.0	1		07/20/17 13:58	110-57-6	L1
1,1-Dichloroethane	ND	ug/L	1.0	1		07/20/17 13:58	75-34-3	

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ANALYTICAL RESULTS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348315

Sample: MW-1 **Lab ID: 92348315002** Collected: 07/18/17 12:50 Received: 07/19/17 09:17 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
1,2-Dichloroethane	ND	ug/L	1.0	1		07/20/17 13:58	107-06-2	
1,1-Dichloroethene	ND	ug/L	1.0	1		07/20/17 13:58	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	1.0	1		07/20/17 13:58	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	1.0	1		07/20/17 13:58	156-60-5	
1,2-Dichloropropane	ND	ug/L	1.0	1		07/20/17 13:58	78-87-5	
cis-1,3-Dichloropropene	ND	ug/L	1.0	1		07/20/17 13:58	10061-01-5	
trans-1,3-Dichloropropene	ND	ug/L	1.0	1		07/20/17 13:58	10061-02-6	
Ethylbenzene	ND	ug/L	1.0	1		07/20/17 13:58	100-41-4	
2-Hexanone	ND	ug/L	5.0	1		07/20/17 13:58	591-78-6	
Iodomethane	ND	ug/L	5.0	1		07/20/17 13:58	74-88-4	
Methylene Chloride	ND	ug/L	1.0	1		07/20/17 13:58	75-09-2	
4-Methyl-2-pentanone (MIBK)	ND	ug/L	5.0	1		07/20/17 13:58	108-10-1	
Styrene	ND	ug/L	1.0	1		07/20/17 13:58	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0	1		07/20/17 13:58	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0	1		07/20/17 13:58	79-34-5	
Tetrachloroethene	ND	ug/L	1.0	1		07/20/17 13:58	127-18-4	
Toluene	ND	ug/L	1.0	1		07/20/17 13:58	108-88-3	
1,1,1-Trichloroethane	ND	ug/L	1.0	1		07/20/17 13:58	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	1.0	1		07/20/17 13:58	79-00-5	
Trichloroethene	ND	ug/L	1.0	1		07/20/17 13:58	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0	1		07/20/17 13:58	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0	1		07/20/17 13:58	96-18-4	
Vinyl acetate	ND	ug/L	2.0	1		07/20/17 13:58	108-05-4	
Vinyl chloride	ND	ug/L	1.0	1		07/20/17 13:58	75-01-4	
Xylene (Total)	ND	ug/L	1.0	1		07/20/17 13:58	1330-20-7	
Surrogates								
4-Bromofluorobenzene (S)	100	%	70-130	1		07/20/17 13:58	460-00-4	
1,2-Dichloroethane-d4 (S)	103	%	70-130	1		07/20/17 13:58	17060-07-0	
Toluene-d8 (S)	105	%	70-130	1		07/20/17 13:58	2037-26-5	
2540C Total Dissolved Solids	Analytical Method: SM 2540C							
Total Dissolved Solids	**1060**	mg/L	50.0	1		07/21/17 18:57		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0							
Chloride	**603**	mg/L	12.0	12		07/23/17 14:41	16887-00-6	
Fluoride	**0.17**	mg/L	0.10	1		07/22/17 14:12	16984-48-8	
Sulfate	**9.3**	mg/L	1.0	1		07/22/17 14:12	14808-79-8	

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(704)875-9092

ANALYTICAL RESULTS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348315

Sample: EQ BLANK **Lab ID: 92348315003** Collected: 07/18/17 19:00 Received: 07/19/17 09:17 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP	Analytical Method: EPA 6010 Preparation Method: EPA 3010A							
Antimony	ND	ug/L	5.0	1	07/20/17 21:50	07/22/17 17:51	7440-36-0	
Arsenic	ND	ug/L	10.0	1	07/20/17 21:50	07/22/17 17:51	7440-38-2	
Barium	ND	ug/L	5.0	1	07/20/17 21:50	07/22/17 17:51	7440-39-3	
Beryllium	ND	ug/L	1.0	1	07/20/17 21:50	07/22/17 17:51	7440-41-7	
Cadmium	ND	ug/L	1.0	1	07/20/17 21:50	07/22/17 17:51	7440-43-9	
Calcium	ND	ug/L	100	1	07/20/17 21:50	07/22/17 17:51	7440-70-2	
Chromium	ND	ug/L	5.0	1	07/20/17 21:50	07/22/17 17:51	7440-47-3	
Cobalt	ND	ug/L	5.0	1	07/20/17 21:50	07/22/17 17:51	7440-48-4	
Copper	ND	ug/L	5.0	1	07/20/17 21:50	07/22/17 17:51	7440-50-8	
Lead	ND	ug/L	5.0	1	07/20/17 21:50	07/22/17 17:51	7439-92-1	
Molybdenum	ND	ug/L	5.0	1	07/20/17 21:50	07/22/17 17:51	7439-98-7	
Nickel	ND	ug/L	5.0	1	07/20/17 21:50	07/22/17 17:51	7440-02-0	
Selenium	ND	ug/L	10.0	1	07/20/17 21:50	07/22/17 17:51	7782-49-2	
Silver	ND	ug/L	5.0	1	07/20/17 21:50	07/22/17 17:51	7440-22-4	
Vanadium	ND	ug/L	5.0	1	07/20/17 21:50	07/22/17 17:51	7440-62-2	
Zinc	ND	ug/L	10.0	1	07/20/17 21:50	07/22/17 17:51	7440-66-6	
6020 MET ICPMS	Analytical Method: EPA 6020B Preparation Method: EPA 3010A							
Boron	ND	ug/L	25.0	1	07/20/17 03:35	07/21/17 16:43	7440-42-8	
Lithium	ND	ug/L	2.5	1	07/20/17 03:35	07/21/17 16:43	7439-93-2	
Thallium	ND	ug/L	0.10	1	07/20/17 03:35	07/21/17 16:43	7440-28-0	
7470 Mercury	Analytical Method: EPA 7470 Preparation Method: EPA 7470							
Mercury	ND	ug/L	0.20	1	07/20/17 14:22	07/21/17 04:46	7439-97-6	
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
Acetone	ND	ug/L	25.0	1		07/20/17 13:24	67-64-1	L1
Acrylonitrile	ND	ug/L	10.0	1		07/20/17 13:24	107-13-1	
Benzene	ND	ug/L	1.0	1		07/20/17 13:24	71-43-2	
Bromochloromethane	ND	ug/L	1.0	1		07/20/17 13:24	74-97-5	
Bromodichloromethane	ND	ug/L	1.0	1		07/20/17 13:24	75-27-4	
Bromoform	ND	ug/L	1.0	1		07/20/17 13:24	75-25-2	
Bromomethane	ND	ug/L	2.0	1		07/20/17 13:24	74-83-9	
2-Butanone (MEK)	ND	ug/L	5.0	1		07/20/17 13:24	78-93-3	
Carbon disulfide	ND	ug/L	2.0	1		07/20/17 13:24	75-15-0	
Carbon tetrachloride	ND	ug/L	1.0	1		07/20/17 13:24	56-23-5	
Chlorobenzene	ND	ug/L	1.0	1		07/20/17 13:24	108-90-7	
Chloroethane	ND	ug/L	1.0	1		07/20/17 13:24	75-00-3	
Chloroform	ND	ug/L	1.0	1		07/20/17 13:24	67-66-3	
Chloromethane	ND	ug/L	1.0	1		07/20/17 13:24	74-87-3	
Dibromochloromethane	ND	ug/L	1.0	1		07/20/17 13:24	124-48-1	
Dibromomethane	ND	ug/L	1.0	1		07/20/17 13:24	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	1.0	1		07/20/17 13:24	95-50-1	
1,4-Dichlorobenzene	ND	ug/L	1.0	1		07/20/17 13:24	106-46-7	
trans-1,4-Dichloro-2-butene	ND	ug/L	1.0	1		07/20/17 13:24	110-57-6	L1
1,1-Dichloroethane	ND	ug/L	1.0	1		07/20/17 13:24	75-34-3	

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ANALYTICAL RESULTS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348315

Sample: EQ BLANK **Lab ID: 92348315003** Collected: 07/18/17 19:00 Received: 07/19/17 09:17 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
1,2-Dichloroethane	ND	ug/L	1.0	1		07/20/17 13:24	107-06-2	
1,1-Dichloroethene	ND	ug/L	1.0	1		07/20/17 13:24	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	1.0	1		07/20/17 13:24	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	1.0	1		07/20/17 13:24	156-60-5	
1,2-Dichloropropane	ND	ug/L	1.0	1		07/20/17 13:24	78-87-5	
cis-1,3-Dichloropropene	ND	ug/L	1.0	1		07/20/17 13:24	10061-01-5	
trans-1,3-Dichloropropene	ND	ug/L	1.0	1		07/20/17 13:24	10061-02-6	
Ethylbenzene	ND	ug/L	1.0	1		07/20/17 13:24	100-41-4	
2-Hexanone	ND	ug/L	5.0	1		07/20/17 13:24	591-78-6	
Iodomethane	ND	ug/L	5.0	1		07/20/17 13:24	74-88-4	
Methylene Chloride	ND	ug/L	1.0	1		07/20/17 13:24	75-09-2	
4-Methyl-2-pentanone (MIBK)	ND	ug/L	5.0	1		07/20/17 13:24	108-10-1	
Styrene	ND	ug/L	1.0	1		07/20/17 13:24	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0	1		07/20/17 13:24	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0	1		07/20/17 13:24	79-34-5	
Tetrachloroethene	ND	ug/L	1.0	1		07/20/17 13:24	127-18-4	
Toluene	ND	ug/L	1.0	1		07/20/17 13:24	108-88-3	
1,1,1-Trichloroethane	ND	ug/L	1.0	1		07/20/17 13:24	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	1.0	1		07/20/17 13:24	79-00-5	
Trichloroethene	ND	ug/L	1.0	1		07/20/17 13:24	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0	1		07/20/17 13:24	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0	1		07/20/17 13:24	96-18-4	
Vinyl acetate	ND	ug/L	2.0	1		07/20/17 13:24	108-05-4	
Vinyl chloride	ND	ug/L	1.0	1		07/20/17 13:24	75-01-4	
Xylene (Total)	ND	ug/L	1.0	1		07/20/17 13:24	1330-20-7	
Surrogates								
4-Bromofluorobenzene (S)	101	%	70-130	1		07/20/17 13:24	460-00-4	
1,2-Dichloroethane-d4 (S)	99	%	70-130	1		07/20/17 13:24	17060-07-0	
Toluene-d8 (S)	105	%	70-130	1		07/20/17 13:24	2037-26-5	
2540C Total Dissolved Solids	Analytical Method: SM 2540C							
Total Dissolved Solids	ND	mg/L	25.0	1		07/21/17 18:57		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0							
Chloride	ND	mg/L	1.0	1		07/22/17 14:29	16887-00-6	
Fluoride	ND	mg/L	0.10	1		07/22/17 14:29	16984-48-8	
Sulfate	ND	mg/L	1.0	1		07/22/17 14:29	14808-79-8	

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(704)875-9092

ANALYTICAL RESULTS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348315

Sample: AMB **Lab ID: 92348315004** Collected: 07/18/17 12:30 Received: 07/19/17 09:17 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP	Analytical Method: EPA 6010 Preparation Method: EPA 3010A							
Antimony	ND	ug/L	5.0	1	07/20/17 21:50	07/22/17 17:54	7440-36-0	
Arsenic	ND	ug/L	10.0	1	07/20/17 21:50	07/22/17 17:54	7440-38-2	
Barium	ND	ug/L	5.0	1	07/20/17 21:50	07/22/17 17:54	7440-39-3	
Beryllium	ND	ug/L	1.0	1	07/20/17 21:50	07/22/17 17:54	7440-41-7	
Cadmium	ND	ug/L	1.0	1	07/20/17 21:50	07/22/17 17:54	7440-43-9	
Calcium	ND	ug/L	100	1	07/20/17 21:50	07/22/17 17:54	7440-70-2	
Chromium	ND	ug/L	5.0	1	07/20/17 21:50	07/22/17 17:54	7440-47-3	
Cobalt	ND	ug/L	5.0	1	07/20/17 21:50	07/22/17 17:54	7440-48-4	
Copper	ND	ug/L	5.0	1	07/20/17 21:50	07/22/17 17:54	7440-50-8	
Lead	ND	ug/L	5.0	1	07/20/17 21:50	07/22/17 17:54	7439-92-1	
Molybdenum	ND	ug/L	5.0	1	07/20/17 21:50	07/22/17 17:54	7439-98-7	
Nickel	ND	ug/L	5.0	1	07/20/17 21:50	07/22/17 17:54	7440-02-0	
Selenium	ND	ug/L	10.0	1	07/20/17 21:50	07/22/17 17:54	7782-49-2	
Silver	ND	ug/L	5.0	1	07/20/17 21:50	07/22/17 17:54	7440-22-4	
Vanadium	ND	ug/L	5.0	1	07/20/17 21:50	07/22/17 17:54	7440-62-2	
Zinc	ND	ug/L	10.0	1	07/20/17 21:50	07/22/17 17:54	7440-66-6	
6020 MET ICPMS	Analytical Method: EPA 6020B Preparation Method: EPA 3010A							
Boron	ND	ug/L	25.0	1	07/21/17 04:15	07/21/17 16:51	7440-42-8	
Lithium	ND	ug/L	2.5	1	07/21/17 04:15	07/21/17 16:51	7439-93-2	
Thallium	ND	ug/L	0.10	1	07/21/17 04:15	07/21/17 16:51	7440-28-0	
7470 Mercury	Analytical Method: EPA 7470 Preparation Method: EPA 7470							
Mercury	ND	ug/L	0.20	1	07/20/17 14:22	07/21/17 04:49	7439-97-6	
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
Acetone	ND	ug/L	25.0	1		07/20/17 14:33	67-64-1	L1
Acrylonitrile	ND	ug/L	10.0	1		07/20/17 14:33	107-13-1	
Benzene	ND	ug/L	1.0	1		07/20/17 14:33	71-43-2	
Bromochloromethane	ND	ug/L	1.0	1		07/20/17 14:33	74-97-5	
Bromodichloromethane	ND	ug/L	1.0	1		07/20/17 14:33	75-27-4	
Bromoform	ND	ug/L	1.0	1		07/20/17 14:33	75-25-2	
Bromomethane	ND	ug/L	2.0	1		07/20/17 14:33	74-83-9	
2-Butanone (MEK)	ND	ug/L	5.0	1		07/20/17 14:33	78-93-3	
Carbon disulfide	ND	ug/L	2.0	1		07/20/17 14:33	75-15-0	
Carbon tetrachloride	ND	ug/L	1.0	1		07/20/17 14:33	56-23-5	
Chlorobenzene	ND	ug/L	1.0	1		07/20/17 14:33	108-90-7	
Chloroethane	ND	ug/L	1.0	1		07/20/17 14:33	75-00-3	
Chloroform	ND	ug/L	1.0	1		07/20/17 14:33	67-66-3	
Chloromethane	ND	ug/L	1.0	1		07/20/17 14:33	74-87-3	
Dibromochloromethane	ND	ug/L	1.0	1		07/20/17 14:33	124-48-1	
Dibromomethane	ND	ug/L	1.0	1		07/20/17 14:33	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	1.0	1		07/20/17 14:33	95-50-1	
1,4-Dichlorobenzene	ND	ug/L	1.0	1		07/20/17 14:33	106-46-7	
trans-1,4-Dichloro-2-butene	ND	ug/L	1.0	1		07/20/17 14:33	110-57-6	L1
1,1-Dichloroethane	ND	ug/L	1.0	1		07/20/17 14:33	75-34-3	

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ANALYTICAL RESULTS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348315

Sample: AMB **Lab ID: 92348315004** Collected: 07/18/17 12:30 Received: 07/19/17 09:17 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
1,2-Dichloroethane	ND	ug/L	1.0	1		07/20/17 14:33	107-06-2	
1,1-Dichloroethene	ND	ug/L	1.0	1		07/20/17 14:33	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	1.0	1		07/20/17 14:33	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	1.0	1		07/20/17 14:33	156-60-5	
1,2-Dichloropropane	ND	ug/L	1.0	1		07/20/17 14:33	78-87-5	
cis-1,3-Dichloropropene	ND	ug/L	1.0	1		07/20/17 14:33	10061-01-5	
trans-1,3-Dichloropropene	ND	ug/L	1.0	1		07/20/17 14:33	10061-02-6	
Ethylbenzene	ND	ug/L	1.0	1		07/20/17 14:33	100-41-4	
2-Hexanone	ND	ug/L	5.0	1		07/20/17 14:33	591-78-6	
Iodomethane	ND	ug/L	5.0	1		07/20/17 14:33	74-88-4	
Methylene Chloride	ND	ug/L	1.0	1		07/20/17 14:33	75-09-2	
4-Methyl-2-pentanone (MIBK)	ND	ug/L	5.0	1		07/20/17 14:33	108-10-1	
Styrene	ND	ug/L	1.0	1		07/20/17 14:33	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0	1		07/20/17 14:33	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0	1		07/20/17 14:33	79-34-5	
Tetrachloroethene	ND	ug/L	1.0	1		07/20/17 14:33	127-18-4	
Toluene	ND	ug/L	1.0	1		07/20/17 14:33	108-88-3	
1,1,1-Trichloroethane	ND	ug/L	1.0	1		07/20/17 14:33	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	1.0	1		07/20/17 14:33	79-00-5	
Trichloroethene	ND	ug/L	1.0	1		07/20/17 14:33	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0	1		07/20/17 14:33	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0	1		07/20/17 14:33	96-18-4	
Vinyl acetate	ND	ug/L	2.0	1		07/20/17 14:33	108-05-4	
Vinyl chloride	ND	ug/L	1.0	1		07/20/17 14:33	75-01-4	
Xylene (Total)	ND	ug/L	1.0	1		07/20/17 14:33	1330-20-7	
Surrogates								
4-Bromofluorobenzene (S)	104	%	70-130	1		07/20/17 14:33	460-00-4	
1,2-Dichloroethane-d4 (S)	104	%	70-130	1		07/20/17 14:33	17060-07-0	
Toluene-d8 (S)	104	%	70-130	1		07/20/17 14:33	2037-26-5	
2540C Total Dissolved Solids	Analytical Method: SM 2540C							
Total Dissolved Solids	ND	mg/L	25.0	1		07/21/17 18:58		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0							
Chloride	ND	mg/L	1.0	1		07/22/17 15:51	16887-00-6	
Fluoride	ND	mg/L	0.10	1		07/22/17 15:51	16984-48-8	
Sulfate	ND	mg/L	1.0	1		07/22/17 15:51	14808-79-8	

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ANALYTICAL RESULTS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348315

Sample: TRIP BLANK **Lab ID: 92348315005** Collected: 07/18/17 00:00 Received: 07/19/17 09:17 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
Acetone	ND	ug/L	25.0	1		07/20/17 13:07	67-64-1	L1
Acrylonitrile	ND	ug/L	10.0	1		07/20/17 13:07	107-13-1	
Benzene	ND	ug/L	1.0	1		07/20/17 13:07	71-43-2	
Bromochloromethane	ND	ug/L	1.0	1		07/20/17 13:07	74-97-5	
Bromodichloromethane	ND	ug/L	1.0	1		07/20/17 13:07	75-27-4	
Bromoform	ND	ug/L	1.0	1		07/20/17 13:07	75-25-2	
Bromomethane	ND	ug/L	2.0	1		07/20/17 13:07	74-83-9	
2-Butanone (MEK)	ND	ug/L	5.0	1		07/20/17 13:07	78-93-3	
Carbon disulfide	ND	ug/L	2.0	1		07/20/17 13:07	75-15-0	
Carbon tetrachloride	ND	ug/L	1.0	1		07/20/17 13:07	56-23-5	
Chlorobenzene	ND	ug/L	1.0	1		07/20/17 13:07	108-90-7	
Chloroethane	ND	ug/L	1.0	1		07/20/17 13:07	75-00-3	
Chloroform	ND	ug/L	1.0	1		07/20/17 13:07	67-66-3	
Chloromethane	ND	ug/L	1.0	1		07/20/17 13:07	74-87-3	
Dibromochloromethane	ND	ug/L	1.0	1		07/20/17 13:07	124-48-1	
Dibromomethane	ND	ug/L	1.0	1		07/20/17 13:07	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	1.0	1		07/20/17 13:07	95-50-1	
1,4-Dichlorobenzene	ND	ug/L	1.0	1		07/20/17 13:07	106-46-7	
trans-1,4-Dichloro-2-butene	ND	ug/L	1.0	1		07/20/17 13:07	110-57-6	L1
1,1-Dichloroethane	ND	ug/L	1.0	1		07/20/17 13:07	75-34-3	
1,2-Dichloroethane	ND	ug/L	1.0	1		07/20/17 13:07	107-06-2	
1,1-Dichloroethene	ND	ug/L	1.0	1		07/20/17 13:07	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	1.0	1		07/20/17 13:07	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	1.0	1		07/20/17 13:07	156-60-5	
1,2-Dichloropropane	ND	ug/L	1.0	1		07/20/17 13:07	78-87-5	
cis-1,3-Dichloropropene	ND	ug/L	1.0	1		07/20/17 13:07	10061-01-5	
trans-1,3-Dichloropropene	ND	ug/L	1.0	1		07/20/17 13:07	10061-02-6	
Ethylbenzene	ND	ug/L	1.0	1		07/20/17 13:07	100-41-4	
2-Hexanone	ND	ug/L	5.0	1		07/20/17 13:07	591-78-6	
Iodomethane	ND	ug/L	5.0	1		07/20/17 13:07	74-88-4	
Methylene Chloride	ND	ug/L	1.0	1		07/20/17 13:07	75-09-2	
4-Methyl-2-pentanone (MIBK)	ND	ug/L	5.0	1		07/20/17 13:07	108-10-1	
Styrene	ND	ug/L	1.0	1		07/20/17 13:07	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0	1		07/20/17 13:07	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0	1		07/20/17 13:07	79-34-5	
Tetrachloroethene	ND	ug/L	1.0	1		07/20/17 13:07	127-18-4	
Toluene	ND	ug/L	1.0	1		07/20/17 13:07	108-88-3	
1,1,1-Trichloroethane	ND	ug/L	1.0	1		07/20/17 13:07	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	1.0	1		07/20/17 13:07	79-00-5	
Trichloroethene	ND	ug/L	1.0	1		07/20/17 13:07	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0	1		07/20/17 13:07	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0	1		07/20/17 13:07	96-18-4	
Vinyl acetate	ND	ug/L	2.0	1		07/20/17 13:07	108-05-4	
Vinyl chloride	ND	ug/L	1.0	1		07/20/17 13:07	75-01-4	
Xylene (Total)	ND	ug/L	1.0	1		07/20/17 13:07	1330-20-7	
Surrogates								
4-Bromofluorobenzene (S)	101	%	70-130	1		07/20/17 13:07	460-00-4	

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ANALYTICAL RESULTS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348315

Sample: TRIP BLANK **Lab ID: 92348315005** Collected: 07/18/17 00:00 Received: 07/19/17 09:17 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
Surrogates								
1,2-Dichloroethane-d4 (S)	100	%	70-130	1		07/20/17 13:07	17060-07-0	
Toluene-d8 (S)	115	%	70-130	1		07/20/17 13:07	2037-26-5	

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QUALITY CONTROL DATA

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348315

QC Batch: 369812 Analysis Method: EPA 7470
QC Batch Method: EPA 7470 Analysis Description: 7470 Mercury
Associated Lab Samples: 92348315001, 92348315002, 92348315003, 92348315004

METHOD BLANK: 2049266 Matrix: Water
Associated Lab Samples: 92348315001, 92348315002, 92348315003, 92348315004

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Mercury	ug/L	ND	0.20	07/21/17 04:22	

LABORATORY CONTROL SAMPLE: 2049267

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Mercury	ug/L	2.5	2.3	92	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2049268 2049269

Parameter	Units	92348315001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Mercury	ug/L	ND	1250	1250	1160	1180	93	94	75-125	2	25	

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QUALITY CONTROL DATA

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348315

QC Batch: 369943 Analysis Method: EPA 6010
QC Batch Method: EPA 3010A Analysis Description: 6010 MET
Associated Lab Samples: 92348315001, 92348315002, 92348315003, 92348315004

METHOD BLANK: 2050029 Matrix: Water
Associated Lab Samples: 92348315001, 92348315002, 92348315003, 92348315004

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Antimony	ug/L	ND	5.0	07/22/17 16:23	
Arsenic	ug/L	ND	10.0	07/22/17 16:23	
Barium	ug/L	ND	5.0	07/22/17 16:23	
Beryllium	ug/L	ND	1.0	07/22/17 16:23	
Cadmium	ug/L	ND	1.0	07/22/17 16:23	
Calcium	ug/L	ND	100	07/22/17 16:23	
Chromium	ug/L	ND	5.0	07/22/17 16:23	
Cobalt	ug/L	ND	5.0	07/22/17 16:23	
Copper	ug/L	ND	5.0	07/22/17 16:23	
Lead	ug/L	ND	5.0	07/22/17 16:23	
Molybdenum	ug/L	ND	5.0	07/22/17 16:23	
Nickel	ug/L	ND	5.0	07/22/17 16:23	
Selenium	ug/L	ND	10.0	07/22/17 16:23	
Silver	ug/L	ND	5.0	07/22/17 16:23	
Vanadium	ug/L	ND	5.0	07/22/17 16:23	
Zinc	ug/L	ND	10.0	07/22/17 16:23	

LABORATORY CONTROL SAMPLE: 2050030

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Antimony	ug/L	500	504	101	80-120	
Arsenic	ug/L	500	481	96	80-120	
Barium	ug/L	500	497	99	80-120	
Beryllium	ug/L	500	492	98	80-120	
Cadmium	ug/L	500	499	100	80-120	
Calcium	ug/L	5000	4980	100	80-120	
Chromium	ug/L	500	485	97	80-120	
Cobalt	ug/L	500	496	99	80-120	
Copper	ug/L	500	503	101	80-120	
Lead	ug/L	500	488	98	80-120	
Molybdenum	ug/L	500	521	104	80-120	
Nickel	ug/L	500	485	97	80-120	
Selenium	ug/L	500	511	102	80-120	
Silver	ug/L	250	252	101	80-120	
Vanadium	ug/L	500	481	96	80-120	
Zinc	ug/L	500	492	98	80-120	

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QUALITY CONTROL DATA

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348315

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2050031 2050032

Parameter	Units	35324818001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Antimony	ug/L	3.9U	500	500	492	498	98	100	75-125	1	20	
Arsenic	ug/L	1310	500	500	1820	1890	100	116	75-125	4	20	
Barium	ug/L	13.8	500	500	494	498	96	97	75-125	1	20	
Beryllium	ug/L	0.50U	500	500	480	483	96	97	75-125	1	20	
Cadmium	ug/L	14.4	500	500	498	504	97	98	75-125	1	20	
Calcium	ug/L	85600	5000	5000	92700	96600	142	221	75-125	4	20	M1
Chromium	ug/L	2.5U	500	500	471	470	94	94	75-125	0	20	
Cobalt	ug/L	2.5U	500	500	470	474	94	95	75-125	1	20	
Copper	ug/L	2.5U	500	500	492	493	98	99	75-125	0	20	
Lead	ug/L	2.5U	500	500	464	469	93	94	75-125	1	20	
Molybdenum	ug/L	2.5U	500	500	509	516	101	103	75-125	1	20	
Nickel	ug/L	2.5U	500	500	461	466	92	93	75-125	1	20	
Selenium	ug/L	5.0U	500	500	489	495	98	99	75-125	1	20	
Silver	ug/L	2.5U	250	250	244	246	98	98	75-125	1	20	
Vanadium	ug/L	2.5U	500	500	474	474	95	94	75-125	0	20	
Zinc	ug/L	5.0U	500	500	467	472	93	94	75-125	1	20	

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QUALITY CONTROL DATA

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348315

QC Batch: 369760 Analysis Method: EPA 6020B
QC Batch Method: EPA 3010A Analysis Description: 6020 MET
Associated Lab Samples: 92348315001, 92348315002, 92348315003

METHOD BLANK: 2049007 Matrix: Water
Associated Lab Samples: 92348315001, 92348315002, 92348315003

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Boron	ug/L	ND	25.0	07/21/17 15:31	
Lithium	ug/L	ND	2.5	07/21/17 15:31	
Thallium	ug/L	ND	0.10	07/21/17 15:31	

LABORATORY CONTROL SAMPLE: 2049008

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Boron	ug/L	100	99.5	99	80-120	
Lithium	ug/L	100	99.2	99	80-120	
Thallium	ug/L	100	98.6	99	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2049009 2049010

Parameter	Units	92348172001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Boron	ug/L	3.1J	100	100	102	101	99	98	75-125	1	20	
Lithium	ug/L	0.17J	100	100	101	98.3	101	98	75-125	3	20	
Thallium	ug/L	0.036J	100	100	100	95.9	100	96	75-125	4	20	

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QUALITY CONTROL DATA

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348315

QC Batch: 369962
QC Batch Method: EPA 3010A
Analysis Method: EPA 6020B
Analysis Description: 6020 MET
Associated Lab Samples: 92348315004

METHOD BLANK: 2050067
Matrix: Water
Associated Lab Samples: 92348315004

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Boron	ug/L	ND	25.0	07/21/17 16:47	
Lithium	ug/L	ND	2.5	07/21/17 16:47	
Thallium	ug/L	ND	0.10	07/21/17 16:47	

LABORATORY CONTROL SAMPLE: 2050068

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Boron	ug/L	100	99.1	99	80-120	
Lithium	ug/L	100	104	104	80-120	
Thallium	ug/L	100	96.6	97	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2050069 2050070

Parameter	Units	92348315004 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Boron	ug/L	ND	100	100	100	101	97	98	75-125	1	20	
Lithium	ug/L	ND	100	100	105	104	104	103	75-125	1	20	
Thallium	ug/L	ND	100	100	99.8	100	100	100	75-125	0	20	

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QUALITY CONTROL DATA

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348315

QC Batch: 369832 Analysis Method: EPA 8260
QC Batch Method: EPA 8260 Analysis Description: 8260 MSV Low Level Landfill
Associated Lab Samples: 92348315001, 92348315002, 92348315003, 92348315004, 92348315005

METHOD BLANK: 2049344 Matrix: Water
Associated Lab Samples: 92348315001, 92348315002, 92348315003, 92348315004, 92348315005

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
1,1,1,2-Tetrachloroethane	ug/L	ND	1.0	07/20/17 12:49	
1,1,1-Trichloroethane	ug/L	ND	1.0	07/20/17 12:49	
1,1,2,2-Tetrachloroethane	ug/L	ND	1.0	07/20/17 12:49	
1,1,2-Trichloroethane	ug/L	ND	1.0	07/20/17 12:49	
1,1-Dichloroethane	ug/L	ND	1.0	07/20/17 12:49	
1,1-Dichloroethene	ug/L	ND	1.0	07/20/17 12:49	
1,2,3-Trichloropropane	ug/L	ND	1.0	07/20/17 12:49	
1,2-Dichlorobenzene	ug/L	ND	1.0	07/20/17 12:49	
1,2-Dichloroethane	ug/L	ND	1.0	07/20/17 12:49	
1,2-Dichloropropane	ug/L	ND	1.0	07/20/17 12:49	
1,4-Dichlorobenzene	ug/L	ND	1.0	07/20/17 12:49	
2-Butanone (MEK)	ug/L	ND	5.0	07/20/17 12:49	
2-Hexanone	ug/L	ND	5.0	07/20/17 12:49	
4-Methyl-2-pentanone (MIBK)	ug/L	ND	5.0	07/20/17 12:49	
Acetone	ug/L	ND	25.0	07/20/17 12:49	
Acrylonitrile	ug/L	ND	10.0	07/20/17 12:49	
Benzene	ug/L	ND	1.0	07/20/17 12:49	
Bromochloromethane	ug/L	ND	1.0	07/20/17 12:49	
Bromodichloromethane	ug/L	ND	1.0	07/20/17 12:49	
Bromoform	ug/L	ND	1.0	07/20/17 12:49	
Bromomethane	ug/L	ND	2.0	07/20/17 12:49	
Carbon disulfide	ug/L	ND	2.0	07/20/17 12:49	
Carbon tetrachloride	ug/L	ND	1.0	07/20/17 12:49	
Chlorobenzene	ug/L	ND	1.0	07/20/17 12:49	
Chloroethane	ug/L	ND	1.0	07/20/17 12:49	
Chloroform	ug/L	ND	1.0	07/20/17 12:49	
Chloromethane	ug/L	ND	1.0	07/20/17 12:49	
cis-1,2-Dichloroethene	ug/L	ND	1.0	07/20/17 12:49	
cis-1,3-Dichloropropene	ug/L	ND	1.0	07/20/17 12:49	
Dibromochloromethane	ug/L	ND	1.0	07/20/17 12:49	
Dibromomethane	ug/L	ND	1.0	07/20/17 12:49	
Ethylbenzene	ug/L	ND	1.0	07/20/17 12:49	
Iodomethane	ug/L	ND	5.0	07/20/17 12:49	
Methylene Chloride	ug/L	ND	1.0	07/20/17 12:49	
Styrene	ug/L	ND	1.0	07/20/17 12:49	
Tetrachloroethene	ug/L	ND	1.0	07/20/17 12:49	
Toluene	ug/L	ND	1.0	07/20/17 12:49	
trans-1,2-Dichloroethene	ug/L	ND	1.0	07/20/17 12:49	
trans-1,3-Dichloropropene	ug/L	ND	1.0	07/20/17 12:49	
trans-1,4-Dichloro-2-butene	ug/L	ND	1.0	07/20/17 12:49	
Trichloroethene	ug/L	ND	1.0	07/20/17 12:49	

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QUALITY CONTROL DATA

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348315

METHOD BLANK: 2049344 Matrix: Water
Associated Lab Samples: 92348315001, 92348315002, 92348315003, 92348315004, 92348315005

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Trichlorofluoromethane	ug/L	ND	1.0	07/20/17 12:49	
Vinyl acetate	ug/L	ND	2.0	07/20/17 12:49	
Vinyl chloride	ug/L	ND	1.0	07/20/17 12:49	
Xylene (Total)	ug/L	ND	1.0	07/20/17 12:49	
1,2-Dichloroethane-d4 (S)	%	102	70-130	07/20/17 12:49	
4-Bromofluorobenzene (S)	%	102	70-130	07/20/17 12:49	
Toluene-d8 (S)	%	105	70-130	07/20/17 12:49	

LABORATORY CONTROL SAMPLE: 2049345

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
1,1,1,2-Tetrachloroethane	ug/L	50	54.4	109	80-125	
1,1,1-Trichloroethane	ug/L	50	51.2	102	71-129	
1,1,2,2-Tetrachloroethane	ug/L	50	53.2	106	79-124	
1,1,2-Trichloroethane	ug/L	50	54.1	108	85-125	
1,1-Dichloroethane	ug/L	50	53.4	107	73-126	
1,1-Dichloroethene	ug/L	50	53.9	108	66-135	
1,2,3-Trichloropropane	ug/L	50	54.3	109	75-130	
1,2-Dichlorobenzene	ug/L	50	48.4	97	80-133	
1,2-Dichloroethane	ug/L	50	49.4	99	67-128	
1,2-Dichloropropane	ug/L	50	53.5	107	75-132	
1,4-Dichlorobenzene	ug/L	50	49.7	99	78-130	
2-Butanone (MEK)	ug/L	100	133	133	61-144	
2-Hexanone	ug/L	100	137	137	68-143	
4-Methyl-2-pentanone (MIBK)	ug/L	100	116	116	72-135	
Acetone	ug/L	100	189	189	48-146	L1
Acrylonitrile	ug/L	250	301	120	40-160	
Benzene	ug/L	50	55.3	111	80-125	
Bromochloromethane	ug/L	50	52.6	105	71-125	
Bromodichloromethane	ug/L	50	53.1	106	78-124	
Bromoform	ug/L	50	45.8	92	71-128	
Bromomethane	ug/L	50	56.4	113	40-160	
Carbon disulfide	ug/L	50	56.5	113	50-160	
Carbon tetrachloride	ug/L	50	50.6	101	69-131	
Chlorobenzene	ug/L	50	53.4	107	81-122	
Chloroethane	ug/L	50	46.2	92	39-148	
Chloroform	ug/L	50	51.1	102	73-127	
Chloromethane	ug/L	50	51.7	103	44-146	
cis-1,2-Dichloroethene	ug/L	50	51.9	104	74-124	
cis-1,3-Dichloropropene	ug/L	50	55.9	112	72-132	
Dibromochloromethane	ug/L	50	54.6	109	78-125	
Dibromomethane	ug/L	50	49.7	99	82-120	
Ethylbenzene	ug/L	50	52.0	104	79-121	
Iodomethane	ug/L	100	105	105	39-154	

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QUALITY CONTROL DATA

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348315

LABORATORY CONTROL SAMPLE: 2049345

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Methylene Chloride	ug/L	50	49.2	98	64-133	
Styrene	ug/L	50	54.3	109	84-126	
Tetrachloroethene	ug/L	50	49.6	99	78-122	
Toluene	ug/L	50	50.9	102	80-121	
trans-1,2-Dichloroethene	ug/L	50	53.0	106	71-127	
trans-1,3-Dichloropropene	ug/L	50	55.1	110	69-141	
trans-1,4-Dichloro-2-butene	ug/L	50	86.6	173	40-160	L1
Trichloroethene	ug/L	50	52.6	105	78-122	
Trichlorofluoromethane	ug/L	50	53.6	107	53-137	
Vinyl acetate	ug/L	100	108	108	40-160	
Vinyl chloride	ug/L	50	52.1	104	58-137	
Xylene (Total)	ug/L	150	156	104	81-126	
1,2-Dichloroethane-d4 (S)	%			96	70-130	
4-Bromofluorobenzene (S)	%			101	70-130	
Toluene-d8 (S)	%			96	70-130	

MATRIX SPIKE SAMPLE: 2049346

Parameter	Units	92348315001 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
1,1,1,2-Tetrachloroethane	ug/L	ND	20	19.8	99	70-130	
1,1,1-Trichloroethane	ug/L	ND	20	21.0	105	70-130	
1,1,2,2-Tetrachloroethane	ug/L	ND	20	22.3	112	70-130	
1,1,2-Trichloroethane	ug/L	ND	20	22.2	111	70-130	
1,1-Dichloroethane	ug/L	ND	20	21.9	109	70-130	
1,1-Dichloroethene	ug/L	ND	20	22.4	112	70-166	
1,2,3-Trichloropropane	ug/L	ND	20	21.9	109	70-130	
1,2-Dichlorobenzene	ug/L	ND	20	20.0	100	70-130	
1,2-Dichloroethane	ug/L	ND	20	21.7	109	70-130	
1,2-Dichloropropane	ug/L	ND	20	21.7	108	70-130	
1,4-Dichlorobenzene	ug/L	ND	20	19.9	99	70-130	
2-Butanone (MEK)	ug/L	ND	40	50.5	126	70-130	
2-Hexanone	ug/L	ND	40	56.9	142	70-130	M1
4-Methyl-2-pentanone (MIBK)	ug/L	ND	40	50.2	126	70-130	
Acetone	ug/L	ND	40	65.1	163	70-130	M0
Acrylonitrile	ug/L	ND	100	135	135	70-130	M1
Benzene	ug/L	ND	20	22.5	112	70-148	
Bromochloromethane	ug/L	ND	20	22.4	112	70-130	
Bromodichloromethane	ug/L	ND	20	21.6	108	70-130	
Bromoform	ug/L	ND	20	15.8	79	70-130	
Bromomethane	ug/L	ND	20	21.9	109	70-130	
Carbon disulfide	ug/L	ND	20	22.8	114	70-130	
Carbon tetrachloride	ug/L	ND	20	20.1	100	70-130	
Chlorobenzene	ug/L	ND	20	21.4	107	70-146	
Chloroethane	ug/L	ND	20	20.7	103	70-130	
Chloroform	ug/L	ND	20	22.0	110	70-130	

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QUALITY CONTROL DATA

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348315

MATRIX SPIKE SAMPLE: 2049346

Parameter	Units	92348315001 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Chloromethane	ug/L	ND	20	21.5	106	70-130	
cis-1,2-Dichloroethene	ug/L	ND	20	21.5	107	70-130	
cis-1,3-Dichloropropene	ug/L	ND	20	20.6	103	70-130	
Dibromochloromethane	ug/L	ND	20	19.7	99	70-130	
Dibromomethane	ug/L	ND	20	20.7	103	70-130	
Ethylbenzene	ug/L	ND	20	21.1	106	70-130	
Iodomethane	ug/L	ND	40	35.2	88	70-130	
Methylene Chloride	ug/L	ND	20	18.7	94	70-130	
Styrene	ug/L	ND	20	21.1	106	70-130	
Tetrachloroethene	ug/L	ND	20	19.9	100	70-130	
Toluene	ug/L	ND	20	21.9	109	70-155	
trans-1,2-Dichloroethene	ug/L	ND	20	21.6	108	70-130	
trans-1,3-Dichloropropene	ug/L	ND	20	19.8	99	70-130	
trans-1,4-Dichloro-2-butene	ug/L	ND	20	18.7	94	70-130	
Trichloroethene	ug/L	ND	20	21.2	106	69-151	
Trichlorofluoromethane	ug/L	ND	20	21.1	106	70-130	
Vinyl acetate	ug/L	ND	40	43.1	108	70-130	
Vinyl chloride	ug/L	ND	20	20.6	103	70-130	
1,2-Dichloroethane-d4 (S)	%				98	70-130	
4-Bromofluorobenzene (S)	%				101	70-130	
Toluene-d8 (S)	%				99	70-130	

SAMPLE DUPLICATE: 2049347

Parameter	Units	92348315002 Result	Dup Result	RPD	Max RPD	Qualifiers
1,1,1,2-Tetrachloroethane	ug/L	ND	ND		30	
1,1,1-Trichloroethane	ug/L	ND	ND		30	
1,1,2,2-Tetrachloroethane	ug/L	ND	ND		30	
1,1,2-Trichloroethane	ug/L	ND	ND		30	
1,1-Dichloroethane	ug/L	ND	ND		30	
1,1-Dichloroethene	ug/L	ND	ND		30	
1,2,3-Trichloropropane	ug/L	ND	ND		30	
1,2-Dichlorobenzene	ug/L	ND	ND		30	
1,2-Dichloroethane	ug/L	ND	ND		30	
1,2-Dichloropropane	ug/L	ND	ND		30	
1,4-Dichlorobenzene	ug/L	ND	ND		30	
2-Butanone (MEK)	ug/L	ND	ND		30	
2-Hexanone	ug/L	ND	ND		30	
4-Methyl-2-pentanone (MIBK)	ug/L	ND	ND		30	
Acetone	ug/L	ND	ND		30	
Acrylonitrile	ug/L	ND	ND		30	
Benzene	ug/L	ND	ND		30	
Bromochloromethane	ug/L	ND	ND		30	
Bromodichloromethane	ug/L	ND	ND		30	
Bromoform	ug/L	ND	ND		30	

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QUALITY CONTROL DATA

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348315

SAMPLE DUPLICATE: 2049347

Parameter	Units	92348315002 Result	Dup Result	RPD	Max RPD	Qualifiers
Bromomethane	ug/L	ND	ND		30	
Carbon disulfide	ug/L	ND	ND		30	
Carbon tetrachloride	ug/L	ND	ND		30	
Chlorobenzene	ug/L	ND	ND		30	
Chloroethane	ug/L	ND	ND		30	
Chloroform	ug/L	ND	.68J		30	
Chloromethane	ug/L	ND	ND		30	
cis-1,2-Dichloroethene	ug/L	ND	ND		30	
cis-1,3-Dichloropropene	ug/L	ND	ND		30	
Dibromochloromethane	ug/L	ND	ND		30	
Dibromomethane	ug/L	ND	ND		30	
Ethylbenzene	ug/L	ND	ND		30	
Iodomethane	ug/L	ND	ND		30	
Methylene Chloride	ug/L	ND	ND		30	
Styrene	ug/L	ND	ND		30	
Tetrachloroethene	ug/L	ND	ND		30	
Toluene	ug/L	ND	ND		30	
trans-1,2-Dichloroethene	ug/L	ND	ND		30	
trans-1,3-Dichloropropene	ug/L	ND	ND		30	
trans-1,4-Dichloro-2-butene	ug/L	ND	ND		30	
Trichloroethene	ug/L	ND	ND		30	
Trichlorofluoromethane	ug/L	ND	ND		30	
Vinyl acetate	ug/L	ND	ND		30	
Vinyl chloride	ug/L	ND	ND		30	
Xylene (Total)	ug/L	ND	ND		30	
1,2-Dichloroethane-d4 (S)	%	103	98	5		
4-Bromofluorobenzene (S)	%	100	100	1		
Toluene-d8 (S)	%	105	103	2		

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QUALITY CONTROL DATA

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348315

QC Batch: 370101 Analysis Method: SM 2540C
QC Batch Method: SM 2540C Analysis Description: 2540C Total Dissolved Solids
Associated Lab Samples: 92348315001, 92348315002, 92348315003, 92348315004

METHOD BLANK: 2050854 Matrix: Water
Associated Lab Samples: 92348315001, 92348315002, 92348315003, 92348315004

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Total Dissolved Solids	mg/L	ND	25.0	07/21/17 18:53	

LABORATORY CONTROL SAMPLE: 2050855

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Total Dissolved Solids	mg/L	250	232	93	90-110	

SAMPLE DUPLICATE: 2050856

Parameter	Units	92348183019 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	103	103	0	5	

SAMPLE DUPLICATE: 2050857

Parameter	Units	92348346001 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	96.0	80.0	18	5	D6

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QUALITY CONTROL DATA

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348315

QC Batch: 370125 Analysis Method: EPA 300.0
QC Batch Method: EPA 300.0 Analysis Description: 300.0 IC Anions
Associated Lab Samples: 92348315001, 92348315002, 92348315003, 92348315004

METHOD BLANK: 2050980 Matrix: Water
Associated Lab Samples: 92348315001, 92348315002, 92348315003, 92348315004

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Chloride	mg/L	ND	1.0	07/22/17 11:45	
Fluoride	mg/L	ND	0.10	07/22/17 11:45	
Sulfate	mg/L	ND	1.0	07/22/17 11:45	

LABORATORY CONTROL SAMPLE: 2050981

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Chloride	mg/L	50	53.0	106	90-110	
Fluoride	mg/L	2.5	2.5	101	90-110	
Sulfate	mg/L	50	52.8	106	90-110	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2050982 2050983

Parameter	Units	92348075001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Chloride	mg/L	3.7	50	50	55.5	55.8	104	104	90-110	1	10	
Fluoride	mg/L	ND	2.5	2.5	2.6	2.6	100	101	90-110	1	10	
Sulfate	mg/L	2.7	50	50	54.3	54.7	103	104	90-110	1	10	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2050984 2050985

Parameter	Units	92348375003 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Chloride	mg/L	2.4	50	50	54.9	54.7	105	105	90-110	0	10	
Fluoride	mg/L	0.28	2.5	2.5	2.8	2.8	102	101	90-110	1	10	
Sulfate	mg/L	2.8	50	50	54.9	54.8	104	104	90-110	0	10	

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348315

Sample: MW-2 **Lab ID: 92348315001** Collected: 07/18/17 16:45 Received: 07/19/17 09:17 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**0.740 ± 0.549 (0.687) C:NA T:104%**	pCi/L	08/04/17 12:35	13982-63-3	
Radium-228	EPA 904.0	**1.54 ± 0.521 (0.735) C:76% T:85%**	pCi/L	08/04/17 11:23	15262-20-1	

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348315

Sample: MW-1 **Lab ID: 92348315002** Collected: 07/18/17 12:50 Received: 07/19/17 09:17 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**0.601 ± 0.510 (0.632) C:NA T:90%**	pCi/L	08/04/17 12:35	13982-63-3	
Radium-228	EPA 904.0	**0.508 ± 0.363 (0.714) C:76% T:96%**	pCi/L	08/04/17 11:23	15262-20-1	

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348315

Sample: EQ BLANK **Lab ID: 92348315003** Collected: 07/18/17 19:00 Received: 07/19/17 09:17 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**0.161 ± 0.548 (1.06) C:NA T:94%**	pCi/L	08/04/17 12:35	13982-63-3	
Radium-228	EPA 904.0	**0.454 ± 0.382 (0.767) C:80% T:75%**	pCi/L	08/04/17 11:23	15262-20-1	

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348315

Sample: AMB **Lab ID: 92348315004** Collected: 07/18/17 12:30 Received: 07/19/17 09:17 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**0.730 ± 0.572 (0.672) C:NA T:85%**	pCi/L	08/04/17 12:35	13982-63-3	
Radium-228	EPA 904.0	**0.255 ± 0.350 (0.751) C:78% T:83%**	pCi/L	08/04/17 11:23	15262-20-1	

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QUALITY CONTROL - RADIOCHEMISTRY

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348315

QC Batch: 266557 Analysis Method: EPA 903.1
QC Batch Method: EPA 903.1 Analysis Description: 903.1 Radium-226
Associated Lab Samples: 92348315001, 92348315002, 92348315003, 92348315004

METHOD BLANK: 1312602 Matrix: Water
Associated Lab Samples: 92348315001, 92348315002, 92348315003, 92348315004

Parameter	Act ± Unc (MDC) Carr Trac	Units	Analyzed	Qualifiers
Radium-226	0.230 ± 0.399 (0.713) C:NA T:98%	pCi/L	08/04/17 12:35	

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QUALITY CONTROL - RADIOCHEMISTRY

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348315

QC Batch: 266558 Analysis Method: EPA 904.0
QC Batch Method: EPA 904.0 Analysis Description: 904.0 Radium 228
Associated Lab Samples: 92348315001, 92348315002, 92348315003, 92348315004

METHOD BLANK: 1312603 Matrix: Water
Associated Lab Samples: 92348315001, 92348315002, 92348315003, 92348315004

Parameter	Act ± Unc (MDC) Carr Trac	Units	Analyzed	Qualifiers
Radium-228	0.0628 ± 0.351 (0.799) C:78% T:81%	pCi/L	08/04/17 11:22	

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QUALIFIERS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348315

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above adjusted reporting limit.

TNTC - Too Numerous To Count

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

Acid preservation may not be appropriate for 2 Chloroethylvinyl ether.

A separate vial preserved to a pH of 4-5 is recommended in SW846 Chapter 4 for the analysis of Acrolein and Acrylonitrile by EPA Method 8260.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Act - Activity

Unc - Uncertainty: SDWA = 1.96 sigma count uncertainty, all other matrices = Expanded Uncertainty (95% confidence interval). Gamma Spec = Expanded Uncertainty (95.4% Confidence Interval)

(MDC) - Minimum Detectable Concentration

Trac - Tracer Recovery (%)

Carr - Carrier Recovery (%)

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

LABORATORIES

PASI-A	Pace Analytical Services - Asheville
PASI-C	Pace Analytical Services - Charlotte
PASI-PA	Pace Analytical Services - Greensburg

ANALYTE QUALIFIERS

D6	The precision between the sample and sample duplicate exceeded laboratory control limits.
L1	Analyte recovery in the laboratory control sample (LCS) was above QC limits. Results for this analyte in associated samples may be biased high.
M0	Matrix spike recovery and/or matrix spike duplicate recovery was outside laboratory control limits.
M1	Matrix spike recovery exceeded QC limits. Batch accepted based on laboratory control sample (LCS) recovery.

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QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348315

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
92348315001	**MW-2**	EPA 3010A	369943	EPA 6010	370074
92348315002	**MW-1**	EPA 3010A	369943	EPA 6010	370074
92348315003	**EQ BLANK**	EPA 3010A	369943	EPA 6010	370074
92348315004	**AMB**	EPA 3010A	369943	EPA 6010	370074
92348315001	**MW-2**	EPA 3010A	369760	EPA 6020B	369879
92348315002	**MW-1**	EPA 3010A	369760	EPA 6020B	369879
92348315003	**EQ BLANK**	EPA 3010A	369760	EPA 6020B	369879
92348315004	**AMB**	EPA 3010A	369962	EPA 6020B	370056
92348315001	**MW-2**	EPA 7470	369812	EPA 7470	369956
92348315002	**MW-1**	EPA 7470	369812	EPA 7470	369956
92348315003	**EQ BLANK**	EPA 7470	369812	EPA 7470	369956
92348315004	**AMB**	EPA 7470	369812	EPA 7470	369956
92348315001	**MW-2**	EPA 8260	369832		
92348315002	**MW-1**	EPA 8260	369832		
92348315003	**EQ BLANK**	EPA 8260	369832		
92348315004	**AMB**	EPA 8260	369832		
92348315005	**TRIP BLANK**	EPA 8260	369832		
92348315001	**MW-2**	EPA 903.1	266557		
92348315002	**MW-1**	EPA 903.1	266557		
92348315003	**EQ BLANK**	EPA 903.1	266557		
92348315004	**AMB**	EPA 903.1	266557		
92348315001	**MW-2**	EPA 904.0	266558		
92348315002	**MW-1**	EPA 904.0	266558		
92348315003	**EQ BLANK**	EPA 904.0	266558		
92348315004	**AMB**	EPA 904.0	266558		
92348315001	**MW-2**	SM 2540C	370101		
92348315002	**MW-1**	SM 2540C	370101		
92348315003	**EQ BLANK**	SM 2540C	370101		
92348315004	**AMB**	SM 2540C	370101		
92348315001	**MW-2**	EPA 300.0	370125		
92348315002	**MW-1**	EPA 300.0	370125		
92348315003	**EQ BLANK**	EPA 300.0	370125		
92348315004	**AMB**	EPA 300.0	370125		

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Laboratory receiving samples:
Asheville ☐ Eden ☐ Greenwood ☐ Huntersville ☑ Raleigh ☐ Mechanicsville ☐

Sample Condition Upon Receipt

Client Name: HDR Engineering

Project #:

WO# : 92348315

92348315

Courier: ☐ Commercial ☐ Fed Ex ☐ UPS ☐ USPS ☐ Client ☑ Pace ☐ Other:____

Custody Seal Present? ☐ Yes ☑ No **Seals Intact?** ☐ Yes ☑ No

Packing Material: ☐ Bubble Wrap ☑ Bubble Bags ☐ None ☐ Other:____

Date/Initials Person Examining Contents: 7-19-17 JR

Thermometer: ☐ IR Gun ID: T1603

Type of Ice: ☑ Wet ☐ Blue ☐ None ☑ Samples on ice, cooling process has begun

Correction Factor: **Cooler Temp Corrected (°C):** 3.6

Biological Tissue Frozen? ☐ Yes ☑ No ☐ N/A

Temp should be above freezing to 6°C

USDA Regulated Soil (☑ N/A, water sample)

Did samples originate in a quarantine zone within the United States: CA, NY, or SC (check maps)? ☐ Yes ☑ No

Did samples originate from a foreign source (internationally, including Hawaii and Puerto Rico)? ☐ Yes ☑ No

				Comments/Discrepancy:
Chain of Custody Present?	☑ Yes	☐ No	☐ N/A	1.
Samples Arrived within Hold Time?	☑ Yes	☐ No	☐ N/A	2.
Short Hold Time Analysis (<72 hr.)?	☐ Yes	☑ No	☐ N/A	3.
Rush Turn Around Time Requested?	☐ Yes	☑ No	☐ N/A	4.
Sufficient Volume?	☑ Yes	☐ No	☐ N/A	5.
Correct Containers Used?	☑ Yes	☐ No	☐ N/A	6.
-Pace Containers Used?	☑ Yes	☐ No	☐ N/A	
Containers Intact?	☑ Yes	☐ No	☐ N/A	7.
Samples Field Filtered?	☐ Yes	☑ No	☐ N/A	8. Note if sediment is visible in the dissolved container
Sample Labels Match COC?	☑ Yes	☐ No	☐ N/A	9.
-Includes Date/Time/ID/Analysis Matrix: WT				
Headspace in VOA Vials (>5-6mm)?	☐ Yes	☐ No	☑ N/A	10.
Trip Blank Present?	☐ Yes	☑ No	☐ N/A	11.
Trip Blank Custody Seals Present?	☐ Yes	☐ No	☑ N/A	

CLIENT NOTIFICATION/RESOLUTION

Field Data Required? ☐ Yes ☐ No

Person Contacted: _____ Date/Time: _____

Comments/Sample Discrepancy: _____

Project Manager SCURF Review: TR **Date:** 7/19

Project Manager SRF Review: TR **Date:** 7/19

Note: Whenever there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office (i.e. Out of hold, incorrect preservative, out of temp, incorrect containers)

*Check mark top half of box if pH and/or dechlorination is verified and within the acceptance range for preservation samples.

**Bottom half of box is to list number of bottles

Project #

WO# : 92348315

PM: KRG **Due Date: 07/26/17**

CLIENT: 92-HDR

Item#	BP4U-125 mL Plastic Unpreserved (N/A) (Cl-)	BP3U-250 mL Plastic Unpreserved (N/A)	BP2U-500 mL Plastic Unpreserved (N/A)	BP1U-1 liter Plastic Unpreserved (N/A)	BP3S-250 mL Plastic H2SO4 (pH < 2) (Cl-)	BP3N-250 mL plastic HNO3 (pH < 2)	BP3Z-250 mL Plastic ZN Acetate & NaOH (>9)	BP3C-250 mL Plastic NaOH (pH > 12) (Cl-)	WGFU-Wide-mouthed Glass jar Unpreserved	AG1U-1 liter Amber Unpreserved (N/A) (Cl-)	AG1H-1 liter Amber HCl (pH < 2)	AG3U-250 mL Amber Unpreserved (N/A) (Cl-)	AG1S-1 liter Amber H2SO4 (pH < 2)	AG3S-250 mL Amber H2SO4 (pH < 2)	AG3A(DG3A)-250 mL Amber NH4Cl (N/A)(Cl-)	DG9H-40 mL VOA HCl (N/A)	VG9T-40 mL VOA Na2S2O3 (N/A)	VG9U-40 mL VOA Unp (N/A)	DG9P-40 mL VOA H3PO4 (N/A)	VOAK (6 vials per kit)-5035 kit (N/A)	V/GK (3 vials per kit)-VPH/Gas kit (N/A)	SP5T-125 mL Sterile Plastic (N/A – lab)	SP2T-250 mL Sterile Plastic (N/A – lab)	BP MW 1 Liter HNO3	BP3A-250 mL Plastic (NH2)2SO4 (9.3-9.7)	Cubitainer	VSGU-20 mL Scintillation vials (N/A)	GN
1		1	1			2										3								3				
2		1	1			2										3								3				
3																												
4		1	1			2										3								3				
5		1	1			2										3								3				
6																2												
7																												
8																												
9																												
10																												
11																												
12																												

pH Adjustment Log for Preserved Samples

Sample ID	Type of Preservative	pH upon receipt	Date preservation adjusted	Time preservation adjusted	Amount of Preservative added	Lot #

Pace Analytical

CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

Page : 1 Of 1

Section A Required Client Information:		Section B Required Project Information:		Section C Invoice Information:	
Company:	HDR Engineering	Report To:	Sean Quarry	Attention:	
Address:	440 South Church Street	Copy To:		Company Name:	
Charlotte, NC 28202				Address:	Regulatory Agency
Email:	sean.quarry@hdrinc.com	Purchase Order #:		Pace Quote:	
Phone:	(704)248-3632 Fax	Project Name:	Charrah-Brickhaven	Pace Project Manager:	kevin.godwin@pacelabs.com, State / Location
Requested Due Date:		Project #:		Pace Profile #:	7672-1 NC

ITEM #	SAMPLE ID (One Character per box. (A-Z, 0-9 / , -) Sample Ids must be unique)	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED START DATE	COLLECTED START TIME	COLLECTED END DATE	COLLECTED END TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Preservatives: Unpreserved	H2SO4	HNO3	HCl	NaOH	Na2S2O3	Methanol	Other	Analyses Test Y/N	Trip BLANK	8260	300.0-Cl, F, Sulfate	TDS	Radium 226/228	6010/7470	6020 (B, Li)	Residual Chlorine (Y/N)	423835
1	MW-2		X			7/18/17	1645		10	2		5	3						X	3	1	1	3	1	1		001
2	MW-1		X			7/18/17	1250		10	2		5	3							3	1	1	3	1	1		002
3																												
4	EQ BLANK		X			7/18/17	1900		10	2		5	3							3	1	1	3	1	1		003
5	AMB		X			7/18/17	1230		10	2		5	3							3	1	1	3	1	1		004
6																												
7	TRIP BLANK					7/18/17													2								005
8																												
9																												
10																												
11																												
12																												

MATRIX CODE: Drinking Water DW; Water WT; Waste Water WW; Product P; Soil/Solid SL; Oil OL; Wipe WP; Air AR; Other OT; Tissue TS

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	SAMPLE CONDITIONS			
	Jesse Allred PACE	7/18/17	1915		7/19/17	0817				
		7/19/17	1502	Pace HL	7/19/17	1502	3.6	Y	N	Y

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER: JESSE ALLRED

SIGNATURE of SAMPLER: [signature] DATE Signed: 7-18-17

TEMP in C | Received on Ice (Y/N) | Custody Sealed Cooler (Y/N) | Samples Intact (Y/N)

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

August 09, 2017

Sean Quarry
HDR Engineering
440 South Church Street
Suite 1000
Charlotte, NC 28202

RE: Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348512

Dear Sean Quarry:
Enclosed are the analytical results for sample(s) received by the laboratory on July 20, 2017. The results relate only to the samples included in this report. Results reported herein conform to the most current, applicable TNI/NELAC standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Kevin Godwin
kevin.godwin@pacelabs.com
1(704)875-9092
Project Manager

Enclosures

cc: Mike Plummer, HDR

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CERTIFICATIONS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348512

Pennsylvania Certification IDs

1638 Roseytown Rd Suites 2,3&4, Greensburg, PA 15601
L-A-B DOD-ELAP Accreditation #: L2417
Alabama Certification #: 41590
Arizona Certification #: AZ0734
Arkansas Certification
California Certification #: 04222CA
Colorado Certification
Connecticut Certification #: PH-0694
Delaware Certification
Florida/TNI Certification #: E87683
Georgia Certification #: C040
Guam Certification
Hawaii Certification
Idaho Certification
Illinois Certification
Indiana Certification
Iowa Certification #: 391
Kansas/TNI Certification #: E-10358
Kentucky Certification #: 90133
Louisiana DHH/TNI Certification #: LA140008
Louisiana DEQ/TNI Certification #: 4086
Maine Certification #: PA00091
Maryland Certification #: 308
Massachusetts Certification #: M-PA1457
Michigan/PADEP Certification
Missouri Certification #: 235
Montana Certification #: Cert 0082
Nebraska Certification #: NE-05-29-14
Nevada Certification #: PA014572015-1
New Hampshire/TNI Certification #: 2976
New Jersey/TNI Certification #: PA 051
New Mexico Certification #: PA01457
New York/TNI Certification #: 10888
North Carolina Certification #: 42706
North Dakota Certification #: R-190
Oregon/TNI Certification #: PA200002
Pennsylvania/TNI Certification #: 65-00282
Puerto Rico Certification #: PA01457
Rhode Island Certification #: 65-00282
South Dakota Certification
Tennessee Certification #: TN2867
Texas/TNI Certification #: T104704188-14-8
Utah/TNI Certification #: PA014572015-5
USDA Soil Permit #: P330-14-00213
Vermont Dept. of Health: ID# VT-0282
Virgin Island/PADEP Certification
Virginia/VELAP Certification #: 460198
Washington Certification #: C868
West Virginia DEP Certification #: 143
West Virginia DHHR Certification #: 9964C
Wisconsin Certification
Wyoming Certification #: 8TMS-L

Charlotte Certification IDs

9800 Kincey Ave. Ste 100, Huntersville, NC 28078
North Carolina Drinking Water Certification #: 37706
North Carolina Field Services Certification #: 5342
North Carolina Wastewater Certification #: 12
South Carolina Certification #: 99006001
Florida/NELAP Certification #: E87627
Kentucky UST Certification #: 84
Virginia/VELAP Certification #: 460221

Asheville Certification IDs

2225 Riverside Drive, Asheville, NC 28804
Florida/NELAP Certification #: E87648
Massachusetts Certification #: M-NC030
North Carolina Drinking Water Certification #: 37712
North Carolina Wastewater Certification #: 40
South Carolina Certification #: 99030001
Virginia/VELAP Certification #: 460222

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SAMPLE SUMMARY

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348512

Lab ID	Sample ID	Matrix	Date Collected	Date Received
92348512001	**MW-5**	Water	07/19/17 11:30	07/20/17 07:50
92348512002	**MW-6 DUPE**	Water	07/19/17 14:00	07/20/17 07:50
92348512003	**MW-6**	Water	07/19/17 14:00	07/20/17 07:50
92348512004	**MW-3**	Water	07/19/17 17:10	07/20/17 07:50
92348512005	**EQB**	Water	07/19/17 10:00	07/20/17 07:50
92348512006	**AMB**	Water	07/19/17 15:30	07/20/17 07:50
92348512007	**TRIP BLANK**	Water	07/19/17 00:00	07/20/17 07:50

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SAMPLE ANALYTE COUNT

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348512

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
92348512001	**MW-5**	EPA 6010	SH1	16	PASI-A
		EPA 6020B	CDF	3	PASI-A
		EPA 7470	WAB	1	PASI-A
		EPA 8260	ZDO	48	PASI-C
		EPA 903.1	KAC	1	PASI-PA
		EPA 904.0	VAL	1	PASI-PA
		SM 2540C	MVC	1	PASI-A
		EPA 300.0	CDC	3	PASI-A
92348512002	**MW-6 DUPE**	EPA 6010	SH1	16	PASI-A
		EPA 6020B	CDF	3	PASI-A
		EPA 7470	WAB	1	PASI-A
		EPA 8260	ZDO	48	PASI-C
		EPA 903.1	KAC	1	PASI-PA
		EPA 904.0	VAL	1	PASI-PA
		SM 2540C	MVC	1	PASI-A
		EPA 300.0	CDC	3	PASI-A
92348512003	**MW-6**	EPA 6010	SH1	16	PASI-A
		EPA 6020B	CDF	3	PASI-A
		EPA 7470	WAB	1	PASI-A
		EPA 8260	ZDO	48	PASI-C
		EPA 903.1	KAC	1	PASI-PA
		EPA 904.0	VAL	1	PASI-PA
		SM 2540C	MVC	1	PASI-A
		EPA 300.0	CDC	3	PASI-A
92348512004	**MW-3**	EPA 6010	SH1	16	PASI-A
		EPA 6020B	CDF	3	PASI-A
		EPA 7470	WAB	1	PASI-A
		EPA 8260	ZDO	48	PASI-C
		EPA 903.1	KAC	1	PASI-PA
		EPA 904.0	VAL	1	PASI-PA
		SM 2540C	MVC	1	PASI-A
		EPA 300.0	CDC	3	PASI-A
92348512005	**EQB**	EPA 6010	SH1	16	PASI-A
		EPA 6020B	CDF	3	PASI-A
		EPA 7470	KAL	1	PASI-A
		EPA 8260	ZDO	48	PASI-C
		EPA 903.1	KAC	1	PASI-PA

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SAMPLE ANALYTE COUNT

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348512

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
		EPA 904.0	VAL	1	PASI-PA
		SM 2540C	MVC	1	PASI-A
		EPA 300.0	CDC	3	PASI-A
92348512006	**AMB**	EPA 6010	SH1	16	PASI-A
		EPA 6020B	CDF	3	PASI-A
		EPA 7470	KAL	1	PASI-A
		EPA 8260	ZDO	48	PASI-C
		EPA 903.1	KAC	1	PASI-PA
		EPA 904.0	VAL	1	PASI-PA
		SM 2540C	MVC	1	PASI-A
		EPA 300.0	CDC	3	PASI-A
92348512007	**TRIP BLANK**	EPA 8260	ZDO	48	PASI-C

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SUMMARY OF DETECTION

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348512

Lab Sample ID / Method	Client Sample ID / Parameters	Result	Units	Report Limit	Analyzed	Qualifiers
92348512001	**MW-5**					
EPA 6010	Barium	103	ug/L	5.0	07/25/17 21:19	
EPA 6010	Calcium	11400	ug/L	100	07/25/17 21:19	
EPA 6010	Zinc	16.6	ug/L	10.0	07/25/17 21:19	
EPA 6020B	Lithium	9.3	ug/L	2.5	07/21/17 18:31	
EPA 903.1	Radium-226	0.120 ± 0.287 (0.555) C:NA T:91%	pCi/L		08/08/17 23:11	
EPA 904.0	Radium-228	0.369 ± 0.386 (0.796) C:79% T:86%	pCi/L		08/07/17 18:34	
SM 2540C	Total Dissolved Solids	228	mg/L	25.0	07/25/17 20:21	
EPA 300.0	Chloride	19.6	mg/L	1.0	07/22/17 20:31	
EPA 300.0	Fluoride	0.54	mg/L	0.10	07/22/17 20:31	
EPA 300.0	Sulfate	5.6	mg/L	1.0	07/22/17 20:31	
92348512002	**MW-6 DUPE**					
EPA 6010	Barium	95.0	ug/L	5.0	07/25/17 21:22	
EPA 6010	Calcium	37100	ug/L	100	07/25/17 21:22	
EPA 6020B	Lithium	38.1	ug/L	2.5	07/21/17 18:33	
EPA 903.1	Radium-226	0.173 ± 0.264 (0.424) C:NA T:94%	pCi/L		08/08/17 23:11	
EPA 904.0	Radium-228	0.546 ± 0.424 (0.817) C:78% T:83%	pCi/L		08/07/17 19:51	
SM 2540C	Total Dissolved Solids	662	mg/L	25.0	07/25/17 20:21	
EPA 300.0	Chloride	238	mg/L	5.0	07/23/17 17:41	
EPA 300.0	Fluoride	0.46	mg/L	0.10	07/22/17 20:48	
EPA 300.0	Sulfate	75.0	mg/L	1.0	07/22/17 20:48	
92348512003	**MW-6**					
EPA 6010	Barium	98.8	ug/L	5.0	07/25/17 21:25	
EPA 6010	Calcium	35400	ug/L	100	07/25/17 21:25	
EPA 6020B	Lithium	45.3	ug/L	2.5	07/21/17 18:35	
EPA 903.1	Radium-226	0.227 ± 0.274 (0.418) C:NA T:88%	pCi/L		08/08/17 23:18	
EPA 904.0	Radium-228	0.680 ± 0.405 (0.731) C:80% T:86%	pCi/L		08/07/17 18:34	
SM 2540C	Total Dissolved Solids	692	mg/L	50.0	07/25/17 20:22	
EPA 300.0	Chloride	245	mg/L	4.0	07/23/17 16:44	
EPA 300.0	Fluoride	0.37	mg/L	0.10	07/23/17 04:48	

REPORT OF LABORATORY ANALYSIS

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SUMMARY OF DETECTION

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348512

Lab Sample ID / Method	Client Sample ID / Parameters	Result	Units	Report Limit	Analyzed	Qualifiers
92348512003	**MW-6**					
EPA 300.0	Sulfate	86.9	mg/L	1.0	07/23/17 04:48	
92348512004	**MW-3**					
EPA 6010	Barium	496	ug/L	5.0	07/25/17 21:28	
EPA 6010	Calcium	138000	ug/L	1000	07/26/17 15:10	
EPA 6010	Chromium	9.4	ug/L	5.0	07/25/17 21:28	
EPA 6010	Molybdenum	6.1	ug/L	5.0	07/25/17 21:28	
EPA 6020B	Lithium	97.1	ug/L	2.5	07/21/17 18:37	
EPA 903.1	Radium-226	1.19 ± 0.529 (0.154) C:NA T:92%	pCi/L		08/08/17 23:11	
EPA 904.0	Radium-228	2.27 ± 0.664 (0.758) C:78% T:92%	pCi/L		08/07/17 18:34	
SM 2540C	Total Dissolved Solids	1870	mg/L	50.0	07/25/17 20:23	D6
EPA 300.0	Chloride	1010	mg/L	18.0	07/23/17 17:09	
EPA 300.0	Fluoride	0.49	mg/L	0.10	07/23/17 05:06	
EPA 300.0	Sulfate	125	mg/L	18.0	07/23/17 17:09	
92348512005	**EQB**					
EPA 903.1	Radium-226	0.203 ± 0.245 (0.374) C:NA T:94%	pCi/L		08/08/17 23:11	
EPA 904.0	Radium-228	0.258 ± 0.346 (0.739) C:76% T:79%	pCi/L		08/07/17 16:29	
92348512006	**AMB**					
EPA 903.1	Radium-226	-0.112 ± 0.312 (0.736) C:NA T:92%	pCi/L		08/08/17 23:24	
EPA 904.0	Radium-228	0.801 ± 0.385 (0.633) C:77% T:78%	pCi/L		08/07/17 16:29	

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Huntersville, NC 28078
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ANALYTICAL RESULTS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348512

Sample: MW-5 **Lab ID: 92348512001** Collected: 07/19/17 11:30 Received: 07/20/17 07:50 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP	Analytical Method: EPA 6010 Preparation Method: EPA 3010A							
Antimony	ND	ug/L	5.0	1	07/24/17 18:00	07/25/17 21:19	7440-36-0	
Arsenic	ND	ug/L	10.0	1	07/24/17 18:00	07/25/17 21:19	7440-38-2	
Barium	**103**	ug/L	5.0	1	07/24/17 18:00	07/25/17 21:19	7440-39-3	
Beryllium	ND	ug/L	1.0	1	07/24/17 18:00	07/25/17 21:19	7440-41-7	
Cadmium	ND	ug/L	1.0	1	07/24/17 18:00	07/25/17 21:19	7440-43-9	
Calcium	**11400**	ug/L	100	1	07/24/17 18:00	07/25/17 21:19	7440-70-2	
Chromium	ND	ug/L	5.0	1	07/24/17 18:00	07/25/17 21:19	7440-47-3	
Cobalt	ND	ug/L	5.0	1	07/24/17 18:00	07/25/17 21:19	7440-48-4	
Copper	ND	ug/L	5.0	1	07/24/17 18:00	07/25/17 21:19	7440-50-8	
Lead	ND	ug/L	5.0	1	07/24/17 18:00	07/25/17 21:19	7439-92-1	
Molybdenum	ND	ug/L	5.0	1	07/24/17 18:00	07/25/17 21:19	7439-98-7	
Nickel	ND	ug/L	5.0	1	07/24/17 18:00	07/25/17 21:19	7440-02-0	
Selenium	ND	ug/L	10.0	1	07/24/17 18:00	07/25/17 21:19	7782-49-2	
Silver	ND	ug/L	5.0	1	07/24/17 18:00	07/25/17 21:19	7440-22-4	
Vanadium	ND	ug/L	5.0	1	07/24/17 18:00	07/25/17 21:19	7440-62-2	
Zinc	**16.6**	ug/L	10.0	1	07/24/17 18:00	07/25/17 21:19	7440-66-6	
6020 MET ICPMS	Analytical Method: EPA 6020B Preparation Method: EPA 3010A							
Boron	ND	ug/L	25.0	1	07/21/17 03:50	07/25/17 14:57	7440-42-8	
Lithium	**9.3**	ug/L	2.5	1	07/21/17 03:50	07/21/17 18:31	7439-93-2	
Thallium	ND	ug/L	0.10	1	07/21/17 03:50	07/21/17 18:31	7440-28-0	
7470 Mercury	Analytical Method: EPA 7470 Preparation Method: EPA 7470							
Mercury	ND	ug/L	0.20	1	07/21/17 12:27	07/24/17 11:47	7439-97-6	
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
Acetone	ND	ug/L	25.0	1		07/23/17 07:52	67-64-1	M1
Acrylonitrile	ND	ug/L	10.0	1		07/23/17 07:52	107-13-1	M1
Benzene	ND	ug/L	1.0	1		07/23/17 07:52	71-43-2	
Bromochloromethane	ND	ug/L	1.0	1		07/23/17 07:52	74-97-5	
Bromodichloromethane	ND	ug/L	1.0	1		07/23/17 07:52	75-27-4	
Bromoform	ND	ug/L	1.0	1		07/23/17 07:52	75-25-2	
Bromomethane	ND	ug/L	2.0	1		07/23/17 07:52	74-83-9	M1
2-Butanone (MEK)	ND	ug/L	5.0	1		07/23/17 07:52	78-93-3	M1
Carbon disulfide	ND	ug/L	2.0	1		07/23/17 07:52	75-15-0	M1
Carbon tetrachloride	ND	ug/L	1.0	1		07/23/17 07:52	56-23-5	
Chlorobenzene	ND	ug/L	1.0	1		07/23/17 07:52	108-90-7	
Chloroethane	ND	ug/L	1.0	1		07/23/17 07:52	75-00-3	
Chloroform	ND	ug/L	1.0	1		07/23/17 07:52	67-66-3	
Chloromethane	ND	ug/L	1.0	1		07/23/17 07:52	74-87-3	M1
Dibromochloromethane	ND	ug/L	1.0	1		07/23/17 07:52	124-48-1	
Dibromomethane	ND	ug/L	1.0	1		07/23/17 07:52	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	1.0	1		07/23/17 07:52	95-50-1	
1,4-Dichlorobenzene	ND	ug/L	1.0	1		07/23/17 07:52	106-46-7	
trans-1,4-Dichloro-2-butene	ND	ug/L	1.0	1		07/23/17 07:52	110-57-6	
1,1-Dichloroethane	ND	ug/L	1.0	1		07/23/17 07:52	75-34-3	

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Huntersville, NC 28078
(704)875-9092

ANALYTICAL RESULTS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348512

Sample: MW-5 **Lab ID: 92348512001** Collected: 07/19/17 11:30 Received: 07/20/17 07:50 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
1,2-Dichloroethane	ND	ug/L	1.0	1		07/23/17 07:52	107-06-2	
1,1-Dichloroethene	ND	ug/L	1.0	1		07/23/17 07:52	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	1.0	1		07/23/17 07:52	156-59-2	M1
trans-1,2-Dichloroethene	ND	ug/L	1.0	1		07/23/17 07:52	156-60-5	M1
1,2-Dichloropropane	ND	ug/L	1.0	1		07/23/17 07:52	78-87-5	
cis-1,3-Dichloropropene	ND	ug/L	1.0	1		07/23/17 07:52	10061-01-5	
trans-1,3-Dichloropropene	ND	ug/L	1.0	1		07/23/17 07:52	10061-02-6	
Ethylbenzene	ND	ug/L	1.0	1		07/23/17 07:52	100-41-4	
2-Hexanone	ND	ug/L	5.0	1		07/23/17 07:52	591-78-6	M1
Iodomethane	ND	ug/L	5.0	1		07/23/17 07:52	74-88-4	
Methylene Chloride	ND	ug/L	1.0	1		07/23/17 07:52	75-09-2	
4-Methyl-2-pentanone (MIBK)	ND	ug/L	5.0	1		07/23/17 07:52	108-10-1	M1
Styrene	ND	ug/L	1.0	1		07/23/17 07:52	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0	1		07/23/17 07:52	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0	1		07/23/17 07:52	79-34-5	
Tetrachloroethene	ND	ug/L	1.0	1		07/23/17 07:52	127-18-4	
Toluene	ND	ug/L	1.0	1		07/23/17 07:52	108-88-3	
1,1,1-Trichloroethane	ND	ug/L	1.0	1		07/23/17 07:52	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	1.0	1		07/23/17 07:52	79-00-5	
Trichloroethene	ND	ug/L	1.0	1		07/23/17 07:52	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0	1		07/23/17 07:52	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0	1		07/23/17 07:52	96-18-4	
Vinyl acetate	ND	ug/L	2.0	1		07/23/17 07:52	108-05-4	
Vinyl chloride	ND	ug/L	1.0	1		07/23/17 07:52	75-01-4	
Xylene (Total)	ND	ug/L	1.0	1		07/23/17 07:52	1330-20-7	
Surrogates								
4-Bromofluorobenzene (S)	104	%	70-130	1		07/23/17 07:52	460-00-4	
1,2-Dichloroethane-d4 (S)	111	%	70-130	1		07/23/17 07:52	17060-07-0	
Toluene-d8 (S)	106	%	70-130	1		07/23/17 07:52	2037-26-5	
2540C Total Dissolved Solids	Analytical Method: SM 2540C							
Total Dissolved Solids	**228**	mg/L	25.0	1		07/25/17 20:21		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0							
Chloride	**19.6**	mg/L	1.0	1		07/22/17 20:31	16887-00-6	
Fluoride	**0.54**	mg/L	0.10	1		07/22/17 20:31	16984-48-8	
Sulfate	**5.6**	mg/L	1.0	1		07/22/17 20:31	14808-79-8	

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(704)875-9092

ANALYTICAL RESULTS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348512

Sample: MW-6 DUPE **Lab ID: 92348512002** Collected: 07/19/17 14:00 Received: 07/20/17 07:50 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP	Analytical Method: EPA 6010 Preparation Method: EPA 3010A							
Antimony	ND	ug/L	5.0	1	07/24/17 18:00	07/25/17 21:22	7440-36-0	
Arsenic	ND	ug/L	10.0	1	07/24/17 18:00	07/25/17 21:22	7440-38-2	
Barium	**95.0**	ug/L	5.0	1	07/24/17 18:00	07/25/17 21:22	7440-39-3	
Beryllium	ND	ug/L	1.0	1	07/24/17 18:00	07/25/17 21:22	7440-41-7	
Cadmium	ND	ug/L	1.0	1	07/24/17 18:00	07/25/17 21:22	7440-43-9	
Calcium	**37100**	ug/L	100	1	07/24/17 18:00	07/25/17 21:22	7440-70-2	
Chromium	ND	ug/L	5.0	1	07/24/17 18:00	07/25/17 21:22	7440-47-3	
Cobalt	ND	ug/L	5.0	1	07/24/17 18:00	07/25/17 21:22	7440-48-4	
Copper	ND	ug/L	5.0	1	07/24/17 18:00	07/25/17 21:22	7440-50-8	
Lead	ND	ug/L	5.0	1	07/24/17 18:00	07/25/17 21:22	7439-92-1	
Molybdenum	ND	ug/L	5.0	1	07/24/17 18:00	07/25/17 21:22	7439-98-7	
Nickel	ND	ug/L	5.0	1	07/24/17 18:00	07/25/17 21:22	7440-02-0	
Selenium	ND	ug/L	10.0	1	07/24/17 18:00	07/25/17 21:22	7782-49-2	
Silver	ND	ug/L	5.0	1	07/24/17 18:00	07/25/17 21:22	7440-22-4	
Vanadium	ND	ug/L	5.0	1	07/24/17 18:00	07/25/17 21:22	7440-62-2	
Zinc	ND	ug/L	10.0	1	07/24/17 18:00	07/25/17 21:22	7440-66-6	
6020 MET ICPMS	Analytical Method: EPA 6020B Preparation Method: EPA 3010A							
Boron	ND	ug/L	25.0	1	07/21/17 03:50	07/25/17 14:59	7440-42-8	
Lithium	**38.1**	ug/L	2.5	1	07/21/17 03:50	07/21/17 18:33	7439-93-2	
Thallium	ND	ug/L	0.10	1	07/21/17 03:50	07/21/17 18:33	7440-28-0	
7470 Mercury	Analytical Method: EPA 7470 Preparation Method: EPA 7470							
Mercury	ND	ug/L	0.20	1	07/21/17 12:27	07/24/17 11:50	7439-97-6	
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
Acetone	ND	ug/L	25.0	1		07/23/17 08:09	67-64-1	
Acrylonitrile	ND	ug/L	10.0	1		07/23/17 08:09	107-13-1	
Benzene	ND	ug/L	1.0	1		07/23/17 08:09	71-43-2	
Bromochloromethane	ND	ug/L	1.0	1		07/23/17 08:09	74-97-5	
Bromodichloromethane	ND	ug/L	1.0	1		07/23/17 08:09	75-27-4	
Bromoform	ND	ug/L	1.0	1		07/23/17 08:09	75-25-2	
Bromomethane	ND	ug/L	2.0	1		07/23/17 08:09	74-83-9	
2-Butanone (MEK)	ND	ug/L	5.0	1		07/23/17 08:09	78-93-3	
Carbon disulfide	ND	ug/L	2.0	1		07/23/17 08:09	75-15-0	
Carbon tetrachloride	ND	ug/L	1.0	1		07/23/17 08:09	56-23-5	
Chlorobenzene	ND	ug/L	1.0	1		07/23/17 08:09	108-90-7	
Chloroethane	ND	ug/L	1.0	1		07/23/17 08:09	75-00-3	
Chloroform	ND	ug/L	1.0	1		07/23/17 08:09	67-66-3	
Chloromethane	ND	ug/L	1.0	1		07/23/17 08:09	74-87-3	
Dibromochloromethane	ND	ug/L	1.0	1		07/23/17 08:09	124-48-1	
Dibromomethane	ND	ug/L	1.0	1		07/23/17 08:09	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	1.0	1		07/23/17 08:09	95-50-1	
1,4-Dichlorobenzene	ND	ug/L	1.0	1		07/23/17 08:09	106-46-7	
trans-1,4-Dichloro-2-butene	ND	ug/L	1.0	1		07/23/17 08:09	110-57-6	
1,1-Dichloroethane	ND	ug/L	1.0	1		07/23/17 08:09	75-34-3	

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ANALYTICAL RESULTS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348512

Sample: MW-6 DUPE **Lab ID: 92348512002** Collected: 07/19/17 14:00 Received: 07/20/17 07:50 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
1,2-Dichloroethane	ND	ug/L	1.0	1		07/23/17 08:09	107-06-2	
1,1-Dichloroethene	ND	ug/L	1.0	1		07/23/17 08:09	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	1.0	1		07/23/17 08:09	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	1.0	1		07/23/17 08:09	156-60-5	
1,2-Dichloropropane	ND	ug/L	1.0	1		07/23/17 08:09	78-87-5	
cis-1,3-Dichloropropene	ND	ug/L	1.0	1		07/23/17 08:09	10061-01-5	
trans-1,3-Dichloropropene	ND	ug/L	1.0	1		07/23/17 08:09	10061-02-6	
Ethylbenzene	ND	ug/L	1.0	1		07/23/17 08:09	100-41-4	
2-Hexanone	ND	ug/L	5.0	1		07/23/17 08:09	591-78-6	
Iodomethane	ND	ug/L	5.0	1		07/23/17 08:09	74-88-4	
Methylene Chloride	ND	ug/L	1.0	1		07/23/17 08:09	75-09-2	
4-Methyl-2-pentanone (MIBK)	ND	ug/L	5.0	1		07/23/17 08:09	108-10-1	
Styrene	ND	ug/L	1.0	1		07/23/17 08:09	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0	1		07/23/17 08:09	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0	1		07/23/17 08:09	79-34-5	
Tetrachloroethene	ND	ug/L	1.0	1		07/23/17 08:09	127-18-4	
Toluene	ND	ug/L	1.0	1		07/23/17 08:09	108-88-3	
1,1,1-Trichloroethane	ND	ug/L	1.0	1		07/23/17 08:09	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	1.0	1		07/23/17 08:09	79-00-5	
Trichloroethene	ND	ug/L	1.0	1		07/23/17 08:09	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0	1		07/23/17 08:09	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0	1		07/23/17 08:09	96-18-4	
Vinyl acetate	ND	ug/L	2.0	1		07/23/17 08:09	108-05-4	
Vinyl chloride	ND	ug/L	1.0	1		07/23/17 08:09	75-01-4	
Xylene (Total)	ND	ug/L	1.0	1		07/23/17 08:09	1330-20-7	
Surrogates								
4-Bromofluorobenzene (S)	103	%	70-130	1		07/23/17 08:09	460-00-4	
1,2-Dichloroethane-d4 (S)	111	%	70-130	1		07/23/17 08:09	17060-07-0	
Toluene-d8 (S)	107	%	70-130	1		07/23/17 08:09	2037-26-5	
2540C Total Dissolved Solids	Analytical Method: SM 2540C							
Total Dissolved Solids	**662**	mg/L	25.0	1		07/25/17 20:21		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0							
Chloride	**238**	mg/L	5.0	5		07/23/17 17:41	16887-00-6	
Fluoride	**0.46**	mg/L	0.10	1		07/22/17 20:48	16984-48-8	
Sulfate	**75.0**	mg/L	1.0	1		07/22/17 20:48	14808-79-8	

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ANALYTICAL RESULTS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348512

Sample: MW-6 **Lab ID: 92348512003** Collected: 07/19/17 14:00 Received: 07/20/17 07:50 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP	Analytical Method: EPA 6010 Preparation Method: EPA 3010A							
Antimony	ND	ug/L	5.0	1	07/24/17 18:00	07/25/17 21:25	7440-36-0	
Arsenic	ND	ug/L	10.0	1	07/24/17 18:00	07/25/17 21:25	7440-38-2	
Barium	**98.8**	ug/L	5.0	1	07/24/17 18:00	07/25/17 21:25	7440-39-3	
Beryllium	ND	ug/L	1.0	1	07/24/17 18:00	07/25/17 21:25	7440-41-7	
Cadmium	ND	ug/L	1.0	1	07/24/17 18:00	07/25/17 21:25	7440-43-9	
Calcium	**35400**	ug/L	100	1	07/24/17 18:00	07/25/17 21:25	7440-70-2	
Chromium	ND	ug/L	5.0	1	07/24/17 18:00	07/25/17 21:25	7440-47-3	
Cobalt	ND	ug/L	5.0	1	07/24/17 18:00	07/25/17 21:25	7440-48-4	
Copper	ND	ug/L	5.0	1	07/24/17 18:00	07/25/17 21:25	7440-50-8	
Lead	ND	ug/L	5.0	1	07/24/17 18:00	07/25/17 21:25	7439-92-1	
Molybdenum	ND	ug/L	5.0	1	07/24/17 18:00	07/25/17 21:25	7439-98-7	
Nickel	ND	ug/L	5.0	1	07/24/17 18:00	07/25/17 21:25	7440-02-0	
Selenium	ND	ug/L	10.0	1	07/24/17 18:00	07/25/17 21:25	7782-49-2	
Silver	ND	ug/L	5.0	1	07/24/17 18:00	07/25/17 21:25	7440-22-4	
Vanadium	ND	ug/L	5.0	1	07/24/17 18:00	07/25/17 21:25	7440-62-2	
Zinc	ND	ug/L	10.0	1	07/24/17 18:00	07/25/17 21:25	7440-66-6	
6020 MET ICPMS	Analytical Method: EPA 6020B Preparation Method: EPA 3010A							
Boron	ND	ug/L	25.0	1	07/21/17 03:50	07/25/17 15:01	7440-42-8	
Lithium	**45.3**	ug/L	2.5	1	07/21/17 03:50	07/21/17 18:35	7439-93-2	
Thallium	ND	ug/L	0.10	1	07/21/17 03:50	07/21/17 18:35	7440-28-0	
7470 Mercury	Analytical Method: EPA 7470 Preparation Method: EPA 7470							
Mercury	ND	ug/L	0.20	1	07/21/17 12:27	07/24/17 11:52	7439-97-6	
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
Acetone	ND	ug/L	25.0	1		07/23/17 08:44	67-64-1	
Acrylonitrile	ND	ug/L	10.0	1		07/23/17 08:44	107-13-1	
Benzene	ND	ug/L	1.0	1		07/23/17 08:44	71-43-2	
Bromochloromethane	ND	ug/L	1.0	1		07/23/17 08:44	74-97-5	
Bromodichloromethane	ND	ug/L	1.0	1		07/23/17 08:44	75-27-4	
Bromoform	ND	ug/L	1.0	1		07/23/17 08:44	75-25-2	
Bromomethane	ND	ug/L	2.0	1		07/23/17 08:44	74-83-9	
2-Butanone (MEK)	ND	ug/L	5.0	1		07/23/17 08:44	78-93-3	
Carbon disulfide	ND	ug/L	2.0	1		07/23/17 08:44	75-15-0	
Carbon tetrachloride	ND	ug/L	1.0	1		07/23/17 08:44	56-23-5	
Chlorobenzene	ND	ug/L	1.0	1		07/23/17 08:44	108-90-7	
Chloroethane	ND	ug/L	1.0	1		07/23/17 08:44	75-00-3	
Chloroform	ND	ug/L	1.0	1		07/23/17 08:44	67-66-3	
Chloromethane	ND	ug/L	1.0	1		07/23/17 08:44	74-87-3	
Dibromochloromethane	ND	ug/L	1.0	1		07/23/17 08:44	124-48-1	
Dibromomethane	ND	ug/L	1.0	1		07/23/17 08:44	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	1.0	1		07/23/17 08:44	95-50-1	
1,4-Dichlorobenzene	ND	ug/L	1.0	1		07/23/17 08:44	106-46-7	
trans-1,4-Dichloro-2-butene	ND	ug/L	1.0	1		07/23/17 08:44	110-57-6	
1,1-Dichloroethane	ND	ug/L	1.0	1		07/23/17 08:44	75-34-3	

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ANALYTICAL RESULTS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348512

Sample: MW-6 **Lab ID: 92348512003** Collected: 07/19/17 14:00 Received: 07/20/17 07:50 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
1,2-Dichloroethane	ND	ug/L	1.0	1		07/23/17 08:44	107-06-2	
1,1-Dichloroethene	ND	ug/L	1.0	1		07/23/17 08:44	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	1.0	1		07/23/17 08:44	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	1.0	1		07/23/17 08:44	156-60-5	
1,2-Dichloropropane	ND	ug/L	1.0	1		07/23/17 08:44	78-87-5	
cis-1,3-Dichloropropene	ND	ug/L	1.0	1		07/23/17 08:44	10061-01-5	
trans-1,3-Dichloropropene	ND	ug/L	1.0	1		07/23/17 08:44	10061-02-6	
Ethylbenzene	ND	ug/L	1.0	1		07/23/17 08:44	100-41-4	
2-Hexanone	ND	ug/L	5.0	1		07/23/17 08:44	591-78-6	
Iodomethane	ND	ug/L	5.0	1		07/23/17 08:44	74-88-4	
Methylene Chloride	ND	ug/L	1.0	1		07/23/17 08:44	75-09-2	
4-Methyl-2-pentanone (MIBK)	ND	ug/L	5.0	1		07/23/17 08:44	108-10-1	
Styrene	ND	ug/L	1.0	1		07/23/17 08:44	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0	1		07/23/17 08:44	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0	1		07/23/17 08:44	79-34-5	
Tetrachloroethene	ND	ug/L	1.0	1		07/23/17 08:44	127-18-4	
Toluene	ND	ug/L	1.0	1		07/23/17 08:44	108-88-3	
1,1,1-Trichloroethane	ND	ug/L	1.0	1		07/23/17 08:44	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	1.0	1		07/23/17 08:44	79-00-5	
Trichloroethene	ND	ug/L	1.0	1		07/23/17 08:44	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0	1		07/23/17 08:44	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0	1		07/23/17 08:44	96-18-4	
Vinyl acetate	ND	ug/L	2.0	1		07/23/17 08:44	108-05-4	
Vinyl chloride	ND	ug/L	1.0	1		07/23/17 08:44	75-01-4	
Xylene (Total)	ND	ug/L	1.0	1		07/23/17 08:44	1330-20-7	
Surrogates								
4-Bromofluorobenzene (S)	104	%	70-130	1		07/23/17 08:44	460-00-4	
1,2-Dichloroethane-d4 (S)	112	%	70-130	1		07/23/17 08:44	17060-07-0	
Toluene-d8 (S)	106	%	70-130	1		07/23/17 08:44	2037-26-5	
2540C Total Dissolved Solids	Analytical Method: SM 2540C							
Total Dissolved Solids	**692**	mg/L	50.0	1		07/25/17 20:22		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0							
Chloride	**245**	mg/L	4.0	4		07/23/17 16:44	16887-00-6	
Fluoride	**0.37**	mg/L	0.10	1		07/23/17 04:48	16984-48-8	
Sulfate	**86.9**	mg/L	1.0	1		07/23/17 04:48	14808-79-8	

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(704)875-9092

ANALYTICAL RESULTS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348512

Sample: MW-3 **Lab ID: 92348512004** Collected: 07/19/17 17:10 Received: 07/20/17 07:50 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP	Analytical Method: EPA 6010 Preparation Method: EPA 3010A							
Antimony	ND	ug/L	5.0	1	07/24/17 18:00	07/25/17 21:28	7440-36-0	
Arsenic	ND	ug/L	10.0	1	07/24/17 18:00	07/25/17 21:28	7440-38-2	
Barium	**496**	ug/L	5.0	1	07/24/17 18:00	07/25/17 21:28	7440-39-3	
Beryllium	ND	ug/L	1.0	1	07/24/17 18:00	07/25/17 21:28	7440-41-7	
Cadmium	ND	ug/L	1.0	1	07/24/17 18:00	07/25/17 21:28	7440-43-9	
Calcium	**138000**	ug/L	1000	10	07/24/17 18:00	07/26/17 15:10	7440-70-2	
Chromium	**9.4**	ug/L	5.0	1	07/24/17 18:00	07/25/17 21:28	7440-47-3	
Cobalt	ND	ug/L	5.0	1	07/24/17 18:00	07/25/17 21:28	7440-48-4	
Copper	ND	ug/L	5.0	1	07/24/17 18:00	07/25/17 21:28	7440-50-8	
Lead	ND	ug/L	5.0	1	07/24/17 18:00	07/25/17 21:28	7439-92-1	
Molybdenum	**6.1**	ug/L	5.0	1	07/24/17 18:00	07/25/17 21:28	7439-98-7	
Nickel	ND	ug/L	5.0	1	07/24/17 18:00	07/25/17 21:28	7440-02-0	
Selenium	ND	ug/L	10.0	1	07/24/17 18:00	07/25/17 21:28	7782-49-2	
Silver	ND	ug/L	5.0	1	07/24/17 18:00	07/25/17 21:28	7440-22-4	
Vanadium	ND	ug/L	5.0	1	07/24/17 18:00	07/25/17 21:28	7440-62-2	
Zinc	ND	ug/L	10.0	1	07/24/17 18:00	07/25/17 21:28	7440-66-6	
6020 MET ICPMS	Analytical Method: EPA 6020B Preparation Method: EPA 3010A							
Boron	ND	ug/L	25.0	1	07/21/17 03:50	07/25/17 15:03	7440-42-8	
Lithium	**97.1**	ug/L	2.5	1	07/21/17 03:50	07/21/17 18:37	7439-93-2	
Thallium	ND	ug/L	0.10	1	07/21/17 03:50	07/21/17 18:37	7440-28-0	
7470 Mercury	Analytical Method: EPA 7470 Preparation Method: EPA 7470							
Mercury	ND	ug/L	0.20	1	07/21/17 12:27	07/24/17 11:55	7439-97-6	
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
Acetone	ND	ug/L	25.0	1		07/23/17 09:02	67-64-1	
Acrylonitrile	ND	ug/L	10.0	1		07/23/17 09:02	107-13-1	
Benzene	ND	ug/L	1.0	1		07/23/17 09:02	71-43-2	
Bromochloromethane	ND	ug/L	1.0	1		07/23/17 09:02	74-97-5	
Bromodichloromethane	ND	ug/L	1.0	1		07/23/17 09:02	75-27-4	
Bromoform	ND	ug/L	1.0	1		07/23/17 09:02	75-25-2	
Bromomethane	ND	ug/L	2.0	1		07/23/17 09:02	74-83-9	
2-Butanone (MEK)	ND	ug/L	5.0	1		07/23/17 09:02	78-93-3	
Carbon disulfide	ND	ug/L	2.0	1		07/23/17 09:02	75-15-0	
Carbon tetrachloride	ND	ug/L	1.0	1		07/23/17 09:02	56-23-5	
Chlorobenzene	ND	ug/L	1.0	1		07/23/17 09:02	108-90-7	
Chloroethane	ND	ug/L	1.0	1		07/23/17 09:02	75-00-3	
Chloroform	ND	ug/L	1.0	1		07/23/17 09:02	67-66-3	
Chloromethane	ND	ug/L	1.0	1		07/23/17 09:02	74-87-3	
Dibromochloromethane	ND	ug/L	1.0	1		07/23/17 09:02	124-48-1	
Dibromomethane	ND	ug/L	1.0	1		07/23/17 09:02	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	1.0	1		07/23/17 09:02	95-50-1	
1,4-Dichlorobenzene	ND	ug/L	1.0	1		07/23/17 09:02	106-46-7	
trans-1,4-Dichloro-2-butene	ND	ug/L	1.0	1		07/23/17 09:02	110-57-6	
1,1-Dichloroethane	ND	ug/L	1.0	1		07/23/17 09:02	75-34-3	

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ANALYTICAL RESULTS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348512

Sample: MW-3 **Lab ID: 92348512004** Collected: 07/19/17 17:10 Received: 07/20/17 07:50 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
1,2-Dichloroethane	ND	ug/L	1.0	1		07/23/17 09:02	107-06-2	
1,1-Dichloroethene	ND	ug/L	1.0	1		07/23/17 09:02	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	1.0	1		07/23/17 09:02	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	1.0	1		07/23/17 09:02	156-60-5	
1,2-Dichloropropane	ND	ug/L	1.0	1		07/23/17 09:02	78-87-5	
cis-1,3-Dichloropropene	ND	ug/L	1.0	1		07/23/17 09:02	10061-01-5	
trans-1,3-Dichloropropene	ND	ug/L	1.0	1		07/23/17 09:02	10061-02-6	
Ethylbenzene	ND	ug/L	1.0	1		07/23/17 09:02	100-41-4	
2-Hexanone	ND	ug/L	5.0	1		07/23/17 09:02	591-78-6	
Iodomethane	ND	ug/L	5.0	1		07/23/17 09:02	74-88-4	
Methylene Chloride	ND	ug/L	1.0	1		07/23/17 09:02	75-09-2	
4-Methyl-2-pentanone (MIBK)	ND	ug/L	5.0	1		07/23/17 09:02	108-10-1	
Styrene	ND	ug/L	1.0	1		07/23/17 09:02	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0	1		07/23/17 09:02	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0	1		07/23/17 09:02	79-34-5	
Tetrachloroethene	ND	ug/L	1.0	1		07/23/17 09:02	127-18-4	
Toluene	ND	ug/L	1.0	1		07/23/17 09:02	108-88-3	
1,1,1-Trichloroethane	ND	ug/L	1.0	1		07/23/17 09:02	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	1.0	1		07/23/17 09:02	79-00-5	
Trichloroethene	ND	ug/L	1.0	1		07/23/17 09:02	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0	1		07/23/17 09:02	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0	1		07/23/17 09:02	96-18-4	
Vinyl acetate	ND	ug/L	2.0	1		07/23/17 09:02	108-05-4	
Vinyl chloride	ND	ug/L	1.0	1		07/23/17 09:02	75-01-4	
Xylene (Total)	ND	ug/L	1.0	1		07/23/17 09:02	1330-20-7	
Surrogates								
4-Bromofluorobenzene (S)	105	%	70-130	1		07/23/17 09:02	460-00-4	
1,2-Dichloroethane-d4 (S)	111	%	70-130	1		07/23/17 09:02	17060-07-0	
Toluene-d8 (S)	108	%	70-130	1		07/23/17 09:02	2037-26-5	
2540C Total Dissolved Solids	Analytical Method: SM 2540C							
Total Dissolved Solids	**1870**	mg/L	50.0	1		07/25/17 20:23		D6
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0							
Chloride	**1010**	mg/L	18.0	18		07/23/17 17:09	16887-00-6	
Fluoride	**0.49**	mg/L	0.10	1		07/23/17 05:06	16984-48-8	
Sulfate	**125**	mg/L	18.0	18		07/23/17 17:09	14808-79-8	

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ANALYTICAL RESULTS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348512

Sample: EQB **Lab ID: 92348512005** Collected: 07/19/17 10:00 Received: 07/20/17 07:50 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP	Analytical Method: EPA 6010 Preparation Method: EPA 3010A							
Antimony	ND	ug/L	5.0	1	07/24/17 18:00	07/25/17 21:32	7440-36-0	
Arsenic	ND	ug/L	10.0	1	07/24/17 18:00	07/25/17 21:32	7440-38-2	
Barium	ND	ug/L	5.0	1	07/24/17 18:00	07/25/17 21:32	7440-39-3	
Beryllium	ND	ug/L	1.0	1	07/24/17 18:00	07/25/17 21:32	7440-41-7	
Cadmium	ND	ug/L	1.0	1	07/24/17 18:00	07/25/17 21:32	7440-43-9	
Calcium	ND	ug/L	100	1	07/24/17 18:00	07/25/17 21:32	7440-70-2	
Chromium	ND	ug/L	5.0	1	07/24/17 18:00	07/25/17 21:32	7440-47-3	
Cobalt	ND	ug/L	5.0	1	07/24/17 18:00	07/25/17 21:32	7440-48-4	
Copper	ND	ug/L	5.0	1	07/24/17 18:00	07/25/17 21:32	7440-50-8	
Lead	ND	ug/L	5.0	1	07/24/17 18:00	07/25/17 21:32	7439-92-1	
Molybdenum	ND	ug/L	5.0	1	07/24/17 18:00	07/25/17 21:32	7439-98-7	
Nickel	ND	ug/L	5.0	1	07/24/17 18:00	07/25/17 21:32	7440-02-0	
Selenium	ND	ug/L	10.0	1	07/24/17 18:00	07/25/17 21:32	7782-49-2	
Silver	ND	ug/L	5.0	1	07/24/17 18:00	07/25/17 21:32	7440-22-4	
Vanadium	ND	ug/L	5.0	1	07/24/17 18:00	07/25/17 21:32	7440-62-2	
Zinc	ND	ug/L	10.0	1	07/24/17 18:00	07/25/17 21:32	7440-66-6	
6020 MET ICPMS	Analytical Method: EPA 6020B Preparation Method: EPA 3010A							
Boron	ND	ug/L	25.0	1	07/21/17 03:50	07/25/17 15:05	7440-42-8	
Lithium	ND	ug/L	2.5	1	07/21/17 03:50	07/21/17 18:39	7439-93-2	
Thallium	ND	ug/L	0.10	1	07/21/17 03:50	07/21/17 18:39	7440-28-0	
7470 Mercury	Analytical Method: EPA 7470 Preparation Method: EPA 7470							
Mercury	ND	ug/L	0.20	1	07/24/17 17:10	07/25/17 03:15	7439-97-6	
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
Acetone	ND	ug/L	25.0	1		07/23/17 09:19	67-64-1	
Acrylonitrile	ND	ug/L	10.0	1		07/23/17 09:19	107-13-1	
Benzene	ND	ug/L	1.0	1		07/23/17 09:19	71-43-2	
Bromochloromethane	ND	ug/L	1.0	1		07/23/17 09:19	74-97-5	
Bromodichloromethane	ND	ug/L	1.0	1		07/23/17 09:19	75-27-4	
Bromoform	ND	ug/L	1.0	1		07/23/17 09:19	75-25-2	
Bromomethane	ND	ug/L	2.0	1		07/23/17 09:19	74-83-9	
2-Butanone (MEK)	ND	ug/L	5.0	1		07/23/17 09:19	78-93-3	
Carbon disulfide	ND	ug/L	2.0	1		07/23/17 09:19	75-15-0	
Carbon tetrachloride	ND	ug/L	1.0	1		07/23/17 09:19	56-23-5	
Chlorobenzene	ND	ug/L	1.0	1		07/23/17 09:19	108-90-7	
Chloroethane	ND	ug/L	1.0	1		07/23/17 09:19	75-00-3	
Chloroform	ND	ug/L	1.0	1		07/23/17 09:19	67-66-3	
Chloromethane	ND	ug/L	1.0	1		07/23/17 09:19	74-87-3	
Dibromochloromethane	ND	ug/L	1.0	1		07/23/17 09:19	124-48-1	
Dibromomethane	ND	ug/L	1.0	1		07/23/17 09:19	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	1.0	1		07/23/17 09:19	95-50-1	
1,4-Dichlorobenzene	ND	ug/L	1.0	1		07/23/17 09:19	106-46-7	
trans-1,4-Dichloro-2-butene	ND	ug/L	1.0	1		07/23/17 09:19	110-57-6	
1,1-Dichloroethane	ND	ug/L	1.0	1		07/23/17 09:19	75-34-3	

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ANALYTICAL RESULTS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348512

Sample: EQB **Lab ID: 92348512005** Collected: 07/19/17 10:00 Received: 07/20/17 07:50 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
1,2-Dichloroethane	ND	ug/L	1.0	1		07/23/17 09:19	107-06-2	
1,1-Dichloroethene	ND	ug/L	1.0	1		07/23/17 09:19	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	1.0	1		07/23/17 09:19	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	1.0	1		07/23/17 09:19	156-60-5	
1,2-Dichloropropane	ND	ug/L	1.0	1		07/23/17 09:19	78-87-5	
cis-1,3-Dichloropropene	ND	ug/L	1.0	1		07/23/17 09:19	10061-01-5	
trans-1,3-Dichloropropene	ND	ug/L	1.0	1		07/23/17 09:19	10061-02-6	
Ethylbenzene	ND	ug/L	1.0	1		07/23/17 09:19	100-41-4	
2-Hexanone	ND	ug/L	5.0	1		07/23/17 09:19	591-78-6	
Iodomethane	ND	ug/L	5.0	1		07/23/17 09:19	74-88-4	
Methylene Chloride	ND	ug/L	1.0	1		07/23/17 09:19	75-09-2	
4-Methyl-2-pentanone (MIBK)	ND	ug/L	5.0	1		07/23/17 09:19	108-10-1	
Styrene	ND	ug/L	1.0	1		07/23/17 09:19	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0	1		07/23/17 09:19	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0	1		07/23/17 09:19	79-34-5	
Tetrachloroethene	ND	ug/L	1.0	1		07/23/17 09:19	127-18-4	
Toluene	ND	ug/L	1.0	1		07/23/17 09:19	108-88-3	
1,1,1-Trichloroethane	ND	ug/L	1.0	1		07/23/17 09:19	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	1.0	1		07/23/17 09:19	79-00-5	
Trichloroethene	ND	ug/L	1.0	1		07/23/17 09:19	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0	1		07/23/17 09:19	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0	1		07/23/17 09:19	96-18-4	
Vinyl acetate	ND	ug/L	2.0	1		07/23/17 09:19	108-05-4	
Vinyl chloride	ND	ug/L	1.0	1		07/23/17 09:19	75-01-4	
Xylene (Total)	ND	ug/L	1.0	1		07/23/17 09:19	1330-20-7	
Surrogates								
4-Bromofluorobenzene (S)	104	%	70-130	1		07/23/17 09:19	460-00-4	
1,2-Dichloroethane-d4 (S)	116	%	70-130	1		07/23/17 09:19	17060-07-0	
Toluene-d8 (S)	107	%	70-130	1		07/23/17 09:19	2037-26-5	
2540C Total Dissolved Solids	Analytical Method: SM 2540C							
Total Dissolved Solids	ND	mg/L	25.0	1		07/25/17 20:25		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0							
Chloride	ND	mg/L	1.0	1		07/23/17 05:24	16887-00-6	
Fluoride	ND	mg/L	0.10	1		07/23/17 05:24	16984-48-8	
Sulfate	ND	mg/L	1.0	1		07/23/17 05:24	14808-79-8	

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ANALYTICAL RESULTS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348512

Sample: AMB **Lab ID: 92348512006** Collected: 07/19/17 15:30 Received: 07/20/17 07:50 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP	Analytical Method: EPA 6010 Preparation Method: EPA 3010A							
Antimony	ND	ug/L	5.0	1	07/24/17 18:00	07/25/17 21:35	7440-36-0	
Arsenic	ND	ug/L	10.0	1	07/24/17 18:00	07/25/17 21:35	7440-38-2	
Barium	ND	ug/L	5.0	1	07/24/17 18:00	07/25/17 21:35	7440-39-3	
Beryllium	ND	ug/L	1.0	1	07/24/17 18:00	07/25/17 21:35	7440-41-7	
Cadmium	ND	ug/L	1.0	1	07/24/17 18:00	07/25/17 21:35	7440-43-9	
Calcium	ND	ug/L	100	1	07/24/17 18:00	07/25/17 21:35	7440-70-2	
Chromium	ND	ug/L	5.0	1	07/24/17 18:00	07/25/17 21:35	7440-47-3	
Cobalt	ND	ug/L	5.0	1	07/24/17 18:00	07/25/17 21:35	7440-48-4	
Copper	ND	ug/L	5.0	1	07/24/17 18:00	07/25/17 21:35	7440-50-8	
Lead	ND	ug/L	5.0	1	07/24/17 18:00	07/25/17 21:35	7439-92-1	
Molybdenum	ND	ug/L	5.0	1	07/24/17 18:00	07/25/17 21:35	7439-98-7	
Nickel	ND	ug/L	5.0	1	07/24/17 18:00	07/25/17 21:35	7440-02-0	
Selenium	ND	ug/L	10.0	1	07/24/17 18:00	07/25/17 21:35	7782-49-2	
Silver	ND	ug/L	5.0	1	07/24/17 18:00	07/25/17 21:35	7440-22-4	
Vanadium	ND	ug/L	5.0	1	07/24/17 18:00	07/25/17 21:35	7440-62-2	
Zinc	ND	ug/L	10.0	1	07/24/17 18:00	07/25/17 21:35	7440-66-6	
6020 MET ICPMS	Analytical Method: EPA 6020B Preparation Method: EPA 3010A							
Boron	ND	ug/L	25.0	1	07/21/17 03:50	07/25/17 15:07	7440-42-8	
Lithium	ND	ug/L	2.5	1	07/21/17 03:50	07/21/17 18:41	7439-93-2	
Thallium	ND	ug/L	0.10	1	07/21/17 03:50	07/21/17 18:41	7440-28-0	
7470 Mercury	Analytical Method: EPA 7470 Preparation Method: EPA 7470							
Mercury	ND	ug/L	0.20	1	07/24/17 17:10	07/25/17 03:22	7439-97-6	
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
Acetone	ND	ug/L	25.0	1		07/23/17 09:36	67-64-1	
Acrylonitrile	ND	ug/L	10.0	1		07/23/17 09:36	107-13-1	
Benzene	ND	ug/L	1.0	1		07/23/17 09:36	71-43-2	
Bromochloromethane	ND	ug/L	1.0	1		07/23/17 09:36	74-97-5	
Bromodichloromethane	ND	ug/L	1.0	1		07/23/17 09:36	75-27-4	
Bromoform	ND	ug/L	1.0	1		07/23/17 09:36	75-25-2	
Bromomethane	ND	ug/L	2.0	1		07/23/17 09:36	74-83-9	
2-Butanone (MEK)	ND	ug/L	5.0	1		07/23/17 09:36	78-93-3	
Carbon disulfide	ND	ug/L	2.0	1		07/23/17 09:36	75-15-0	
Carbon tetrachloride	ND	ug/L	1.0	1		07/23/17 09:36	56-23-5	
Chlorobenzene	ND	ug/L	1.0	1		07/23/17 09:36	108-90-7	
Chloroethane	ND	ug/L	1.0	1		07/23/17 09:36	75-00-3	
Chloroform	ND	ug/L	1.0	1		07/23/17 09:36	67-66-3	
Chloromethane	ND	ug/L	1.0	1		07/23/17 09:36	74-87-3	
Dibromochloromethane	ND	ug/L	1.0	1		07/23/17 09:36	124-48-1	
Dibromomethane	ND	ug/L	1.0	1		07/23/17 09:36	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	1.0	1		07/23/17 09:36	95-50-1	
1,4-Dichlorobenzene	ND	ug/L	1.0	1		07/23/17 09:36	106-46-7	
trans-1,4-Dichloro-2-butene	ND	ug/L	1.0	1		07/23/17 09:36	110-57-6	
1,1-Dichloroethane	ND	ug/L	1.0	1		07/23/17 09:36	75-34-3	

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(704)875-9092

ANALYTICAL RESULTS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348512

Sample: AMB **Lab ID: 92348512006** Collected: 07/19/17 15:30 Received: 07/20/17 07:50 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
1,2-Dichloroethane	ND	ug/L	1.0	1		07/23/17 09:36	107-06-2	
1,1-Dichloroethene	ND	ug/L	1.0	1		07/23/17 09:36	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	1.0	1		07/23/17 09:36	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	1.0	1		07/23/17 09:36	156-60-5	
1,2-Dichloropropane	ND	ug/L	1.0	1		07/23/17 09:36	78-87-5	
cis-1,3-Dichloropropene	ND	ug/L	1.0	1		07/23/17 09:36	10061-01-5	
trans-1,3-Dichloropropene	ND	ug/L	1.0	1		07/23/17 09:36	10061-02-6	
Ethylbenzene	ND	ug/L	1.0	1		07/23/17 09:36	100-41-4	
2-Hexanone	ND	ug/L	5.0	1		07/23/17 09:36	591-78-6	
Iodomethane	ND	ug/L	5.0	1		07/23/17 09:36	74-88-4	
Methylene Chloride	ND	ug/L	1.0	1		07/23/17 09:36	75-09-2	
4-Methyl-2-pentanone (MIBK)	ND	ug/L	5.0	1		07/23/17 09:36	108-10-1	
Styrene	ND	ug/L	1.0	1		07/23/17 09:36	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0	1		07/23/17 09:36	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0	1		07/23/17 09:36	79-34-5	
Tetrachloroethene	ND	ug/L	1.0	1		07/23/17 09:36	127-18-4	
Toluene	ND	ug/L	1.0	1		07/23/17 09:36	108-88-3	
1,1,1-Trichloroethane	ND	ug/L	1.0	1		07/23/17 09:36	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	1.0	1		07/23/17 09:36	79-00-5	
Trichloroethene	ND	ug/L	1.0	1		07/23/17 09:36	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0	1		07/23/17 09:36	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0	1		07/23/17 09:36	96-18-4	
Vinyl acetate	ND	ug/L	2.0	1		07/23/17 09:36	108-05-4	
Vinyl chloride	ND	ug/L	1.0	1		07/23/17 09:36	75-01-4	
Xylene (Total)	ND	ug/L	1.0	1		07/23/17 09:36	1330-20-7	
Surrogates								
4-Bromofluorobenzene (S)	104	%	70-130	1		07/23/17 09:36	460-00-4	
1,2-Dichloroethane-d4 (S)	111	%	70-130	1		07/23/17 09:36	17060-07-0	
Toluene-d8 (S)	106	%	70-130	1		07/23/17 09:36	2037-26-5	
2540C Total Dissolved Solids	Analytical Method: SM 2540C							
Total Dissolved Solids	ND	mg/L	25.0	1		07/25/17 20:25		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0							
Chloride	ND	mg/L	1.0	1		07/23/17 05:42	16887-00-6	
Fluoride	ND	mg/L	0.10	1		07/23/17 05:42	16984-48-8	
Sulfate	ND	mg/L	1.0	1		07/23/17 05:42	14808-79-8	

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ANALYTICAL RESULTS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348512

Sample: TRIP BLANK **Lab ID: 92348512007** Collected: 07/19/17 00:00 Received: 07/20/17 07:50 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
Acetone	ND	ug/L	25.0	1		07/23/17 09:54	67-64-1	
Acrylonitrile	ND	ug/L	10.0	1		07/23/17 09:54	107-13-1	
Benzene	ND	ug/L	1.0	1		07/23/17 09:54	71-43-2	
Bromochloromethane	ND	ug/L	1.0	1		07/23/17 09:54	74-97-5	
Bromodichloromethane	ND	ug/L	1.0	1		07/23/17 09:54	75-27-4	
Bromoform	ND	ug/L	1.0	1		07/23/17 09:54	75-25-2	
Bromomethane	ND	ug/L	2.0	1		07/23/17 09:54	74-83-9	
2-Butanone (MEK)	ND	ug/L	5.0	1		07/23/17 09:54	78-93-3	
Carbon disulfide	ND	ug/L	2.0	1		07/23/17 09:54	75-15-0	
Carbon tetrachloride	ND	ug/L	1.0	1		07/23/17 09:54	56-23-5	
Chlorobenzene	ND	ug/L	1.0	1		07/23/17 09:54	108-90-7	
Chloroethane	ND	ug/L	1.0	1		07/23/17 09:54	75-00-3	
Chloroform	ND	ug/L	1.0	1		07/23/17 09:54	67-66-3	
Chloromethane	ND	ug/L	1.0	1		07/23/17 09:54	74-87-3	
Dibromochloromethane	ND	ug/L	1.0	1		07/23/17 09:54	124-48-1	
Dibromomethane	ND	ug/L	1.0	1		07/23/17 09:54	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	1.0	1		07/23/17 09:54	95-50-1	
1,4-Dichlorobenzene	ND	ug/L	1.0	1		07/23/17 09:54	106-46-7	
trans-1,4-Dichloro-2-butene	ND	ug/L	1.0	1		07/23/17 09:54	110-57-6	
1,1-Dichloroethane	ND	ug/L	1.0	1		07/23/17 09:54	75-34-3	
1,2-Dichloroethane	ND	ug/L	1.0	1		07/23/17 09:54	107-06-2	
1,1-Dichloroethene	ND	ug/L	1.0	1		07/23/17 09:54	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	1.0	1		07/23/17 09:54	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	1.0	1		07/23/17 09:54	156-60-5	
1,2-Dichloropropane	ND	ug/L	1.0	1		07/23/17 09:54	78-87-5	
cis-1,3-Dichloropropene	ND	ug/L	1.0	1		07/23/17 09:54	10061-01-5	
trans-1,3-Dichloropropene	ND	ug/L	1.0	1		07/23/17 09:54	10061-02-6	
Ethylbenzene	ND	ug/L	1.0	1		07/23/17 09:54	100-41-4	
2-Hexanone	ND	ug/L	5.0	1		07/23/17 09:54	591-78-6	
Iodomethane	ND	ug/L	5.0	1		07/23/17 09:54	74-88-4	
Methylene Chloride	ND	ug/L	1.0	1		07/23/17 09:54	75-09-2	
4-Methyl-2-pentanone (MIBK)	ND	ug/L	5.0	1		07/23/17 09:54	108-10-1	
Styrene	ND	ug/L	1.0	1		07/23/17 09:54	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0	1		07/23/17 09:54	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0	1		07/23/17 09:54	79-34-5	
Tetrachloroethene	ND	ug/L	1.0	1		07/23/17 09:54	127-18-4	
Toluene	ND	ug/L	1.0	1		07/23/17 09:54	108-88-3	
1,1,1-Trichloroethane	ND	ug/L	1.0	1		07/23/17 09:54	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	1.0	1		07/23/17 09:54	79-00-5	
Trichloroethene	ND	ug/L	1.0	1		07/23/17 09:54	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0	1		07/23/17 09:54	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0	1		07/23/17 09:54	96-18-4	
Vinyl acetate	ND	ug/L	2.0	1		07/23/17 09:54	108-05-4	
Vinyl chloride	ND	ug/L	1.0	1		07/23/17 09:54	75-01-4	
Xylene (Total)	ND	ug/L	1.0	1		07/23/17 09:54	1330-20-7	
Surrogates								
4-Bromofluorobenzene (S)	104	%	70-130	1		07/23/17 09:54	460-00-4	

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ANALYTICAL RESULTS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348512

Sample: TRIP BLANK **Lab ID: 92348512007** Collected: 07/19/17 00:00 Received: 07/20/17 07:50 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
Surrogates								
1,2-Dichloroethane-d4 (S)	117	%	70-130	1		07/23/17 09:54	17060-07-0	
Toluene-d8 (S)	105	%	70-130	1		07/23/17 09:54	2037-26-5	

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QUALITY CONTROL DATA

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348512

QC Batch: 370008 Analysis Method: EPA 7470
QC Batch Method: EPA 7470 Analysis Description: 7470 Mercury
Associated Lab Samples: 92348512001, 92348512002, 92348512003, 92348512004

METHOD BLANK: 2050248 Matrix: Water
Associated Lab Samples: 92348512001, 92348512002, 92348512003, 92348512004

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Mercury	ug/L	ND	0.20	07/24/17 10:45	

LABORATORY CONTROL SAMPLE: 2050249

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Mercury	ug/L	2.5	2.6	102	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2050250 2050251

Parameter	Units	92348397001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Mercury	ug/L	ND	2.5	2.5	2.6	2.6	100	100	75-125	0	25	

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QUALITY CONTROL DATA

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348512

QC Batch: 370296 Analysis Method: EPA 7470
QC Batch Method: EPA 7470 Analysis Description: 7470 Mercury
Associated Lab Samples: 92348512005, 92348512006

METHOD BLANK: 2051778 Matrix: Water
Associated Lab Samples: 92348512005, 92348512006

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Mercury	ug/L	ND	0.20	07/25/17 03:11	

LABORATORY CONTROL SAMPLE: 2051779

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Mercury	ug/L	2.5	2.6	104	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2051780 2051781

Parameter	Units	92348512005 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Mercury	ug/L	ND	2.5	2.5	2.6	2.6	103	102	75-125	1	25	

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QUALITY CONTROL DATA

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348512

QC Batch: 370164 Analysis Method: EPA 6010
QC Batch Method: EPA 3010A Analysis Description: 6010 MET
Associated Lab Samples: 92348512001, 92348512002, 92348512003, 92348512004, 92348512005, 92348512006

METHOD BLANK: 2051142 Matrix: Water
Associated Lab Samples: 92348512001, 92348512002, 92348512003, 92348512004, 92348512005, 92348512006

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Antimony	ug/L	ND	5.0	07/25/17 19:56	
Arsenic	ug/L	ND	10.0	07/26/17 14:29	
Barium	ug/L	ND	5.0	07/25/17 19:56	
Beryllium	ug/L	ND	1.0	07/25/17 19:56	
Cadmium	ug/L	ND	1.0	07/25/17 19:56	
Calcium	ug/L	ND	100	07/25/17 19:56	
Chromium	ug/L	ND	5.0	07/25/17 19:56	
Cobalt	ug/L	ND	5.0	07/25/17 19:56	
Copper	ug/L	ND	5.0	07/25/17 19:56	
Lead	ug/L	ND	5.0	07/25/17 19:56	
Molybdenum	ug/L	ND	5.0	07/25/17 19:56	
Nickel	ug/L	ND	5.0	07/25/17 19:56	
Selenium	ug/L	ND	10.0	07/25/17 19:56	
Silver	ug/L	ND	5.0	07/25/17 19:56	
Vanadium	ug/L	ND	5.0	07/25/17 19:56	
Zinc	ug/L	ND	10.0	07/25/17 19:56	

LABORATORY CONTROL SAMPLE: 2051143

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Antimony	ug/L	500	526	105	80-120	
Arsenic	ug/L	500	479	96	80-120	
Barium	ug/L	500	485	97	80-120	
Beryllium	ug/L	500	490	98	80-120	
Cadmium	ug/L	500	492	98	80-120	
Calcium	ug/L	5000	5300	106	80-120	
Chromium	ug/L	500	523	105	80-120	
Cobalt	ug/L	500	521	104	80-120	
Copper	ug/L	500	502	100	80-120	
Lead	ug/L	500	516	103	80-120	
Molybdenum	ug/L	500	564	113	80-120	
Nickel	ug/L	500	486	97	80-120	
Selenium	ug/L	500	520	104	80-120	
Silver	ug/L	250	259	103	80-120	
Vanadium	ug/L	500	496	99	80-120	
Zinc	ug/L	500	527	105	80-120	

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QUALITY CONTROL DATA

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348512

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2051144 2051145

Parameter	Units	92348357001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Antimony	ug/L	ND	500	500	519	520	104	104	75-125	0	20	
Arsenic	ug/L	ND	500	500	486	494	97	99	75-125	2	20	
Barium	ug/L	93.5	500	500	564	573	94	96	75-125	1	20	
Beryllium	ug/L	ND	500	500	482	488	96	98	75-125	1	20	
Cadmium	ug/L	ND	500	500	480	484	96	97	75-125	1	20	
Calcium	ug/L	13100	5000	5000	17900	18300	96	103	75-125	2	20	
Chromium	ug/L	ND	500	500	515	515	103	103	75-125	0	20	
Cobalt	ug/L	ND	500	500	511	513	102	103	75-125	0	20	
Copper	ug/L	27.0	500	500	517	520	98	99	75-125	1	20	
Lead	ug/L	ND	500	500	505	507	100	101	75-125	1	20	
Molybdenum	ug/L	ND	500	500	559	559	112	112	75-125	0	20	
Nickel	ug/L	ND	500	500	476	480	95	96	75-125	1	20	
Selenium	ug/L	ND	500	500	502	508	100	101	75-125	1	20	
Silver	ug/L	ND	250	250	254	256	102	102	75-125	1	20	
Vanadium	ug/L	ND	500	500	490	497	98	99	75-125	1	20	
Zinc	ug/L	68.2	500	500	582	589	103	104	75-125	1	20	

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QUALITY CONTROL DATA

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348512

QC Batch: 369963 Analysis Method: EPA 6020B
QC Batch Method: EPA 3010A Analysis Description: 6020 MET
Associated Lab Samples: 92348512001, 92348512002, 92348512003, 92348512004, 92348512005, 92348512006

METHOD BLANK: 2050073 Matrix: Water
Associated Lab Samples: 92348512001, 92348512002, 92348512003, 92348512004, 92348512005, 92348512006

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Boron	ug/L	ND	25.0	07/21/17 17:57	
Lithium	ug/L	ND	2.5	07/21/17 17:57	
Thallium	ug/L	ND	0.10	07/21/17 17:57	

LABORATORY CONTROL SAMPLE: 2050074

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Boron	ug/L	100	102	102	80-120	
Lithium	ug/L	100	105	105	80-120	
Thallium	ug/L	100	96.5	97	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2050075 2050076

Parameter	Units	92348397014 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Boron	ug/L	1610	100	100	1700	1740	88	127	75-125	2	20	M1
Lithium	ug/L	63.4	100	100	163	165	100	102	75-125	1	20	
Thallium	ug/L	0.038J	100	100	99.2	98.8	99	99	75-125	0	20	

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QUALITY CONTROL DATA

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348512

QC Batch: 370146 Analysis Method: EPA 8260
QC Batch Method: EPA 8260 Analysis Description: 8260 MSV Low Level Landfill
Associated Lab Samples: 92348512001, 92348512002, 92348512003, 92348512004, 92348512005, 92348512006, 92348512007

METHOD BLANK: 2051100 Matrix: Water
Associated Lab Samples: 92348512001, 92348512002, 92348512003, 92348512004, 92348512005, 92348512006, 92348512007

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
1,1,1,2-Tetrachloroethane	ug/L	ND	1.0	07/23/17 07:17	
1,1,1-Trichloroethane	ug/L	ND	1.0	07/23/17 07:17	
1,1,2,2-Tetrachloroethane	ug/L	ND	1.0	07/23/17 07:17	
1,1,2-Trichloroethane	ug/L	ND	1.0	07/23/17 07:17	
1,1-Dichloroethane	ug/L	ND	1.0	07/23/17 07:17	
1,1-Dichloroethene	ug/L	ND	1.0	07/23/17 07:17	
1,2,3-Trichloropropane	ug/L	ND	1.0	07/23/17 07:17	
1,2-Dichlorobenzene	ug/L	ND	1.0	07/23/17 07:17	
1,2-Dichloroethane	ug/L	ND	1.0	07/23/17 07:17	
1,2-Dichloropropane	ug/L	ND	1.0	07/23/17 07:17	
1,4-Dichlorobenzene	ug/L	ND	1.0	07/23/17 07:17	
2-Butanone (MEK)	ug/L	ND	5.0	07/23/17 07:17	
2-Hexanone	ug/L	ND	5.0	07/23/17 07:17	
4-Methyl-2-pentanone (MIBK)	ug/L	ND	5.0	07/23/17 07:17	
Acetone	ug/L	ND	25.0	07/23/17 07:17	
Acrylonitrile	ug/L	ND	10.0	07/23/17 07:17	
Benzene	ug/L	ND	1.0	07/23/17 07:17	
Bromochloromethane	ug/L	ND	1.0	07/23/17 07:17	
Bromodichloromethane	ug/L	ND	1.0	07/23/17 07:17	
Bromoform	ug/L	ND	1.0	07/23/17 07:17	
Bromomethane	ug/L	ND	2.0	07/23/17 07:17	
Carbon disulfide	ug/L	ND	2.0	07/23/17 07:17	
Carbon tetrachloride	ug/L	ND	1.0	07/23/17 07:17	
Chlorobenzene	ug/L	ND	1.0	07/23/17 07:17	
Chloroethane	ug/L	ND	1.0	07/23/17 07:17	
Chloroform	ug/L	ND	1.0	07/23/17 07:17	
Chloromethane	ug/L	ND	1.0	07/23/17 07:17	
cis-1,2-Dichloroethene	ug/L	ND	1.0	07/23/17 07:17	
cis-1,3-Dichloropropene	ug/L	ND	1.0	07/23/17 07:17	
Dibromochloromethane	ug/L	ND	1.0	07/23/17 07:17	
Dibromomethane	ug/L	ND	1.0	07/23/17 07:17	
Ethylbenzene	ug/L	ND	1.0	07/23/17 07:17	
Iodomethane	ug/L	ND	5.0	07/23/17 07:17	
Methylene Chloride	ug/L	ND	1.0	07/23/17 07:17	
Styrene	ug/L	ND	1.0	07/23/17 07:17	
Tetrachloroethene	ug/L	ND	1.0	07/23/17 07:17	
Toluene	ug/L	ND	1.0	07/23/17 07:17	
trans-1,2-Dichloroethene	ug/L	ND	1.0	07/23/17 07:17	
trans-1,3-Dichloropropene	ug/L	ND	1.0	07/23/17 07:17	
trans-1,4-Dichloro-2-butene	ug/L	ND	1.0	07/23/17 07:17	
Trichloroethene	ug/L	ND	1.0	07/23/17 07:17	

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QUALITY CONTROL DATA

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348512

METHOD BLANK: 2051100 Matrix: Water
Associated Lab Samples: 92348512001, 92348512002, 92348512003, 92348512004, 92348512005, 92348512006, 92348512007

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Trichlorofluoromethane	ug/L	ND	1.0	07/23/17 07:17	
Vinyl acetate	ug/L	ND	2.0	07/23/17 07:17	
Vinyl chloride	ug/L	ND	1.0	07/23/17 07:17	
Xylene (Total)	ug/L	ND	1.0	07/23/17 07:17	
1,2-Dichloroethane-d4 (S)	%	107	70-130	07/23/17 07:17	
4-Bromofluorobenzene (S)	%	106	70-130	07/23/17 07:17	
Toluene-d8 (S)	%	106	70-130	07/23/17 07:17	

LABORATORY CONTROL SAMPLE: 2051101

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
1,1,1,2-Tetrachloroethane	ug/L	50	47.6	95	80-125	
1,1,1-Trichloroethane	ug/L	50	49.7	99	71-129	
1,1,2,2-Tetrachloroethane	ug/L	50	52.9	106	79-124	
1,1,2-Trichloroethane	ug/L	50	52.2	104	85-125	
1,1-Dichloroethane	ug/L	50	52.4	105	73-126	
1,1-Dichloroethene	ug/L	50	53.0	106	66-135	
1,2,3-Trichloropropane	ug/L	50	53.3	107	75-130	
1,2-Dichlorobenzene	ug/L	50	47.2	94	80-133	
1,2-Dichloroethane	ug/L	50	50.5	101	67-128	
1,2-Dichloropropane	ug/L	50	53.5	107	75-132	
1,4-Dichlorobenzene	ug/L	50	46.8	94	78-130	
2-Butanone (MEK)	ug/L	100	124	124	61-144	
2-Hexanone	ug/L	100	128	128	68-143	
4-Methyl-2-pentanone (MIBK)	ug/L	100	124	124	72-135	
Acetone	ug/L	100	134	134	48-146	
Acrylonitrile	ug/L	250	300	120	40-160	
Benzene	ug/L	50	53.3	107	80-125	
Bromochloromethane	ug/L	50	52.9	106	71-125	
Bromodichloromethane	ug/L	50	52.3	105	78-124	
Bromoform	ug/L	50	39.1	78	71-128	
Bromomethane	ug/L	50	56.3	113	40-160	
Carbon disulfide	ug/L	50	52.5	105	50-160	
Carbon tetrachloride	ug/L	50	45.9	92	69-131	
Chlorobenzene	ug/L	50	49.0	98	81-122	
Chloroethane	ug/L	50	45.2	90	39-148	
Chloroform	ug/L	50	51.8	104	73-127	
Chloromethane	ug/L	50	53.5	107	44-146	
cis-1,2-Dichloroethene	ug/L	50	51.2	102	74-124	
cis-1,3-Dichloropropene	ug/L	50	54.2	108	72-132	
Dibromochloromethane	ug/L	50	48.3	97	78-125	
Dibromomethane	ug/L	50	49.5	99	82-120	
Ethylbenzene	ug/L	50	48.6	97	79-121	
Iodomethane	ug/L	100	99.8	100	39-154	

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QUALITY CONTROL DATA

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348512

LABORATORY CONTROL SAMPLE: 2051101

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Methylene Chloride	ug/L	50	52.4	105	64-133	
Styrene	ug/L	50	49.7	99	84-126	
Tetrachloroethene	ug/L	50	44.3	89	78-122	
Toluene	ug/L	50	49.9	100	80-121	
trans-1,2-Dichloroethene	ug/L	50	52.1	104	71-127	
trans-1,3-Dichloropropene	ug/L	50	51.9	104	69-141	
trans-1,4-Dichloro-2-butene	ug/L	50	48.0	96	40-160	
Trichloroethene	ug/L	50	49.5	99	78-122	
Trichlorofluoromethane	ug/L	50	49.9	100	53-137	
Vinyl acetate	ug/L	100	117	117	40-160	
Vinyl chloride	ug/L	50	49.4	99	58-137	
Xylene (Total)	ug/L	150	143	95	81-126	
1,2-Dichloroethane-d4 (S)	%			104	70-130	
4-Bromofluorobenzene (S)	%			100	70-130	
Toluene-d8 (S)	%			100	70-130	

MATRIX SPIKE SAMPLE: 2051102

Parameter	Units	92348512001 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
1,1,1,2-Tetrachloroethane	ug/L	ND	20	19.6	98	70-130	
1,1,1-Trichloroethane	ug/L	ND	20	24.8	124	70-130	
1,1,2,2-Tetrachloroethane	ug/L	ND	20	22.3	111	70-130	
1,1,2-Trichloroethane	ug/L	ND	20	22.8	114	70-130	
1,1-Dichloroethane	ug/L	ND	20	25.5	127	70-130	
1,1-Dichloroethene	ug/L	ND	20	27.7	139	70-166	
1,2,3-Trichloropropane	ug/L	ND	20	24.1	120	70-130	
1,2-Dichlorobenzene	ug/L	ND	20	19.7	98	70-130	
1,2-Dichloroethane	ug/L	ND	20	25.7	129	70-130	
1,2-Dichloropropane	ug/L	ND	20	23.7	118	70-130	
1,4-Dichlorobenzene	ug/L	ND	20	20.1	100	70-130	
2-Butanone (MEK)	ug/L	ND	40	55.3	138	70-130	M1
2-Hexanone	ug/L	ND	40	56.3	141	70-130	M1
4-Methyl-2-pentanone (MIBK)	ug/L	ND	40	54.9	137	70-130	M1
Acetone	ug/L	ND	40	68.1	170	70-130	M1
Acrylonitrile	ug/L	ND	100	145	145	70-130	M1
Benzene	ug/L	ND	20	24.4	122	70-148	
Bromochloromethane	ug/L	ND	20	25.5	127	70-130	
Bromodichloromethane	ug/L	ND	20	23.3	117	70-130	
Bromoform	ug/L	ND	20	15.2	76	70-130	
Bromomethane	ug/L	ND	20	26.1	131	70-130	M1
Carbon disulfide	ug/L	ND	20	27.4	137	70-130	M1
Carbon tetrachloride	ug/L	ND	20	21.5	108	70-130	
Chlorobenzene	ug/L	ND	20	22.1	110	70-146	
Chloroethane	ug/L	ND	20	24.6	123	70-130	
Chloroform	ug/L	ND	20	25.0	125	70-130	

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QUALITY CONTROL DATA

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348512

MATRIX SPIKE SAMPLE: 2051102

Parameter	Units	92348512001 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Chloromethane	ug/L	ND	20	29.4	147	70-130	M1
cis-1,2-Dichloroethene	ug/L	ND	20	26.6	133	70-130	M1
cis-1,3-Dichloropropene	ug/L	ND	20	21.5	107	70-130	
Dibromochloromethane	ug/L	ND	20	20.0	100	70-130	
Dibromomethane	ug/L	ND	20	21.3	106	70-130	
Ethylbenzene	ug/L	ND	20	22.2	111	70-130	
Iodomethane	ug/L	ND	40	45.0	112	70-130	
Methylene Chloride	ug/L	ND	20	24.7	123	70-130	
Styrene	ug/L	ND	20	22.3	111	70-130	
Tetrachloroethene	ug/L	ND	20	19.3	97	70-130	
Toluene	ug/L	ND	20	23.2	116	70-155	
trans-1,2-Dichloroethene	ug/L	ND	20	26.6	133	70-130	M1
trans-1,3-Dichloropropene	ug/L	ND	20	20.2	101	70-130	
trans-1,4-Dichloro-2-butene	ug/L	ND	20	18.7	93	70-130	
Trichloroethene	ug/L	ND	20	22.0	110	69-151	
Trichlorofluoromethane	ug/L	ND	20	23.7	119	70-130	
Vinyl acetate	ug/L	ND	40	40.0	100	70-130	
Vinyl chloride	ug/L	ND	20	25.2	126	70-130	
1,2-Dichloroethane-d4 (S)	%				115	70-130	
4-Bromofluorobenzene (S)	%				104	70-130	
Toluene-d8 (S)	%				99	70-130	

SAMPLE DUPLICATE: 2051103

Parameter	Units	92348512002 Result	Dup Result	RPD	Max RPD	Qualifiers
1,1,1,2-Tetrachloroethane	ug/L	ND	ND		30	
1,1,1-Trichloroethane	ug/L	ND	ND		30	
1,1,2,2-Tetrachloroethane	ug/L	ND	ND		30	
1,1,2-Trichloroethane	ug/L	ND	ND		30	
1,1-Dichloroethane	ug/L	ND	ND		30	
1,1-Dichloroethene	ug/L	ND	ND		30	
1,2,3-Trichloropropane	ug/L	ND	ND		30	
1,2-Dichlorobenzene	ug/L	ND	ND		30	
1,2-Dichloroethane	ug/L	ND	ND		30	
1,2-Dichloropropane	ug/L	ND	ND		30	
1,4-Dichlorobenzene	ug/L	ND	ND		30	
2-Butanone (MEK)	ug/L	ND	ND		30	
2-Hexanone	ug/L	ND	ND		30	
4-Methyl-2-pentanone (MIBK)	ug/L	ND	ND		30	
Acetone	ug/L	ND	ND		30	
Acrylonitrile	ug/L	ND	ND		30	
Benzene	ug/L	ND	ND		30	
Bromochloromethane	ug/L	ND	ND		30	
Bromodichloromethane	ug/L	ND	ND		30	
Bromoform	ug/L	ND	ND		30	

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QUALITY CONTROL DATA

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348512

SAMPLE DUPLICATE: 2051103

Parameter	Units	92348512002 Result	Dup Result	RPD	Max RPD	Qualifiers
Bromomethane	ug/L	ND	ND		30	
Carbon disulfide	ug/L	ND	ND		30	
Carbon tetrachloride	ug/L	ND	ND		30	
Chlorobenzene	ug/L	ND	ND		30	
Chloroethane	ug/L	ND	ND		30	
Chloroform	ug/L	ND	ND		30	
Chloromethane	ug/L	ND	ND		30	
cis-1,2-Dichloroethene	ug/L	ND	ND		30	
cis-1,3-Dichloropropene	ug/L	ND	ND		30	
Dibromochloromethane	ug/L	ND	ND		30	
Dibromomethane	ug/L	ND	ND		30	
Ethylbenzene	ug/L	ND	ND		30	
Iodomethane	ug/L	ND	ND		30	
Methylene Chloride	ug/L	ND	ND		30	
Styrene	ug/L	ND	ND		30	
Tetrachloroethene	ug/L	ND	ND		30	
Toluene	ug/L	ND	ND		30	
trans-1,2-Dichloroethene	ug/L	ND	ND		30	
trans-1,3-Dichloropropene	ug/L	ND	ND		30	
trans-1,4-Dichloro-2-butene	ug/L	ND	ND		30	
Trichloroethene	ug/L	ND	ND		30	
Trichlorofluoromethane	ug/L	ND	ND		30	
Vinyl acetate	ug/L	ND	ND		30	
Vinyl chloride	ug/L	ND	ND		30	
Xylene (Total)	ug/L	ND	ND		30	
1,2-Dichloroethane-d4 (S)	%	111	110	1		
4-Bromofluorobenzene (S)	%	103	103	1		
Toluene-d8 (S)	%	107	107	0		

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QUALITY CONTROL DATA

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348512

QC Batch: 370340 Analysis Method: SM 2540C
QC Batch Method: SM 2540C Analysis Description: 2540C Total Dissolved Solids
Associated Lab Samples: 92348512001, 92348512002, 92348512003, 92348512004, 92348512005, 92348512006

METHOD BLANK: 2052094 Matrix: Water
Associated Lab Samples: 92348512001, 92348512002, 92348512003, 92348512004, 92348512005, 92348512006

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Total Dissolved Solids	mg/L	ND	25.0	07/25/17 20:15	

LABORATORY CONTROL SAMPLE: 2052095

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Total Dissolved Solids	mg/L	250	254	102	90-110	

SAMPLE DUPLICATE: 2052096

Parameter	Units	92348402014 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	42.0	40.0	5	5	

SAMPLE DUPLICATE: 2052097

Parameter	Units	92348512004 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	1870	2110	12	5	D6

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QUALITY CONTROL DATA

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348512

QC Batch: 370125
QC Batch Method: EPA 300.0
Analysis Method: EPA 300.0
Analysis Description: 300.0 IC Anions
Associated Lab Samples: 92348512001, 92348512002

METHOD BLANK: 2050980 Matrix: Water
Associated Lab Samples: 92348512001, 92348512002

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Chloride	mg/L	ND	1.0	07/22/17 11:45	
Fluoride	mg/L	ND	0.10	07/22/17 11:45	
Sulfate	mg/L	ND	1.0	07/22/17 11:45	

LABORATORY CONTROL SAMPLE: 2050981

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Chloride	mg/L	50	53.0	106	90-110	
Fluoride	mg/L	2.5	2.5	101	90-110	
Sulfate	mg/L	50	52.8	106	90-110	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2050982 2050983

Parameter	Units	92348075001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Chloride	mg/L	3.7	50	50	55.5	55.8	104	104	90-110	1	10	
Fluoride	mg/L	ND	2.5	2.5	2.6	2.6	100	101	90-110	1	10	
Sulfate	mg/L	2.7	50	50	54.3	54.7	103	104	90-110	1	10	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2050984 2050985

Parameter	Units	92348375003 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Chloride	mg/L	2.4	50	50	54.9	54.7	105	105	90-110	0	10	
Fluoride	mg/L	0.28	2.5	2.5	2.8	2.8	102	101	90-110	1	10	
Sulfate	mg/L	2.8	50	50	54.9	54.8	104	104	90-110	0	10	

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QUALITY CONTROL DATA

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348512

QC Batch: 370139 Analysis Method: EPA 300.0
QC Batch Method: EPA 300.0 Analysis Description: 300.0 IC Anions
Associated Lab Samples: 92348512003, 92348512004, 92348512005, 92348512006

METHOD BLANK: 2051076 Matrix: Water
Associated Lab Samples: 92348512003, 92348512004, 92348512005, 92348512006

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Chloride	mg/L	ND	1.0	07/23/17 01:13	
Fluoride	mg/L	ND	0.10	07/23/17 01:13	
Sulfate	mg/L	ND	1.0	07/23/17 01:13	

LABORATORY CONTROL SAMPLE: 2051077

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Chloride	mg/L	50	48.0	96	90-110	
Fluoride	mg/L	2.5	2.3	91	90-110	
Sulfate	mg/L	50	47.3	95	90-110	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2051078 2051079

Parameter	Units	92348701001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Chloride	mg/L	17.3	50	50	66.6	73.7	99	113	90-110	10	10	M1
Fluoride	mg/L	0.19	2.5	2.5	2.6	3.1	95	115	90-110	18	10	M1,R1
Sulfate	mg/L	54.5	50	50	114	117	118	124	90-110	3	10	M1

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2051080 2051081

Parameter	Units	92348330001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Chloride	mg/L	1.9	50	50	51.1	51.5	98	99	90-110	1	10	
Fluoride	mg/L	0.17	2.5	2.5	2.5	2.6	95	95	90-110	0	10	
Sulfate	mg/L	9.2	50	50	58.0	58.1	98	98	90-110	0	10	

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REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348512

Sample: MW-5 **Lab ID: 92348512001** Collected: 07/19/17 11:30 Received: 07/20/17 07:50 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**0.120 ± 0.287 (0.555) C:NA T:91%**	pCi/L	08/08/17 23:11	13982-63-3	
Radium-228	EPA 904.0	**0.369 ± 0.386 (0.796) C:79% T:86%**	pCi/L	08/07/17 18:34	15262-20-1	

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348512

Sample: MW-6 DUPE **Lab ID: 92348512002** Collected: 07/19/17 14:00 Received: 07/20/17 07:50 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**0.173 ± 0.264 (0.424) C:NA T:94%**	pCi/L	08/08/17 23:11	13982-63-3	
Radium-228	EPA 904.0	**0.546 ± 0.424 (0.817) C:78% T:83%**	pCi/L	08/07/17 19:51	15262-20-1	

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348512

Sample: MW-6 **Lab ID: 92348512003** Collected: 07/19/17 14:00 Received: 07/20/17 07:50 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**0.227 ± 0.274 (0.418) C:NA T:88%**	pCi/L	08/08/17 23:18	13982-63-3	
Radium-228	EPA 904.0	**0.680 ± 0.405 (0.731) C:80% T:86%**	pCi/L	08/07/17 18:34	15262-20-1	

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348512

Sample: MW-3 **Lab ID: 92348512004** Collected: 07/19/17 17:10 Received: 07/20/17 07:50 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**1.19 ± 0.529 (0.154) C:NA T:92%**	pCi/L	08/08/17 23:11	13982-63-3	
Radium-228	EPA 904.0	**2.27 ± 0.664 (0.758) C:78% T:92%**	pCi/L	08/07/17 18:34	15262-20-1	

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348512

Sample: EQB **Lab ID: 92348512005** Collected: 07/19/17 10:00 Received: 07/20/17 07:50 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**0.203 ± 0.245 (0.374) C:NA T:94%**	pCi/L	08/08/17 23:11	13982-63-3	
Radium-228	EPA 904.0	**0.258 ± 0.346 (0.739) C:76% T:79%**	pCi/L	08/07/17 16:29	15262-20-1	

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348512

Sample: AMB **Lab ID: 92348512006** Collected: 07/19/17 15:30 Received: 07/20/17 07:50 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**-0.112 ± 0.312 (0.736) C:NA T:92%**	pCi/L	08/08/17 23:24	13982-63-3	
Radium-228	EPA 904.0	**0.801 ± 0.385 (0.633) C:77% T:78%**	pCi/L	08/07/17 16:29	15262-20-1	

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QUALITY CONTROL - RADIOCHEMISTRY

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348512

QC Batch: 266570 Analysis Method: EPA 903.1
QC Batch Method: EPA 903.1 Analysis Description: 903.1 Radium-226
Associated Lab Samples: 92348512001, 92348512002, 92348512003, 92348512004, 92348512005, 92348512006

METHOD BLANK: 1312630 Matrix: Water
Associated Lab Samples: 92348512001, 92348512002, 92348512003, 92348512004, 92348512005, 92348512006

Parameter	Act ± Unc (MDC) Carr Trac	Units	Analyzed	Qualifiers
Radium-226	0.107 ± 0.244 (0.394) C:NA T:98%	pCi/L	08/08/17 22:44	

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QUALITY CONTROL - RADIOCHEMISTRY

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348512

QC Batch: 266571 Analysis Method: EPA 904.0
QC Batch Method: EPA 904.0 Analysis Description: 904.0 Radium 228
Associated Lab Samples: 92348512001, 92348512002, 92348512003, 92348512004, 92348512005, 92348512006

METHOD BLANK: 1312631 Matrix: Water
Associated Lab Samples: 92348512001, 92348512002, 92348512003, 92348512004, 92348512005, 92348512006

Parameter	Act ± Unc (MDC) Carr Trac	Units	Analyzed	Qualifiers
Radium-228	0.616 ± 0.324 (0.565) C:82% T:91%	pCi/L	08/07/17 16:29	

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QUALIFIERS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348512

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above adjusted reporting limit.

TNTC - Too Numerous To Count

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

Acid preservation may not be appropriate for 2 Chloroethylvinyl ether.

A separate vial preserved to a pH of 4-5 is recommended in SW846 Chapter 4 for the analysis of Acrolein and Acrylonitrile by EPA Method 8260.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Act - Activity

Unc - Uncertainty: SDWA = 1.96 sigma count uncertainty, all other matrices = Expanded Uncertainty (95% confidence interval). Gamma Spec = Expanded Uncertainty (95.4% Confidence Interval)

(MDC) - Minimum Detectable Concentration

Trac - Tracer Recovery (%)

Carr - Carrier Recovery (%)

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

LABORATORIES

PASI-A	Pace Analytical Services - Asheville
PASI-C	Pace Analytical Services - Charlotte
PASI-PA	Pace Analytical Services - Greensburg

ANALYTE QUALIFIERS

D6	The precision between the sample and sample duplicate exceeded laboratory control limits.
M1	Matrix spike recovery exceeded QC limits. Batch accepted based on laboratory control sample (LCS) recovery.
R1	RPD value was outside control limits.

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QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348512

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
92348512001	**MW-5**	EPA 3010A	370164	EPA 6010	370490
92348512002	**MW-6 DUPE**	EPA 3010A	370164	EPA 6010	370490
92348512003	**MW-6**	EPA 3010A	370164	EPA 6010	370490
92348512004	**MW-3**	EPA 3010A	370164	EPA 6010	370490
92348512005	**EQB**	EPA 3010A	370164	EPA 6010	370490
92348512006	**AMB**	EPA 3010A	370164	EPA 6010	370490
92348512001	**MW-5**	EPA 3010A	369963	EPA 6020B	370057
92348512002	**MW-6 DUPE**	EPA 3010A	369963	EPA 6020B	370057
92348512003	**MW-6**	EPA 3010A	369963	EPA 6020B	370057
92348512004	**MW-3**	EPA 3010A	369963	EPA 6020B	370057
92348512005	**EQB**	EPA 3010A	369963	EPA 6020B	370057
92348512006	**AMB**	EPA 3010A	369963	EPA 6020B	370057
92348512001	**MW-5**	EPA 7470	370008	EPA 7470	370247
92348512002	**MW-6 DUPE**	EPA 7470	370008	EPA 7470	370247
92348512003	**MW-6**	EPA 7470	370008	EPA 7470	370247
92348512004	**MW-3**	EPA 7470	370008	EPA 7470	370247
92348512005	**EQB**	EPA 7470	370296	EPA 7470	370335
92348512006	**AMB**	EPA 7470	370296	EPA 7470	370335
92348512001	**MW-5**	EPA 8260	370146		
92348512002	**MW-6 DUPE**	EPA 8260	370146		
92348512003	**MW-6**	EPA 8260	370146		
92348512004	**MW-3**	EPA 8260	370146		
92348512005	**EQB**	EPA 8260	370146		
92348512006	**AMB**	EPA 8260	370146		
92348512007	**TRIP BLANK**	EPA 8260	370146		
92348512001	**MW-5**	EPA 903.1	266570		
92348512002	**MW-6 DUPE**	EPA 903.1	266570		
92348512003	**MW-6**	EPA 903.1	266570		
92348512004	**MW-3**	EPA 903.1	266570		
92348512005	**EQB**	EPA 903.1	266570		
92348512006	**AMB**	EPA 903.1	266570		
92348512001	**MW-5**	EPA 904.0	266571		
92348512002	**MW-6 DUPE**	EPA 904.0	266571		
92348512003	**MW-6**	EPA 904.0	266571		
92348512004	**MW-3**	EPA 904.0	266571		
92348512005	**EQB**	EPA 904.0	266571		
92348512006	**AMB**	EPA 904.0	266571		
92348512001	**MW-5**	SM 2540C	370340		
92348512002	**MW-6 DUPE**	SM 2540C	370340		
92348512003	**MW-6**	SM 2540C	370340		
92348512004	**MW-3**	SM 2540C	370340		
92348512005	**EQB**	SM 2540C	370340		
92348512006	**AMB**	SM 2540C	370340		
92348512001	**MW-5**	EPA 300.0	370125		
92348512002	**MW-6 DUPE**	EPA 300.0	370125		

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QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348512

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
92348512003	**MW-6**	EPA 300.0	370139		
92348512004	**MW-3**	EPA 300.0	370139		
92348512005	**EQB**	EPA 300.0	370139		
92348512006	**AMB**	EPA 300.0	370139		

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Pace Analytical®	Document Name: Sample Condition Upon Receipt(SCUR)	Document Revised: Sept. 21, 2016 Page 1 of 2
	Document No.: F-CAR-CS-033-Rev.01	Issuing Authority: Pace Quality Office

Laboratory receiving samples:
Asheville ☐ Eden ☐ Greenwood ☐ Huntersville ☑ Raleigh ☐ Mechanicsville ☐

Sample Condition Upon Receipt

Client Name: HDR **Project #:**

WO# : 92348512

92348512

Courier: ☐ Commercial ☑ Pace ☐ Fed Ex ☐ UPS ☐ USPS ☐ Other:____ ☐ Client

Custody Seal Present? ☐ Yes ☑ No **Seals Intact?** ☐ Yes ☐ No

Packing Material: ☐ Bubble Wrap ☑ Bubble Bags ☐ None ☐ Other:____

Date/Initials Person Examining Contents: 7/20/17

Thermometer:
☑ IR Gun ID: T1603 **Type of Ice:** ☑ Wet ☐ Blue ☐ None ☑ Samples on ice, cooling process has begun

Correction Factor: **Cooler Temp Corrected (°C):** 2.3/2.4 **Biological Tissue Frozen?** ☐ Yes ☑ No ☐ N/A

Temp should be above freezing to 6°C

USDA Regulated Soil (☑ N/A, water sample)

Did samples originate in a quarantine zone within the United States: CA, NY, or SC (check maps)? ☐ Yes ☑ No

Did samples originate from a foreign source (internationally, including Hawaii and Puerto Rico)? ☐ Yes ☑ No

				Comments/Discrepancy:
Chain of Custody Present?	☑ Yes	☐ No	☐ N/A	1.
Samples Arrived within Hold Time?	☑ Yes	☐ No	☐ N/A	2.
Short Hold Time Analysis (<72 hr.)?	☐ Yes	☑ No	☐ N/A	3.
Rush Turn Around Time Requested?	☐ Yes	☑ No	☐ N/A	4.
Sufficient Volume?	☑ Yes	☐ No	☐ N/A	5.
Correct Containers Used?	☑ Yes	☐ No	☐ N/A	6.
-Pace Containers Used?	☑ Yes	☐ No	☐ N/A	
Containers Intact?	☑ Yes	☐ No	☐ N/A	7.
Samples Field Filtered?	☐ Yes	☐ No	☑ N/A	8. Note if sediment is visible in the dissolved container
Sample Labels Match COC?	☑ Yes	☐ No	☐ N/A	9.
-Includes Date/Time/ID/Analysis Matrix: WT				
Headspace in VOA Vials (>5-6mm)?	☐ Yes	☑ No	☐ N/A	10.
Trip Blank Present?	☑ Yes	☐ No	☐ N/A	11.
Trip Blank Custody Seals Present?	☑ Yes	☐ No	☐ N/A	

CLIENT NOTIFICATION/RESOLUTION **Field Data Required?** ☐ Yes ☐ No

Person Contacted: _____ Date/Time: _____

Comments/Sample Discrepancy: _____

Project Manager SCURF Review: TF **Date:** 7/20

Project Manager SRF Review: TF **Date:** 7/20

Note: Whenever there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office (i.e. Out of hold, incorrect preservative, out of temp, incorrect containers)

*Check mark top half of box if pH and/or dechlorination is verified and within the acceptance range for preservation samples.

**Bottom half of box is to list number of bottles

Project # WO#: 92348512

PM: KRG Due Date: 07/27/17

CLIENT: 92-HDR

Item#	BP4U-125 mL Plastic Unpreserved (N/A) (Cl-)	BP3U-250 mL Plastic Unpreserved (N/A)	BP2U-500 mL Plastic Unpreserved (N/A)	BP1U-1 liter Plastic Unpreserved (N/A)	BP3S-250 mL Plastic H2SO4 (pH < 2) (Cl-)	BP3N-250 mL plastic HNO3 (pH < 2)	BP3Z-250 mL Plastic ZN Acetate & NaOH (>9)	BP3C-250 mL Plastic NaOH (pH > 12) (Cl-)	WGFU-Wide-mouthed Glass jar Unpreserved	AG1U-1 liter Amber Unpreserved (N/A) (Cl-)	AG1H-1 liter Amber HCl (pH < 2)	AG3U-250 mL Amber Unpreserved (N/A) (Cl-)	AG1S-1 liter Amber H2SO4 (pH < 2)	AG3S-250 mL Amber H2SO4 (pH < 2)	AG3A(DG3A)-250 mL Amber NH4Cl (N/A)(Cl-)	DG9H-40 mL VOA HCl (N/A)	VG9T-40 mL VOA Na2S2O3 (N/A)	VG9U-40 mL VOA Unp (N/A)	DG9P-40 mL VOA H3PO4 (N/A)	VOAK (6 vials per kit)-5035 kit (N/A)	V/GK (3 vials per kit)-VPH/Gas kit (N/A)	SP5T-125 mL Sterile Plastic (N/A – lab)	SP2T-250 mL Sterile Plastic (N/A – lab)	BP1N	BP3A-250 mL Plastic (NH2)2SO4 (9.3-9.7)	Cubitainer	VSGU-20 mL Scintillation vials (N/A)	GN
1		1	1			2										3								3				
2		1	1			2										3								3				
3		1	1			2										3								3				
4		1	1			2										3								3				
5																												
6		1	1			2										3								3				
7		1	1			2										3								3				
8		1														2												
9																												
10																												
11																												
12																												

pH Adjustment Log for Preserved Samples

Sample ID	Type of Preservative	pH upon receipt	Date preservation adjusted	Time preservation adjusted	Amount of Preservative added	Lot #

Pace Analytical

CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

Page : 1 Of 1

Section A Required Client Information:		Section B Required Project Information:		Section C Invoice Information:	
Company:	HDR Engineering	Report To:	Sean Quarry	Attention:	
Address:	440 South Church Street	Copy To:		Company Name:	
Charlotte, NC 28202				Address:	
Email:	sean.quarry@hdrinc.com	Purchase Order #:		Pace Quote:	
Phone:	(704)248-3632 Fax	Project Name:	Charrah-Brickhaven	Pace Project Manager:	kevin.godwin@pacelabs.com,
Requested Due Date:		Project #:		Pace Profile #:	7672-1

Regulatory Agency
State / Location
NC

SAMPLE ID
One Character per box.
(A-Z, 0-9 / , -)
Sample Ids must be unique

MATRIX	CODE
Drinking Water	DW
Water	WT
Waste Water	WW
Product	P
Soil/Solid	SL
Oil	OL
Wipe	WP
Air	AR
Other	OT
Tissue	TS

ITEM #	SAMPLE ID	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED START DATE	COLLECTED START TIME	COLLECTED END DATE	COLLECTED END TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Preservatives: Unpreserved	H2SO4	HNO3	HCl	NaOH	Na2S2O3	Methanol	Other	Analyses Test Y/N	Trip BLANK	8260	300.0-Cl,F,Sulfate	TDS	Radium 226/228	6010/7470	6020 (B, Li)	Residual Chlorine (Y/N)	
1	MW-5		G	/	/	7/19/17	1130		10	2		5	3							3	1	1	3	1	1		01
2	MW-6 DUPE		G	/	/	7/19/17	1400		10	2		5	3							3	1	1	3	1	1		02
3	MW 6		G	/	/	7/19/17	1400		10	2		5	3							3	1	1	3	1	1		03
4	MW 3		G	/	/	7/19/17	1710		10	2		5	3							3	1	1	3	1	1		04
5																											
6	EQB		G	/	/	7/19/17	1000		10	2		5	3							3	1	1	3	1	1		05
7	AMB		G	/	/	7/19/17	1530		10	2		5	3							3	1	1	3	1	1		06
8	TRIP BLANK																			2							07
9																											
10																											
11																											
12																											

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME
	Jesse Alred PACE	7/19/17	2000		7/20/17	0750
		7/20/17	1350	Pace FTL	7/20/17	1350

SAMPLE CONDITIONS				
TEMP in C	Received on Ice (Y/N)	Custody Sealed Cooler (Y/N)	Samples Intact (Y/N)	
2.3 2.6	4	N	4	

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER: Jesse ALFRED

SIGNATURE of SAMPLER: Jesse Alred DATE Signed: 7-19-17

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

August 15, 2017

Sean Quarry
HDR Engineering
440 South Church Street
Suite 1000
Charlotte, NC 28202

RE: Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348626

Dear Sean Quarry:
Enclosed are the analytical results for sample(s) received by the laboratory on July 21, 2017. The results relate only to the samples included in this report. Results reported herein conform to the most current, applicable TNI/NELAC standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Kevin Godwin
kevin.godwin@pacelabs.com
1(704)875-9092
Project Manager

Enclosures

cc: Mike Plummer, HDR

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CERTIFICATIONS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348626

Pennsylvania Certification IDs

1638 Roseytown Rd Suites 2,3&4, Greensburg, PA 15601
L-A-B DOD-ELAP Accreditation #: L2417
Alabama Certification #: 41590
Arizona Certification #: AZ0734
Arkansas Certification
California Certification #: 04222CA
Colorado Certification
Connecticut Certification #: PH-0694
Delaware Certification
Florida/TNI Certification #: E87683
Georgia Certification #: C040
Guam Certification
Hawaii Certification
Idaho Certification
Illinois Certification
Indiana Certification
Iowa Certification #: 391
Kansas/TNI Certification #: E-10358
Kentucky Certification #: 90133
Louisiana DHH/TNI Certification #: LA140008
Louisiana DEQ/TNI Certification #: 4086
Maine Certification #: PA00091
Maryland Certification #: 308
Massachusetts Certification #: M-PA1457
Michigan/PADEP Certification
Missouri Certification #: 235
Montana Certification #: Cert 0082
Nebraska Certification #: NE-05-29-14
Nevada Certification #: PA014572015-1
New Hampshire/TNI Certification #: 2976
New Jersey/TNI Certification #: PA 051
New Mexico Certification #: PA01457
New York/TNI Certification #: 10888
North Carolina Certification #: 42706
North Dakota Certification #: R-190
Oregon/TNI Certification #: PA200002
Pennsylvania/TNI Certification #: 65-00282
Puerto Rico Certification #: PA01457
Rhode Island Certification #: 65-00282
South Dakota Certification
Tennessee Certification #: TN2867
Texas/TNI Certification #: T104704188-14-8
Utah/TNI Certification #: PA014572015-5
USDA Soil Permit #: P330-14-00213
Vermont Dept. of Health: ID# VT-0282
Virgin Island/PADEP Certification
Virginia/VELAP Certification #: 460198
Washington Certification #: C868
West Virginia DEP Certification #: 143
West Virginia DHHR Certification #: 9964C
Wisconsin Certification
Wyoming Certification #: 8TMS-L

Charlotte Certification IDs

9800 Kincey Ave. Ste 100, Huntersville, NC 28078
North Carolina Drinking Water Certification #: 37706
North Carolina Field Services Certification #: 5342
North Carolina Wastewater Certification #: 12
South Carolina Certification #: 99006001
Florida/NELAP Certification #: E87627
Kentucky UST Certification #: 84
Virginia/VELAP Certification #: 460221

Asheville Certification IDs

2225 Riverside Drive, Asheville, NC 28804
Florida/NELAP Certification #: E87648
Massachusetts Certification #: M-NC030
North Carolina Drinking Water Certification #: 37712
North Carolina Wastewater Certification #: 40
South Carolina Certification #: 99030001
Virginia/VELAP Certification #: 460222

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SAMPLE SUMMARY

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348626

Lab ID	Sample ID	Matrix	Date Collected	Date Received
92348626001	**MW-4**	Water	07/20/17 09:55	07/21/17 09:30
92348626002	**MW-7R**	Water	07/20/17 15:20	07/21/17 09:30
92348626003	**EQ BLANK**	Water	07/20/17 08:00	07/21/17 09:30
92348626004	**AMB**	Water	07/20/17 08:00	07/21/17 09:30
92348626005	**TRIP BLANK**	Water	07/20/17 00:00	07/21/17 09:30

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SAMPLE ANALYTE COUNT

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348626

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
92348626001	**MW-4**	EPA 6010	SH1	16	PASI-A
		EPA 6020B	CDF	3	PASI-A
		EPA 7470	KAL	1	PASI-A
		EPA 8260	ZDO	48	PASI-C
		EPA 903.1	KAC	1	PASI-PA
		EPA 904.0	JLW	1	PASI-PA
		SM 2540C	SLB	1	PASI-A
		EPA 300.0	CDC	3	PASI-A
92348626002	**MW-7R**	EPA 6010	SH1	16	PASI-A
		EPA 6020B	CDF	3	PASI-A
		EPA 7470	KAL	1	PASI-A
		EPA 8260	ZDO	48	PASI-C
		EPA 903.1	KAC	1	PASI-PA
		EPA 904.0	JLW	1	PASI-PA
		SM 2540C	SLB	1	PASI-A
		EPA 300.0	CDC	3	PASI-A
92348626003	**EQ BLANK**	EPA 6010	SH1	16	PASI-A
		EPA 6020B	CDF	3	PASI-A
		EPA 7470	KAL	1	PASI-A
		EPA 8260	ZDO	48	PASI-C
		EPA 903.1	KAC	1	PASI-PA
		EPA 904.0	JLW	1	PASI-PA
		SM 2540C	SLB	1	PASI-A
		EPA 300.0	CDC	3	PASI-A
92348626004	**AMB**	EPA 6010	SH1	16	PASI-A
		EPA 6020B	CDF	3	PASI-A
		EPA 7470	KAL	1	PASI-A
		EPA 8260	ZDO	48	PASI-C
		EPA 903.1	KAC	1	PASI-PA
		EPA 904.0	JLW	1	PASI-PA
		SM 2540C	SLB	1	PASI-A
		EPA 300.0	CDC	3	PASI-A
92348626005	**TRIP BLANK**	EPA 8260	ZDO	48	PASI-C

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SUMMARY OF DETECTION

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348626

Lab Sample ID / Method	Client Sample ID / Parameters	Result	Units	Report Limit	Analyzed	Qualifiers
92348626001	**MW-4**					
EPA 6010	Barium	332	ug/L	5.0	07/28/17 01:07	
EPA 6010	Calcium	63900	ug/L	100	07/28/17 01:07	
EPA 6010	Cobalt	5.3	ug/L	5.0	07/28/17 01:07	
EPA 6010	Nickel	5.2	ug/L	5.0	07/28/17 01:07	
EPA 6020B	Lithium	27.7	ug/L	2.5	07/26/17 15:12	
EPA 903.1	Radium-226	0.684 ± 0.412 (0.168) C:NA T:91%	pCi/L		08/10/17 22:01	
EPA 904.0	Radium-228	0.819 ± 0.404 (0.714) C:79% T:93%	pCi/L		08/10/17 15:59	
SM 2540C	Total Dissolved Solids	1150	mg/L	50.0	07/25/17 15:46	
EPA 300.0	Chloride	515	mg/L	10.0	07/23/17 20:06	
EPA 300.0	Fluoride	0.31	mg/L	0.10	07/23/17 11:21	
EPA 300.0	Sulfate	10.8	mg/L	1.0	07/23/17 11:21	
92348626002	**MW-7R**					
EPA 6010	Barium	50.1	ug/L	5.0	07/28/17 01:10	
EPA 6010	Calcium	87700	ug/L	100	07/28/17 01:10	
EPA 6010	Chromium	8.1	ug/L	5.0	07/28/17 01:10	
EPA 6010	Molybdenum	19.5	ug/L	5.0	07/28/17 20:41	
EPA 6010	Vanadium	17.6	ug/L	5.0	07/28/17 01:10	
EPA 6020B	Boron	25.3	ug/L	25.0	07/27/17 16:57	
EPA 6020B	Lithium	5.6	ug/L	2.5	07/26/17 15:20	
EPA 6020B	Thallium	0.48	ug/L	0.10	07/26/17 15:20	
EPA 903.1	Radium-226	-0.059 ± 0.271 (0.638) C:NA T:94%	pCi/L		08/10/17 22:01	
EPA 904.0	Radium-228	0.585 ± 0.402 (0.770) C:76% T:77%	pCi/L		08/10/17 15:59	
SM 2540C	Total Dissolved Solids	740	mg/L	50.0	07/25/17 15:47	
EPA 300.0	Chloride	312	mg/L	5.0	07/25/17 10:24	
EPA 300.0	Fluoride	0.32	mg/L	0.10	07/24/17 16:12	
EPA 300.0	Sulfate	51.2	mg/L	1.0	07/24/17 16:12	M6
92348626003	**EQ BLANK**					
EPA 903.1	Radium-226	0.193 ± 0.488 (0.906) C:NA T:94%	pCi/L		08/10/17 22:22	
EPA 904.0	Radium-228	0.597 ± 0.422 (0.816) C:77% T:72%	pCi/L		08/10/17 15:59	

REPORT OF LABORATORY ANALYSIS

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SUMMARY OF DETECTION

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348626

Lab Sample ID / Method	Client Sample ID / Parameters	Result	Units	Report Limit	Analyzed	Qualifiers
92348626004	**AMB**					
EPA 6010	Barium	5.2	ug/L	5.0	07/28/17 01:25	
EPA 6020B	Boron	40.4	ug/L	25.0	07/27/17 17:00	
EPA 903.1	Radium-226	-0.058 ± 0.375 (0.814) C:NA T:101%	pCi/L		08/10/17 22:22	
EPA 904.0	Radium-228	0.651 ± 0.361 (0.643) C:75% T:85%	pCi/L		08/10/17 15:59	

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ANALYTICAL RESULTS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348626

Sample: MW-4 **Lab ID: 92348626001** Collected: 07/20/17 09:55 Received: 07/21/17 09:30 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP	Analytical Method: EPA 6010 Preparation Method: EPA 3010A							
Antimony	ND	ug/L	5.0	1	07/25/17 15:50	07/28/17 01:07	7440-36-0	
Arsenic	ND	ug/L	10.0	1	07/25/17 15:50	07/28/17 01:07	7440-38-2	
Barium	**332**	ug/L	5.0	1	07/25/17 15:50	07/28/17 01:07	7440-39-3	
Beryllium	ND	ug/L	1.0	1	07/25/17 15:50	07/28/17 01:07	7440-41-7	
Cadmium	ND	ug/L	1.0	1	07/25/17 15:50	07/28/17 01:07	7440-43-9	
Calcium	**63900**	ug/L	100	1	07/25/17 15:50	07/28/17 01:07	7440-70-2	
Chromium	ND	ug/L	5.0	1	07/25/17 15:50	07/28/17 01:07	7440-47-3	
Cobalt	**5.3**	ug/L	5.0	1	07/25/17 15:50	07/28/17 01:07	7440-48-4	
Copper	ND	ug/L	5.0	1	07/25/17 15:50	07/28/17 01:07	7440-50-8	
Lead	ND	ug/L	5.0	1	07/25/17 15:50	07/28/17 01:07	7439-92-1	
Molybdenum	ND	ug/L	5.0	1	07/25/17 15:50	07/28/17 20:38	7439-98-7	
Nickel	**5.2**	ug/L	5.0	1	07/25/17 15:50	07/28/17 01:07	7440-02-0	
Selenium	ND	ug/L	10.0	1	07/25/17 15:50	07/28/17 20:38	7782-49-2	
Silver	ND	ug/L	5.0	1	07/25/17 15:50	07/28/17 01:07	7440-22-4	
Vanadium	ND	ug/L	5.0	1	07/25/17 15:50	07/28/17 01:07	7440-62-2	
Zinc	ND	ug/L	10.0	1	07/25/17 15:50	07/28/17 01:07	7440-66-6	
6020 MET ICPMS	Analytical Method: EPA 6020B Preparation Method: EPA 3010A							
Boron	ND	ug/L	25.0	1	07/22/17 02:35	07/27/17 16:55	7440-42-8	
Lithium	**27.7**	ug/L	2.5	1	07/22/17 02:35	07/26/17 15:12	7439-93-2	
Thallium	ND	ug/L	0.10	1	07/22/17 02:35	07/26/17 15:12	7440-28-0	
7470 Mercury	Analytical Method: EPA 7470 Preparation Method: EPA 7470							
Mercury	ND	ug/L	0.20	1	07/24/17 13:40	07/24/17 21:11	7439-97-6	
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
Acetone	ND	ug/L	25.0	1		07/23/17 10:11	67-64-1	
Acrylonitrile	ND	ug/L	10.0	1		07/23/17 10:11	107-13-1	
Benzene	ND	ug/L	1.0	1		07/23/17 10:11	71-43-2	
Bromochloromethane	ND	ug/L	1.0	1		07/23/17 10:11	74-97-5	
Bromodichloromethane	ND	ug/L	1.0	1		07/23/17 10:11	75-27-4	
Bromoform	ND	ug/L	1.0	1		07/23/17 10:11	75-25-2	
Bromomethane	ND	ug/L	2.0	1		07/23/17 10:11	74-83-9	
2-Butanone (MEK)	ND	ug/L	5.0	1		07/23/17 10:11	78-93-3	
Carbon disulfide	ND	ug/L	2.0	1		07/23/17 10:11	75-15-0	
Carbon tetrachloride	ND	ug/L	1.0	1		07/23/17 10:11	56-23-5	
Chlorobenzene	ND	ug/L	1.0	1		07/23/17 10:11	108-90-7	
Chloroethane	ND	ug/L	1.0	1		07/23/17 10:11	75-00-3	
Chloroform	ND	ug/L	1.0	1		07/23/17 10:11	67-66-3	
Chloromethane	ND	ug/L	1.0	1		07/23/17 10:11	74-87-3	
Dibromochloromethane	ND	ug/L	1.0	1		07/23/17 10:11	124-48-1	
Dibromomethane	ND	ug/L	1.0	1		07/23/17 10:11	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	1.0	1		07/23/17 10:11	95-50-1	
1,4-Dichlorobenzene	ND	ug/L	1.0	1		07/23/17 10:11	106-46-7	
trans-1,4-Dichloro-2-butene	ND	ug/L	1.0	1		07/23/17 10:11	110-57-6	
1,1-Dichloroethane	ND	ug/L	1.0	1		07/23/17 10:11	75-34-3	

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ANALYTICAL RESULTS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348626

Sample: MW-4 **Lab ID: 92348626001** Collected: 07/20/17 09:55 Received: 07/21/17 09:30 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
1,2-Dichloroethane	ND	ug/L	1.0	1		07/23/17 10:11	107-06-2	
1,1-Dichloroethene	ND	ug/L	1.0	1		07/23/17 10:11	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	1.0	1		07/23/17 10:11	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	1.0	1		07/23/17 10:11	156-60-5	
1,2-Dichloropropane	ND	ug/L	1.0	1		07/23/17 10:11	78-87-5	
cis-1,3-Dichloropropene	ND	ug/L	1.0	1		07/23/17 10:11	10061-01-5	
trans-1,3-Dichloropropene	ND	ug/L	1.0	1		07/23/17 10:11	10061-02-6	
Ethylbenzene	ND	ug/L	1.0	1		07/23/17 10:11	100-41-4	
2-Hexanone	ND	ug/L	5.0	1		07/23/17 10:11	591-78-6	
Iodomethane	ND	ug/L	5.0	1		07/23/17 10:11	74-88-4	
Methylene Chloride	ND	ug/L	1.0	1		07/23/17 10:11	75-09-2	
4-Methyl-2-pentanone (MIBK)	ND	ug/L	5.0	1		07/23/17 10:11	108-10-1	
Styrene	ND	ug/L	1.0	1		07/23/17 10:11	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0	1		07/23/17 10:11	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0	1		07/23/17 10:11	79-34-5	
Tetrachloroethene	ND	ug/L	1.0	1		07/23/17 10:11	127-18-4	
Toluene	ND	ug/L	1.0	1		07/23/17 10:11	108-88-3	
1,1,1-Trichloroethane	ND	ug/L	1.0	1		07/23/17 10:11	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	1.0	1		07/23/17 10:11	79-00-5	
Trichloroethene	ND	ug/L	1.0	1		07/23/17 10:11	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0	1		07/23/17 10:11	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0	1		07/23/17 10:11	96-18-4	
Vinyl acetate	ND	ug/L	2.0	1		07/23/17 10:11	108-05-4	
Vinyl chloride	ND	ug/L	1.0	1		07/23/17 10:11	75-01-4	
Xylene (Total)	ND	ug/L	1.0	1		07/23/17 10:11	1330-20-7	
Surrogates								
4-Bromofluorobenzene (S)	104	%	70-130	1		07/23/17 10:11	460-00-4	
1,2-Dichloroethane-d4 (S)	111	%	70-130	1		07/23/17 10:11	17060-07-0	
Toluene-d8 (S)	104	%	70-130	1		07/23/17 10:11	2037-26-5	
2540C Total Dissolved Solids	Analytical Method: SM 2540C							
Total Dissolved Solids	**1150**	mg/L	50.0	1		07/25/17 15:46		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0							
Chloride	**515**	mg/L	10.0	10		07/23/17 20:06	16887-00-6	
Fluoride	**0.31**	mg/L	0.10	1		07/23/17 11:21	16984-48-8	
Sulfate	**10.8**	mg/L	1.0	1		07/23/17 11:21	14808-79-8	

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ANALYTICAL RESULTS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348626

Sample: MW-7R **Lab ID: 92348626002** Collected: 07/20/17 15:20 Received: 07/21/17 09:30 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP	Analytical Method: EPA 6010 Preparation Method: EPA 3010A							
Antimony	ND	ug/L	5.0	1	07/25/17 15:50	07/28/17 01:10	7440-36-0	
Arsenic	ND	ug/L	10.0	1	07/25/17 15:50	07/28/17 01:10	7440-38-2	
Barium	**50.1**	ug/L	5.0	1	07/25/17 15:50	07/28/17 01:10	7440-39-3	
Beryllium	ND	ug/L	1.0	1	07/25/17 15:50	07/28/17 01:10	7440-41-7	
Cadmium	ND	ug/L	1.0	1	07/25/17 15:50	07/28/17 20:41	7440-43-9	
Calcium	**87700**	ug/L	100	1	07/25/17 15:50	07/28/17 01:10	7440-70-2	
Chromium	**8.1**	ug/L	5.0	1	07/25/17 15:50	07/28/17 01:10	7440-47-3	
Cobalt	ND	ug/L	5.0	1	07/25/17 15:50	07/28/17 01:10	7440-48-4	
Copper	ND	ug/L	5.0	1	07/25/17 15:50	07/28/17 01:10	7440-50-8	
Lead	ND	ug/L	5.0	1	07/25/17 15:50	07/28/17 01:10	7439-92-1	
Molybdenum	**19.5**	ug/L	5.0	1	07/25/17 15:50	07/28/17 20:41	7439-98-7	
Nickel	ND	ug/L	5.0	1	07/25/17 15:50	07/28/17 01:10	7440-02-0	
Selenium	ND	ug/L	10.0	1	07/25/17 15:50	07/28/17 20:41	7782-49-2	
Silver	ND	ug/L	5.0	1	07/25/17 15:50	07/28/17 01:10	7440-22-4	
Vanadium	**17.6**	ug/L	5.0	1	07/25/17 15:50	07/28/17 01:10	7440-62-2	
Zinc	ND	ug/L	10.0	1	07/25/17 15:50	07/28/17 01:10	7440-66-6	
6020 MET ICPMS	Analytical Method: EPA 6020B Preparation Method: EPA 3010A							
Boron	**25.3**	ug/L	25.0	1	07/22/17 02:35	07/27/17 16:57	7440-42-8	
Lithium	**5.6**	ug/L	2.5	1	07/22/17 02:35	07/26/17 15:20	7439-93-2	
Thallium	**0.48**	ug/L	0.10	1	07/22/17 02:35	07/26/17 15:20	7440-28-0	
7470 Mercury	Analytical Method: EPA 7470 Preparation Method: EPA 7470							
Mercury	ND	ug/L	0.20	1	07/24/17 13:40	07/24/17 21:13	7439-97-6	
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
Acetone	ND	ug/L	25.0	1		07/23/17 10:29	67-64-1	
Acrylonitrile	ND	ug/L	10.0	1		07/23/17 10:29	107-13-1	
Benzene	ND	ug/L	1.0	1		07/23/17 10:29	71-43-2	
Bromochloromethane	ND	ug/L	1.0	1		07/23/17 10:29	74-97-5	
Bromodichloromethane	ND	ug/L	1.0	1		07/23/17 10:29	75-27-4	
Bromoform	ND	ug/L	1.0	1		07/23/17 10:29	75-25-2	
Bromomethane	ND	ug/L	2.0	1		07/23/17 10:29	74-83-9	
2-Butanone (MEK)	ND	ug/L	5.0	1		07/23/17 10:29	78-93-3	
Carbon disulfide	ND	ug/L	2.0	1		07/23/17 10:29	75-15-0	
Carbon tetrachloride	ND	ug/L	1.0	1		07/23/17 10:29	56-23-5	
Chlorobenzene	ND	ug/L	1.0	1		07/23/17 10:29	108-90-7	
Chloroethane	ND	ug/L	1.0	1		07/23/17 10:29	75-00-3	
Chloroform	ND	ug/L	1.0	1		07/23/17 10:29	67-66-3	
Chloromethane	ND	ug/L	1.0	1		07/23/17 10:29	74-87-3	
Dibromochloromethane	ND	ug/L	1.0	1		07/23/17 10:29	124-48-1	
Dibromomethane	ND	ug/L	1.0	1		07/23/17 10:29	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	1.0	1		07/23/17 10:29	95-50-1	
1,4-Dichlorobenzene	ND	ug/L	1.0	1		07/23/17 10:29	106-46-7	
trans-1,4-Dichloro-2-butene	ND	ug/L	1.0	1		07/23/17 10:29	110-57-6	
1,1-Dichloroethane	ND	ug/L	1.0	1		07/23/17 10:29	75-34-3	

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9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

ANALYTICAL RESULTS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348626

Sample: MW-7R **Lab ID: 92348626002** Collected: 07/20/17 15:20 Received: 07/21/17 09:30 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
1,2-Dichloroethane	ND	ug/L	1.0	1		07/23/17 10:29	107-06-2	
1,1-Dichloroethene	ND	ug/L	1.0	1		07/23/17 10:29	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	1.0	1		07/23/17 10:29	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	1.0	1		07/23/17 10:29	156-60-5	
1,2-Dichloropropane	ND	ug/L	1.0	1		07/23/17 10:29	78-87-5	
cis-1,3-Dichloropropene	ND	ug/L	1.0	1		07/23/17 10:29	10061-01-5	
trans-1,3-Dichloropropene	ND	ug/L	1.0	1		07/23/17 10:29	10061-02-6	
Ethylbenzene	ND	ug/L	1.0	1		07/23/17 10:29	100-41-4	
2-Hexanone	ND	ug/L	5.0	1		07/23/17 10:29	591-78-6	
Iodomethane	ND	ug/L	5.0	1		07/23/17 10:29	74-88-4	
Methylene Chloride	ND	ug/L	1.0	1		07/23/17 10:29	75-09-2	
4-Methyl-2-pentanone (MIBK)	ND	ug/L	5.0	1		07/23/17 10:29	108-10-1	
Styrene	ND	ug/L	1.0	1		07/23/17 10:29	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0	1		07/23/17 10:29	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0	1		07/23/17 10:29	79-34-5	
Tetrachloroethene	ND	ug/L	1.0	1		07/23/17 10:29	127-18-4	
Toluene	ND	ug/L	1.0	1		07/23/17 10:29	108-88-3	
1,1,1-Trichloroethane	ND	ug/L	1.0	1		07/23/17 10:29	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	1.0	1		07/23/17 10:29	79-00-5	
Trichloroethene	ND	ug/L	1.0	1		07/23/17 10:29	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0	1		07/23/17 10:29	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0	1		07/23/17 10:29	96-18-4	
Vinyl acetate	ND	ug/L	2.0	1		07/23/17 10:29	108-05-4	
Vinyl chloride	ND	ug/L	1.0	1		07/23/17 10:29	75-01-4	
Xylene (Total)	ND	ug/L	1.0	1		07/23/17 10:29	1330-20-7	
Surrogates								
4-Bromofluorobenzene (S)	103	%	70-130	1		07/23/17 10:29	460-00-4	
1,2-Dichloroethane-d4 (S)	110	%	70-130	1		07/23/17 10:29	17060-07-0	
Toluene-d8 (S)	106	%	70-130	1		07/23/17 10:29	2037-26-5	
2540C Total Dissolved Solids	Analytical Method: SM 2540C							
Total Dissolved Solids	**740**	mg/L	50.0	1		07/25/17 15:47		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0							
Chloride	**312**	mg/L	5.0	5		07/25/17 10:24	16887-00-6	
Fluoride	**0.32**	mg/L	0.10	1		07/24/17 16:12	16984-48-8	
Sulfate	**51.2**	mg/L	1.0	1		07/24/17 16:12	14808-79-8	M6

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(704)875-9092

ANALYTICAL RESULTS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348626

Sample: EQ BLANK **Lab ID: 92348626003** Collected: 07/20/17 08:00 Received: 07/21/17 09:30 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP	Analytical Method: EPA 6010 Preparation Method: EPA 3010A							
Antimony	ND	ug/L	5.0	1	07/25/17 15:50	07/28/17 01:13	7440-36-0	
Arsenic	ND	ug/L	10.0	1	07/25/17 15:50	07/28/17 01:13	7440-38-2	
Barium	ND	ug/L	5.0	1	07/25/17 15:50	07/28/17 01:13	7440-39-3	
Beryllium	ND	ug/L	1.0	1	07/25/17 15:50	07/28/17 01:13	7440-41-7	
Cadmium	ND	ug/L	1.0	1	07/25/17 15:50	07/28/17 01:13	7440-43-9	
Calcium	ND	ug/L	100	1	07/25/17 15:50	07/28/17 01:13	7440-70-2	
Chromium	ND	ug/L	5.0	1	07/25/17 15:50	07/28/17 01:13	7440-47-3	
Cobalt	ND	ug/L	5.0	1	07/25/17 15:50	07/28/17 01:13	7440-48-4	
Copper	ND	ug/L	5.0	1	07/25/17 15:50	07/28/17 01:13	7440-50-8	
Lead	ND	ug/L	5.0	1	07/25/17 15:50	07/28/17 01:13	7439-92-1	
Molybdenum	ND	ug/L	5.0	1	07/25/17 15:50	07/28/17 20:45	7439-98-7	
Nickel	ND	ug/L	5.0	1	07/25/17 15:50	07/28/17 01:13	7440-02-0	
Selenium	ND	ug/L	10.0	1	07/25/17 15:50	07/28/17 20:45	7782-49-2	
Silver	ND	ug/L	5.0	1	07/25/17 15:50	07/28/17 01:13	7440-22-4	
Vanadium	ND	ug/L	5.0	1	07/25/17 15:50	07/28/17 01:13	7440-62-2	
Zinc	ND	ug/L	10.0	1	07/25/17 15:50	07/28/17 01:13	7440-66-6	
6020 MET ICPMS	Analytical Method: EPA 6020B Preparation Method: EPA 3010A							
Boron	ND	ug/L	25.0	1	07/22/17 02:35	07/27/17 16:59	7440-42-8	
Lithium	ND	ug/L	2.5	1	07/22/17 02:35	07/26/17 15:22	7439-93-2	
Thallium	ND	ug/L	0.10	1	07/22/17 02:35	07/26/17 15:22	7440-28-0	
7470 Mercury	Analytical Method: EPA 7470 Preparation Method: EPA 7470							
Mercury	ND	ug/L	0.20	1	07/24/17 13:40	07/24/17 21:16	7439-97-6	
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
Acetone	ND	ug/L	25.0	1		07/23/17 10:46	67-64-1	
Acrylonitrile	ND	ug/L	10.0	1		07/23/17 10:46	107-13-1	
Benzene	ND	ug/L	1.0	1		07/23/17 10:46	71-43-2	
Bromochloromethane	ND	ug/L	1.0	1		07/23/17 10:46	74-97-5	
Bromodichloromethane	ND	ug/L	1.0	1		07/23/17 10:46	75-27-4	
Bromoform	ND	ug/L	1.0	1		07/23/17 10:46	75-25-2	
Bromomethane	ND	ug/L	2.0	1		07/23/17 10:46	74-83-9	
2-Butanone (MEK)	ND	ug/L	5.0	1		07/23/17 10:46	78-93-3	
Carbon disulfide	ND	ug/L	2.0	1		07/23/17 10:46	75-15-0	
Carbon tetrachloride	ND	ug/L	1.0	1		07/23/17 10:46	56-23-5	
Chlorobenzene	ND	ug/L	1.0	1		07/23/17 10:46	108-90-7	
Chloroethane	ND	ug/L	1.0	1		07/23/17 10:46	75-00-3	
Chloroform	ND	ug/L	1.0	1		07/23/17 10:46	67-66-3	
Chloromethane	ND	ug/L	1.0	1		07/23/17 10:46	74-87-3	
Dibromochloromethane	ND	ug/L	1.0	1		07/23/17 10:46	124-48-1	
Dibromomethane	ND	ug/L	1.0	1		07/23/17 10:46	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	1.0	1		07/23/17 10:46	95-50-1	
1,4-Dichlorobenzene	ND	ug/L	1.0	1		07/23/17 10:46	106-46-7	
trans-1,4-Dichloro-2-butene	ND	ug/L	1.0	1		07/23/17 10:46	110-57-6	
1,1-Dichloroethane	ND	ug/L	1.0	1		07/23/17 10:46	75-34-3	

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ANALYTICAL RESULTS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348626

Sample: EQ BLANK **Lab ID: 92348626003** Collected: 07/20/17 08:00 Received: 07/21/17 09:30 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
1,2-Dichloroethane	ND	ug/L	1.0	1		07/23/17 10:46	107-06-2	
1,1-Dichloroethene	ND	ug/L	1.0	1		07/23/17 10:46	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	1.0	1		07/23/17 10:46	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	1.0	1		07/23/17 10:46	156-60-5	
1,2-Dichloropropane	ND	ug/L	1.0	1		07/23/17 10:46	78-87-5	
cis-1,3-Dichloropropene	ND	ug/L	1.0	1		07/23/17 10:46	10061-01-5	
trans-1,3-Dichloropropene	ND	ug/L	1.0	1		07/23/17 10:46	10061-02-6	
Ethylbenzene	ND	ug/L	1.0	1		07/23/17 10:46	100-41-4	
2-Hexanone	ND	ug/L	5.0	1		07/23/17 10:46	591-78-6	
Iodomethane	ND	ug/L	5.0	1		07/23/17 10:46	74-88-4	
Methylene Chloride	ND	ug/L	1.0	1		07/23/17 10:46	75-09-2	
4-Methyl-2-pentanone (MIBK)	ND	ug/L	5.0	1		07/23/17 10:46	108-10-1	
Styrene	ND	ug/L	1.0	1		07/23/17 10:46	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0	1		07/23/17 10:46	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0	1		07/23/17 10:46	79-34-5	
Tetrachloroethene	ND	ug/L	1.0	1		07/23/17 10:46	127-18-4	
Toluene	ND	ug/L	1.0	1		07/23/17 10:46	108-88-3	
1,1,1-Trichloroethane	ND	ug/L	1.0	1		07/23/17 10:46	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	1.0	1		07/23/17 10:46	79-00-5	
Trichloroethene	ND	ug/L	1.0	1		07/23/17 10:46	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0	1		07/23/17 10:46	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0	1		07/23/17 10:46	96-18-4	
Vinyl acetate	ND	ug/L	2.0	1		07/23/17 10:46	108-05-4	
Vinyl chloride	ND	ug/L	1.0	1		07/23/17 10:46	75-01-4	
Xylene (Total)	ND	ug/L	1.0	1		07/23/17 10:46	1330-20-7	
Surrogates								
4-Bromofluorobenzene (S)	105	%	70-130	1		07/23/17 10:46	460-00-4	
1,2-Dichloroethane-d4 (S)	111	%	70-130	1		07/23/17 10:46	17060-07-0	
Toluene-d8 (S)	105	%	70-130	1		07/23/17 10:46	2037-26-5	
2540C Total Dissolved Solids	Analytical Method: SM 2540C							
Total Dissolved Solids	ND	mg/L	25.0	1		07/26/17 09:17		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0							
Chloride	ND	mg/L	1.0	1		07/24/17 17:05	16887-00-6	
Fluoride	ND	mg/L	0.10	1		07/24/17 17:05	16984-48-8	
Sulfate	ND	mg/L	1.0	1		07/24/17 17:05	14808-79-8	

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ANALYTICAL RESULTS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348626

Sample: AMB **Lab ID: 92348626004** Collected: 07/20/17 08:00 Received: 07/21/17 09:30 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP	Analytical Method: EPA 6010 Preparation Method: EPA 3010A							
Antimony	ND	ug/L	5.0	1	07/25/17 15:50	07/28/17 01:25	7440-36-0	
Arsenic	ND	ug/L	10.0	1	07/25/17 15:50	07/28/17 01:25	7440-38-2	
Barium	**5.2**	ug/L	5.0	1	07/25/17 15:50	07/28/17 01:25	7440-39-3	
Beryllium	ND	ug/L	1.0	1	07/25/17 15:50	07/28/17 01:25	7440-41-7	
Cadmium	ND	ug/L	1.0	1	07/25/17 15:50	07/28/17 01:25	7440-43-9	
Calcium	ND	ug/L	100	1	07/25/17 15:50	07/28/17 01:25	7440-70-2	
Chromium	ND	ug/L	5.0	1	07/25/17 15:50	07/28/17 01:25	7440-47-3	
Cobalt	ND	ug/L	5.0	1	07/25/17 15:50	07/28/17 01:25	7440-48-4	
Copper	ND	ug/L	5.0	1	07/25/17 15:50	07/28/17 01:25	7440-50-8	
Lead	ND	ug/L	5.0	1	07/25/17 15:50	07/28/17 01:25	7439-92-1	
Molybdenum	ND	ug/L	5.0	1	07/25/17 15:50	07/28/17 20:48	7439-98-7	
Nickel	ND	ug/L	5.0	1	07/25/17 15:50	07/28/17 01:25	7440-02-0	
Selenium	ND	ug/L	10.0	1	07/25/17 15:50	07/28/17 20:48	7782-49-2	
Silver	ND	ug/L	5.0	1	07/25/17 15:50	07/28/17 01:25	7440-22-4	
Vanadium	ND	ug/L	5.0	1	07/25/17 15:50	07/28/17 01:25	7440-62-2	
Zinc	ND	ug/L	10.0	1	07/25/17 15:50	07/28/17 01:25	7440-66-6	
6020 MET ICPMS	Analytical Method: EPA 6020B Preparation Method: EPA 3010A							
Boron	**40.4**	ug/L	25.0	1	07/22/17 02:35	07/27/17 17:00	7440-42-8	
Lithium	ND	ug/L	2.5	1	07/22/17 02:35	07/26/17 15:24	7439-93-2	
Thallium	ND	ug/L	0.10	1	07/22/17 02:35	07/26/17 15:24	7440-28-0	
7470 Mercury	Analytical Method: EPA 7470 Preparation Method: EPA 7470							
Mercury	ND	ug/L	0.20	1	07/24/17 13:40	07/24/17 21:18	7439-97-6	
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
Acetone	ND	ug/L	25.0	1		07/23/17 11:04	67-64-1	
Acrylonitrile	ND	ug/L	10.0	1		07/23/17 11:04	107-13-1	
Benzene	ND	ug/L	1.0	1		07/23/17 11:04	71-43-2	
Bromochloromethane	ND	ug/L	1.0	1		07/23/17 11:04	74-97-5	
Bromodichloromethane	ND	ug/L	1.0	1		07/23/17 11:04	75-27-4	
Bromoform	ND	ug/L	1.0	1		07/23/17 11:04	75-25-2	
Bromomethane	ND	ug/L	2.0	1		07/23/17 11:04	74-83-9	
2-Butanone (MEK)	ND	ug/L	5.0	1		07/23/17 11:04	78-93-3	
Carbon disulfide	ND	ug/L	2.0	1		07/23/17 11:04	75-15-0	
Carbon tetrachloride	ND	ug/L	1.0	1		07/23/17 11:04	56-23-5	
Chlorobenzene	ND	ug/L	1.0	1		07/23/17 11:04	108-90-7	
Chloroethane	ND	ug/L	1.0	1		07/23/17 11:04	75-00-3	
Chloroform	ND	ug/L	1.0	1		07/23/17 11:04	67-66-3	
Chloromethane	ND	ug/L	1.0	1		07/23/17 11:04	74-87-3	
Dibromochloromethane	ND	ug/L	1.0	1		07/23/17 11:04	124-48-1	
Dibromomethane	ND	ug/L	1.0	1		07/23/17 11:04	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	1.0	1		07/23/17 11:04	95-50-1	
1,4-Dichlorobenzene	ND	ug/L	1.0	1		07/23/17 11:04	106-46-7	
trans-1,4-Dichloro-2-butene	ND	ug/L	1.0	1		07/23/17 11:04	110-57-6	
1,1-Dichloroethane	ND	ug/L	1.0	1		07/23/17 11:04	75-34-3	

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ANALYTICAL RESULTS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348626

Sample: AMB **Lab ID: 92348626004** Collected: 07/20/17 08:00 Received: 07/21/17 09:30 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
1,2-Dichloroethane	ND	ug/L	1.0	1		07/23/17 11:04	107-06-2	
1,1-Dichloroethene	ND	ug/L	1.0	1		07/23/17 11:04	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	1.0	1		07/23/17 11:04	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	1.0	1		07/23/17 11:04	156-60-5	
1,2-Dichloropropane	ND	ug/L	1.0	1		07/23/17 11:04	78-87-5	
cis-1,3-Dichloropropene	ND	ug/L	1.0	1		07/23/17 11:04	10061-01-5	
trans-1,3-Dichloropropene	ND	ug/L	1.0	1		07/23/17 11:04	10061-02-6	
Ethylbenzene	ND	ug/L	1.0	1		07/23/17 11:04	100-41-4	
2-Hexanone	ND	ug/L	5.0	1		07/23/17 11:04	591-78-6	
Iodomethane	ND	ug/L	5.0	1		07/23/17 11:04	74-88-4	
Methylene Chloride	ND	ug/L	1.0	1		07/23/17 11:04	75-09-2	
4-Methyl-2-pentanone (MIBK)	ND	ug/L	5.0	1		07/23/17 11:04	108-10-1	
Styrene	ND	ug/L	1.0	1		07/23/17 11:04	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0	1		07/23/17 11:04	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0	1		07/23/17 11:04	79-34-5	
Tetrachloroethene	ND	ug/L	1.0	1		07/23/17 11:04	127-18-4	
Toluene	ND	ug/L	1.0	1		07/23/17 11:04	108-88-3	
1,1,1-Trichloroethane	ND	ug/L	1.0	1		07/23/17 11:04	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	1.0	1		07/23/17 11:04	79-00-5	
Trichloroethene	ND	ug/L	1.0	1		07/23/17 11:04	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0	1		07/23/17 11:04	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0	1		07/23/17 11:04	96-18-4	
Vinyl acetate	ND	ug/L	2.0	1		07/23/17 11:04	108-05-4	
Vinyl chloride	ND	ug/L	1.0	1		07/23/17 11:04	75-01-4	
Xylene (Total)	ND	ug/L	1.0	1		07/23/17 11:04	1330-20-7	
Surrogates								
4-Bromofluorobenzene (S)	103	%	70-130	1		07/23/17 11:04	460-00-4	
1,2-Dichloroethane-d4 (S)	112	%	70-130	1		07/23/17 11:04	17060-07-0	
Toluene-d8 (S)	106	%	70-130	1		07/23/17 11:04	2037-26-5	
2540C Total Dissolved Solids	Analytical Method: SM 2540C							
Total Dissolved Solids	ND	mg/L	25.0	1		07/26/17 09:18		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0							
Chloride	ND	mg/L	1.0	1		07/24/17 17:23	16887-00-6	
Fluoride	ND	mg/L	0.10	1		07/24/17 17:23	16984-48-8	
Sulfate	ND	mg/L	1.0	1		07/24/17 17:23	14808-79-8	

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ANALYTICAL RESULTS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348626

Sample: TRIP BLANK **Lab ID: 92348626005** Collected: 07/20/17 00:00 Received: 07/21/17 09:30 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
Acetone	ND	ug/L	25.0	1		07/23/17 11:21	67-64-1	
Acrylonitrile	ND	ug/L	10.0	1		07/23/17 11:21	107-13-1	
Benzene	ND	ug/L	1.0	1		07/23/17 11:21	71-43-2	
Bromochloromethane	ND	ug/L	1.0	1		07/23/17 11:21	74-97-5	
Bromodichloromethane	ND	ug/L	1.0	1		07/23/17 11:21	75-27-4	
Bromoform	ND	ug/L	1.0	1		07/23/17 11:21	75-25-2	
Bromomethane	ND	ug/L	2.0	1		07/23/17 11:21	74-83-9	
2-Butanone (MEK)	ND	ug/L	5.0	1		07/23/17 11:21	78-93-3	
Carbon disulfide	ND	ug/L	2.0	1		07/23/17 11:21	75-15-0	
Carbon tetrachloride	ND	ug/L	1.0	1		07/23/17 11:21	56-23-5	
Chlorobenzene	ND	ug/L	1.0	1		07/23/17 11:21	108-90-7	
Chloroethane	ND	ug/L	1.0	1		07/23/17 11:21	75-00-3	
Chloroform	ND	ug/L	1.0	1		07/23/17 11:21	67-66-3	
Chloromethane	ND	ug/L	1.0	1		07/23/17 11:21	74-87-3	
Dibromochloromethane	ND	ug/L	1.0	1		07/23/17 11:21	124-48-1	
Dibromomethane	ND	ug/L	1.0	1		07/23/17 11:21	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	1.0	1		07/23/17 11:21	95-50-1	
1,4-Dichlorobenzene	ND	ug/L	1.0	1		07/23/17 11:21	106-46-7	
trans-1,4-Dichloro-2-butene	ND	ug/L	1.0	1		07/23/17 11:21	110-57-6	
1,1-Dichloroethane	ND	ug/L	1.0	1		07/23/17 11:21	75-34-3	
1,2-Dichloroethane	ND	ug/L	1.0	1		07/23/17 11:21	107-06-2	
1,1-Dichloroethene	ND	ug/L	1.0	1		07/23/17 11:21	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	1.0	1		07/23/17 11:21	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	1.0	1		07/23/17 11:21	156-60-5	
1,2-Dichloropropane	ND	ug/L	1.0	1		07/23/17 11:21	78-87-5	
cis-1,3-Dichloropropene	ND	ug/L	1.0	1		07/23/17 11:21	10061-01-5	
trans-1,3-Dichloropropene	ND	ug/L	1.0	1		07/23/17 11:21	10061-02-6	
Ethylbenzene	ND	ug/L	1.0	1		07/23/17 11:21	100-41-4	
2-Hexanone	ND	ug/L	5.0	1		07/23/17 11:21	591-78-6	
Iodomethane	ND	ug/L	5.0	1		07/23/17 11:21	74-88-4	
Methylene Chloride	ND	ug/L	1.0	1		07/23/17 11:21	75-09-2	
4-Methyl-2-pentanone (MIBK)	ND	ug/L	5.0	1		07/23/17 11:21	108-10-1	
Styrene	ND	ug/L	1.0	1		07/23/17 11:21	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0	1		07/23/17 11:21	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0	1		07/23/17 11:21	79-34-5	
Tetrachloroethene	ND	ug/L	1.0	1		07/23/17 11:21	127-18-4	
Toluene	ND	ug/L	1.0	1		07/23/17 11:21	108-88-3	
1,1,1-Trichloroethane	ND	ug/L	1.0	1		07/23/17 11:21	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	1.0	1		07/23/17 11:21	79-00-5	
Trichloroethene	ND	ug/L	1.0	1		07/23/17 11:21	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0	1		07/23/17 11:21	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0	1		07/23/17 11:21	96-18-4	
Vinyl acetate	ND	ug/L	2.0	1		07/23/17 11:21	108-05-4	
Vinyl chloride	ND	ug/L	1.0	1		07/23/17 11:21	75-01-4	
Xylene (Total)	ND	ug/L	1.0	1		07/23/17 11:21	1330-20-7	
Surrogates								
4-Bromofluorobenzene (S)	101	%	70-130	1		07/23/17 11:21	460-00-4	

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ANALYTICAL RESULTS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348626

Sample: TRIP BLANK **Lab ID: 92348626005** Collected: 07/20/17 00:00 Received: 07/21/17 09:30 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level Landfill	Analytical Method: EPA 8260							
Surrogates								
1,2-Dichloroethane-d4 (S)	112	%	70-130	1		07/23/17 11:21	17060-07-0	
Toluene-d8 (S)	102	%	70-130	1		07/23/17 11:21	2037-26-5	

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QUALITY CONTROL DATA

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348626

QC Batch: 370238 Analysis Method: EPA 7470
QC Batch Method: EPA 7470 Analysis Description: 7470 Mercury
Associated Lab Samples: 92348626001, 92348626002, 92348626003, 92348626004

METHOD BLANK: 2051393 Matrix: Water
Associated Lab Samples: 92348626001, 92348626002, 92348626003, 92348626004

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Mercury	ug/L	ND	0.20	07/24/17 20:45	

LABORATORY CONTROL SAMPLE: 2051394

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Mercury	ug/L	2.5	2.5	101	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2051395 2051396

Parameter	Units	92348570001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Mercury	ug/L	ND	2.5	2.5	2.5	2.5	97	98	75-125	1	25	

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QUALITY CONTROL DATA

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348626

QC Batch: 370167 Analysis Method: EPA 6010
QC Batch Method: EPA 3010A Analysis Description: 6010 MET
Associated Lab Samples: 92348626001, 92348626002, 92348626003, 92348626004

METHOD BLANK: 2051154 Matrix: Water
Associated Lab Samples: 92348626001, 92348626002, 92348626003, 92348626004

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Antimony	ug/L	ND	5.0	07/28/17 00:33	
Arsenic	ug/L	ND	10.0	07/28/17 00:33	
Barium	ug/L	ND	5.0	07/28/17 00:33	
Beryllium	ug/L	ND	1.0	07/28/17 00:33	
Cadmium	ug/L	ND	1.0	07/28/17 00:33	
Calcium	ug/L	ND	100	07/28/17 00:33	
Chromium	ug/L	ND	5.0	07/28/17 00:33	
Cobalt	ug/L	ND	5.0	07/28/17 00:33	
Copper	ug/L	ND	5.0	07/28/17 00:33	
Lead	ug/L	ND	5.0	07/28/17 00:33	
Molybdenum	ug/L	ND	5.0	07/28/17 20:31	
Nickel	ug/L	ND	5.0	07/28/17 00:33	
Selenium	ug/L	ND	10.0	07/28/17 20:31	
Silver	ug/L	ND	5.0	07/28/17 00:33	
Vanadium	ug/L	ND	5.0	07/28/17 00:33	
Zinc	ug/L	ND	10.0	07/28/17 00:33	

LABORATORY CONTROL SAMPLE: 2051155

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Antimony	ug/L	500	503	101	80-120	
Arsenic	ug/L	500	452	90	80-120	
Barium	ug/L	500	489	98	80-120	
Beryllium	ug/L	500	457	91	80-120	
Cadmium	ug/L	500	492	98	80-120	
Calcium	ug/L	5000	4790	96	80-120	
Chromium	ug/L	500	458	92	80-120	
Cobalt	ug/L	500	477	95	80-120	
Copper	ug/L	500	476	95	80-120	
Lead	ug/L	500	470	94	80-120	
Molybdenum	ug/L	500	488	98	80-120	
Nickel	ug/L	500	473	95	80-120	
Selenium	ug/L	500	481	96	80-120	
Silver	ug/L	250	246	98	80-120	
Vanadium	ug/L	500	457	91	80-120	
Zinc	ug/L	500	470	94	80-120	

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QUALITY CONTROL DATA

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348626

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2051156 2051157

Parameter	Units	92348570001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Antimony	ug/L	ND	500	500	509	538	101	107	75-125	6	20	
Arsenic	ug/L	5.9J	500	500	461	494	91	98	75-125	7	20	
Barium	ug/L	87.6	500	500	568	599	96	102	75-125	5	20	
Beryllium	ug/L	ND	500	500	462	488	92	98	75-125	5	20	
Cadmium	ug/L	ND	500	500	490	522	98	104	75-125	6	20	
Calcium	ug/L	69600	5000	5000	71000	74600	29	102	75-125	5	20	M1
Chromium	ug/L	ND	500	500	454	485	90	97	75-125	7	20	
Cobalt	ug/L	ND	500	500	467	498	93	100	75-125	6	20	
Copper	ug/L	ND	500	500	480	510	96	102	75-125	6	20	
Lead	ug/L	ND	500	500	458	488	91	97	75-125	6	20	
Molybdenum	ug/L	22.7	500	500	520	560	100	108	75-125	7	20	
Nickel	ug/L	16.0	500	500	475	506	92	98	75-125	6	20	
Selenium	ug/L	5.1J	500	500	478	510	95	101	75-125	7	20	
Silver	ug/L	ND	250	250	245	261	98	104	75-125	6	20	
Vanadium	ug/L	ND	500	500	464	495	93	99	75-125	6	20	
Zinc	ug/L	32.8	500	500	488	519	91	97	75-125	6	20	

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QUALITY CONTROL DATA

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348626

QC Batch: 370115 Analysis Method: EPA 6020B
QC Batch Method: EPA 3010A Analysis Description: 6020 MET
Associated Lab Samples: 92348626001, 92348626002, 92348626003, 92348626004

METHOD BLANK: 2050929 Matrix: Water
Associated Lab Samples: 92348626001, 92348626002, 92348626003, 92348626004

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Boron	ug/L	ND	25.0	07/26/17 14:01	
Lithium	ug/L	ND	2.5	07/26/17 14:01	
Thallium	ug/L	ND	0.10	07/26/17 14:01	

LABORATORY CONTROL SAMPLE: 2050930

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Boron	ug/L	100	100	100	80-120	
Lithium	ug/L	100	103	103	80-120	
Thallium	ug/L	100	99.5	99	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2050931 2050932

Parameter	Units	92348609001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Boron	ug/L	5040	100	100	5040	5100	-7	55	75-125	1	20	M1
Lithium	ug/L	19.0	100	100	116	115	97	96	75-125	1	20	
Thallium	ug/L	ND	100	100	123	95.8	123	96	75-125	25	20	R1

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QUALITY CONTROL DATA

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348626

QC Batch: 370146 Analysis Method: EPA 8260
QC Batch Method: EPA 8260 Analysis Description: 8260 MSV Low Level Landfill
Associated Lab Samples: 92348626001, 92348626002, 92348626003, 92348626004, 92348626005

METHOD BLANK: 2051100 Matrix: Water
Associated Lab Samples: 92348626001, 92348626002, 92348626003, 92348626004, 92348626005

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
1,1,1,2-Tetrachloroethane	ug/L	ND	1.0	07/23/17 07:17	
1,1,1-Trichloroethane	ug/L	ND	1.0	07/23/17 07:17	
1,1,2,2-Tetrachloroethane	ug/L	ND	1.0	07/23/17 07:17	
1,1,2-Trichloroethane	ug/L	ND	1.0	07/23/17 07:17	
1,1-Dichloroethane	ug/L	ND	1.0	07/23/17 07:17	
1,1-Dichloroethene	ug/L	ND	1.0	07/23/17 07:17	
1,2,3-Trichloropropane	ug/L	ND	1.0	07/23/17 07:17	
1,2-Dichlorobenzene	ug/L	ND	1.0	07/23/17 07:17	
1,2-Dichloroethane	ug/L	ND	1.0	07/23/17 07:17	
1,2-Dichloropropane	ug/L	ND	1.0	07/23/17 07:17	
1,4-Dichlorobenzene	ug/L	ND	1.0	07/23/17 07:17	
2-Butanone (MEK)	ug/L	ND	5.0	07/23/17 07:17	
2-Hexanone	ug/L	ND	5.0	07/23/17 07:17	
4-Methyl-2-pentanone (MIBK)	ug/L	ND	5.0	07/23/17 07:17	
Acetone	ug/L	ND	25.0	07/23/17 07:17	
Acrylonitrile	ug/L	ND	10.0	07/23/17 07:17	
Benzene	ug/L	ND	1.0	07/23/17 07:17	
Bromochloromethane	ug/L	ND	1.0	07/23/17 07:17	
Bromodichloromethane	ug/L	ND	1.0	07/23/17 07:17	
Bromoform	ug/L	ND	1.0	07/23/17 07:17	
Bromomethane	ug/L	ND	2.0	07/23/17 07:17	
Carbon disulfide	ug/L	ND	2.0	07/23/17 07:17	
Carbon tetrachloride	ug/L	ND	1.0	07/23/17 07:17	
Chlorobenzene	ug/L	ND	1.0	07/23/17 07:17	
Chloroethane	ug/L	ND	1.0	07/23/17 07:17	
Chloroform	ug/L	ND	1.0	07/23/17 07:17	
Chloromethane	ug/L	ND	1.0	07/23/17 07:17	
cis-1,2-Dichloroethene	ug/L	ND	1.0	07/23/17 07:17	
cis-1,3-Dichloropropene	ug/L	ND	1.0	07/23/17 07:17	
Dibromochloromethane	ug/L	ND	1.0	07/23/17 07:17	
Dibromomethane	ug/L	ND	1.0	07/23/17 07:17	
Ethylbenzene	ug/L	ND	1.0	07/23/17 07:17	
Iodomethane	ug/L	ND	5.0	07/23/17 07:17	
Methylene Chloride	ug/L	ND	1.0	07/23/17 07:17	
Styrene	ug/L	ND	1.0	07/23/17 07:17	
Tetrachloroethene	ug/L	ND	1.0	07/23/17 07:17	
Toluene	ug/L	ND	1.0	07/23/17 07:17	
trans-1,2-Dichloroethene	ug/L	ND	1.0	07/23/17 07:17	
trans-1,3-Dichloropropene	ug/L	ND	1.0	07/23/17 07:17	
trans-1,4-Dichloro-2-butene	ug/L	ND	1.0	07/23/17 07:17	
Trichloroethene	ug/L	ND	1.0	07/23/17 07:17	

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QUALITY CONTROL DATA

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348626

METHOD BLANK: 2051100 Matrix: Water
Associated Lab Samples: 92348626001, 92348626002, 92348626003, 92348626004, 92348626005

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Trichlorofluoromethane	ug/L	ND	1.0	07/23/17 07:17	
Vinyl acetate	ug/L	ND	2.0	07/23/17 07:17	
Vinyl chloride	ug/L	ND	1.0	07/23/17 07:17	
Xylene (Total)	ug/L	ND	1.0	07/23/17 07:17	
1,2-Dichloroethane-d4 (S)	%	107	70-130	07/23/17 07:17	
4-Bromofluorobenzene (S)	%	106	70-130	07/23/17 07:17	
Toluene-d8 (S)	%	106	70-130	07/23/17 07:17	

LABORATORY CONTROL SAMPLE: 2051101

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
1,1,1,2-Tetrachloroethane	ug/L	50	47.6	95	80-125	
1,1,1-Trichloroethane	ug/L	50	49.7	99	71-129	
1,1,2,2-Tetrachloroethane	ug/L	50	52.9	106	79-124	
1,1,2-Trichloroethane	ug/L	50	52.2	104	85-125	
1,1-Dichloroethane	ug/L	50	52.4	105	73-126	
1,1-Dichloroethene	ug/L	50	53.0	106	66-135	
1,2,3-Trichloropropane	ug/L	50	53.3	107	75-130	
1,2-Dichlorobenzene	ug/L	50	47.2	94	80-133	
1,2-Dichloroethane	ug/L	50	50.5	101	67-128	
1,2-Dichloropropane	ug/L	50	53.5	107	75-132	
1,4-Dichlorobenzene	ug/L	50	46.8	94	78-130	
2-Butanone (MEK)	ug/L	100	124	124	61-144	
2-Hexanone	ug/L	100	128	128	68-143	
4-Methyl-2-pentanone (MIBK)	ug/L	100	124	124	72-135	
Acetone	ug/L	100	134	134	48-146	
Acrylonitrile	ug/L	250	300	120	40-160	
Benzene	ug/L	50	53.3	107	80-125	
Bromochloromethane	ug/L	50	52.9	106	71-125	
Bromodichloromethane	ug/L	50	52.3	105	78-124	
Bromoform	ug/L	50	39.1	78	71-128	
Bromomethane	ug/L	50	56.3	113	40-160	
Carbon disulfide	ug/L	50	52.5	105	50-160	
Carbon tetrachloride	ug/L	50	45.9	92	69-131	
Chlorobenzene	ug/L	50	49.0	98	81-122	
Chloroethane	ug/L	50	45.2	90	39-148	
Chloroform	ug/L	50	51.8	104	73-127	
Chloromethane	ug/L	50	53.5	107	44-146	
cis-1,2-Dichloroethene	ug/L	50	51.2	102	74-124	
cis-1,3-Dichloropropene	ug/L	50	54.2	108	72-132	
Dibromochloromethane	ug/L	50	48.3	97	78-125	
Dibromomethane	ug/L	50	49.5	99	82-120	
Ethylbenzene	ug/L	50	48.6	97	79-121	
Iodomethane	ug/L	100	99.8	100	39-154	

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QUALITY CONTROL DATA

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348626

LABORATORY CONTROL SAMPLE: 2051101

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Methylene Chloride	ug/L	50	52.4	105	64-133	
Styrene	ug/L	50	49.7	99	84-126	
Tetrachloroethene	ug/L	50	44.3	89	78-122	
Toluene	ug/L	50	49.9	100	80-121	
trans-1,2-Dichloroethene	ug/L	50	52.1	104	71-127	
trans-1,3-Dichloropropene	ug/L	50	51.9	104	69-141	
trans-1,4-Dichloro-2-butene	ug/L	50	48.0	96	40-160	
Trichloroethene	ug/L	50	49.5	99	78-122	
Trichlorofluoromethane	ug/L	50	49.9	100	53-137	
Vinyl acetate	ug/L	100	117	117	40-160	
Vinyl chloride	ug/L	50	49.4	99	58-137	
Xylene (Total)	ug/L	150	143	95	81-126	
1,2-Dichloroethane-d4 (S)	%			104	70-130	
4-Bromofluorobenzene (S)	%			100	70-130	
Toluene-d8 (S)	%			100	70-130	

MATRIX SPIKE SAMPLE: 2051102

Parameter	Units	92348512001 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
1,1,1,2-Tetrachloroethane	ug/L	ND	20	19.6	98	70-130	
1,1,1-Trichloroethane	ug/L	ND	20	24.8	124	70-130	
1,1,2,2-Tetrachloroethane	ug/L	ND	20	22.3	111	70-130	
1,1,2-Trichloroethane	ug/L	ND	20	22.8	114	70-130	
1,1-Dichloroethane	ug/L	ND	20	25.5	127	70-130	
1,1-Dichloroethene	ug/L	ND	20	27.7	139	70-166	
1,2,3-Trichloropropane	ug/L	ND	20	24.1	120	70-130	
1,2-Dichlorobenzene	ug/L	ND	20	19.7	98	70-130	
1,2-Dichloroethane	ug/L	ND	20	25.7	129	70-130	
1,2-Dichloropropane	ug/L	ND	20	23.7	118	70-130	
1,4-Dichlorobenzene	ug/L	ND	20	20.1	100	70-130	
2-Butanone (MEK)	ug/L	ND	40	55.3	138	70-130	M1
2-Hexanone	ug/L	ND	40	56.3	141	70-130	M1
4-Methyl-2-pentanone (MIBK)	ug/L	ND	40	54.9	137	70-130	M1
Acetone	ug/L	ND	40	68.1	170	70-130	M1
Acrylonitrile	ug/L	ND	100	145	145	70-130	M1
Benzene	ug/L	ND	20	24.4	122	70-148	
Bromochloromethane	ug/L	ND	20	25.5	127	70-130	
Bromodichloromethane	ug/L	ND	20	23.3	117	70-130	
Bromoform	ug/L	ND	20	15.2	76	70-130	
Bromomethane	ug/L	ND	20	26.1	131	70-130	M1
Carbon disulfide	ug/L	ND	20	27.4	137	70-130	M1
Carbon tetrachloride	ug/L	ND	20	21.5	108	70-130	
Chlorobenzene	ug/L	ND	20	22.1	110	70-146	
Chloroethane	ug/L	ND	20	24.6	123	70-130	
Chloroform	ug/L	ND	20	25.0	125	70-130	

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QUALITY CONTROL DATA

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348626

MATRIX SPIKE SAMPLE: 2051102

Parameter	Units	92348512001 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Chloromethane	ug/L	ND	20	29.4	147	70-130	M1
cis-1,2-Dichloroethene	ug/L	ND	20	26.6	133	70-130	M1
cis-1,3-Dichloropropene	ug/L	ND	20	21.5	107	70-130	
Dibromochloromethane	ug/L	ND	20	20.0	100	70-130	
Dibromomethane	ug/L	ND	20	21.3	106	70-130	
Ethylbenzene	ug/L	ND	20	22.2	111	70-130	
Iodomethane	ug/L	ND	40	45.0	112	70-130	
Methylene Chloride	ug/L	ND	20	24.7	123	70-130	
Styrene	ug/L	ND	20	22.3	111	70-130	
Tetrachloroethene	ug/L	ND	20	19.3	97	70-130	
Toluene	ug/L	ND	20	23.2	116	70-155	
trans-1,2-Dichloroethene	ug/L	ND	20	26.6	133	70-130	M1
trans-1,3-Dichloropropene	ug/L	ND	20	20.2	101	70-130	
trans-1,4-Dichloro-2-butene	ug/L	ND	20	18.7	93	70-130	
Trichloroethene	ug/L	ND	20	22.0	110	69-151	
Trichlorofluoromethane	ug/L	ND	20	23.7	119	70-130	
Vinyl acetate	ug/L	ND	40	40.0	100	70-130	
Vinyl chloride	ug/L	ND	20	25.2	126	70-130	
1,2-Dichloroethane-d4 (S)	%				115	70-130	
4-Bromofluorobenzene (S)	%				104	70-130	
Toluene-d8 (S)	%				99	70-130	

SAMPLE DUPLICATE: 2051103

Parameter	Units	92348512002 Result	Dup Result	RPD	Max RPD	Qualifiers
1,1,1,2-Tetrachloroethane	ug/L	ND	ND		30	
1,1,1-Trichloroethane	ug/L	ND	ND		30	
1,1,2,2-Tetrachloroethane	ug/L	ND	ND		30	
1,1,2-Trichloroethane	ug/L	ND	ND		30	
1,1-Dichloroethane	ug/L	ND	ND		30	
1,1-Dichloroethene	ug/L	ND	ND		30	
1,2,3-Trichloropropane	ug/L	ND	ND		30	
1,2-Dichlorobenzene	ug/L	ND	ND		30	
1,2-Dichloroethane	ug/L	ND	ND		30	
1,2-Dichloropropane	ug/L	ND	ND		30	
1,4-Dichlorobenzene	ug/L	ND	ND		30	
2-Butanone (MEK)	ug/L	ND	ND		30	
2-Hexanone	ug/L	ND	ND		30	
4-Methyl-2-pentanone (MIBK)	ug/L	ND	ND		30	
Acetone	ug/L	ND	ND		30	
Acrylonitrile	ug/L	ND	ND		30	
Benzene	ug/L	ND	ND		30	
Bromochloromethane	ug/L	ND	ND		30	
Bromodichloromethane	ug/L	ND	ND		30	
Bromoform	ug/L	ND	ND		30	

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QUALITY CONTROL DATA

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348626

SAMPLE DUPLICATE: 2051103

Parameter	Units	92348512002 Result	Dup Result	RPD	Max RPD	Qualifiers
Bromomethane	ug/L	ND	ND		30	
Carbon disulfide	ug/L	ND	ND		30	
Carbon tetrachloride	ug/L	ND	ND		30	
Chlorobenzene	ug/L	ND	ND		30	
Chloroethane	ug/L	ND	ND		30	
Chloroform	ug/L	ND	ND		30	
Chloromethane	ug/L	ND	ND		30	
cis-1,2-Dichloroethene	ug/L	ND	ND		30	
cis-1,3-Dichloropropene	ug/L	ND	ND		30	
Dibromochloromethane	ug/L	ND	ND		30	
Dibromomethane	ug/L	ND	ND		30	
Ethylbenzene	ug/L	ND	ND		30	
Iodomethane	ug/L	ND	ND		30	
Methylene Chloride	ug/L	ND	ND		30	
Styrene	ug/L	ND	ND		30	
Tetrachloroethene	ug/L	ND	ND		30	
Toluene	ug/L	ND	ND		30	
trans-1,2-Dichloroethene	ug/L	ND	ND		30	
trans-1,3-Dichloropropene	ug/L	ND	ND		30	
trans-1,4-Dichloro-2-butene	ug/L	ND	ND		30	
Trichloroethene	ug/L	ND	ND		30	
Trichlorofluoromethane	ug/L	ND	ND		30	
Vinyl acetate	ug/L	ND	ND		30	
Vinyl chloride	ug/L	ND	ND		30	
Xylene (Total)	ug/L	ND	ND		30	
1,2-Dichloroethane-d4 (S)	%	111	110	1		
4-Bromofluorobenzene (S)	%	103	103	1		
Toluene-d8 (S)	%	107	107	0		

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QUALITY CONTROL DATA

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348626

QC Batch: 370480 Analysis Method: SM 2540C
QC Batch Method: SM 2540C Analysis Description: 2540C Total Dissolved Solids
Associated Lab Samples: 92348626001, 92348626002

METHOD BLANK: 2052825 Matrix: Water
Associated Lab Samples: 92348626001, 92348626002

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Total Dissolved Solids	mg/L	ND	25.0	07/25/17 15:37	

LABORATORY CONTROL SAMPLE: 2052826

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Total Dissolved Solids	mg/L	250	238	95	90-110	

SAMPLE DUPLICATE: 2052827

Parameter	Units	92348566008 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	932	972	4	5	

SAMPLE DUPLICATE: 2052828

Parameter	Units	92348566018 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	ND	ND		5	

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QUALITY CONTROL DATA

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348626

QC Batch: 370562 Analysis Method: SM 2540C
QC Batch Method: SM 2540C Analysis Description: 2540C Total Dissolved Solids
Associated Lab Samples: 92348626003, 92348626004

METHOD BLANK: 2053307 Matrix: Water
Associated Lab Samples: 92348626003, 92348626004

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Total Dissolved Solids	mg/L	ND	25.0	07/26/17 09:16	

LABORATORY CONTROL SAMPLE: 2053308

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Total Dissolved Solids	mg/L	250	242	97	90-110	

SAMPLE DUPLICATE: 2053309

Parameter	Units	92348626003 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	ND	ND		5	

SAMPLE DUPLICATE: 2053310

Parameter	Units	92348850009 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	256	261	2	5	

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QUALITY CONTROL DATA

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348626

QC Batch: 370139
QC Batch Method: EPA 300.0
Analysis Method: EPA 300.0
Analysis Description: 300.0 IC Anions
Associated Lab Samples: 92348626001

METHOD BLANK: 2051076 Matrix: Water
Associated Lab Samples: 92348626001

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Chloride	mg/L	ND	1.0	07/23/17 01:13	
Fluoride	mg/L	ND	0.10	07/23/17 01:13	
Sulfate	mg/L	ND	1.0	07/23/17 01:13	

LABORATORY CONTROL SAMPLE: 2051077

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Chloride	mg/L	50	48.0	96	90-110	
Fluoride	mg/L	2.5	2.3	91	90-110	
Sulfate	mg/L	50	47.3	95	90-110	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2051078 2051079

Parameter	Units	92348701001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Chloride	mg/L	17.3	50	50	66.6	73.7	99	113	90-110	10	10	M1
Fluoride	mg/L	0.19	2.5	2.5	2.6	3.1	95	115	90-110	18	10	M1,R1
Sulfate	mg/L	54.5	50	50	114	117	118	124	90-110	3	10	M1

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2051080 2051081

Parameter	Units	92348330001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Chloride	mg/L	1.9	50	50	51.1	51.5	98	99	90-110	1	10	
Fluoride	mg/L	0.17	2.5	2.5	2.5	2.6	95	95	90-110	0	10	
Sulfate	mg/L	9.2	50	50	58.0	58.1	98	98	90-110	0	10	

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QUALITY CONTROL DATA

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348626

QC Batch: 370260 Analysis Method: EPA 300.0
QC Batch Method: EPA 300.0 Analysis Description: 300.0 IC Anions
Associated Lab Samples: 92348626002, 92348626003, 92348626004

METHOD BLANK: 2051535 Matrix: Water
Associated Lab Samples: 92348626002, 92348626003, 92348626004

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Chloride	mg/L	ND	1.0	07/24/17 15:36	
Fluoride	mg/L	ND	0.10	07/24/17 15:36	
Sulfate	mg/L	ND	1.0	07/24/17 15:36	

LABORATORY CONTROL SAMPLE: 2051536

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Chloride	mg/L	50	49.2	98	90-110	
Fluoride	mg/L	2.5	2.3	92	90-110	
Sulfate	mg/L	50	48.4	97	90-110	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2051537 2051538

Parameter	Units	92348626002 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Chloride	mg/L	312	50	50	362	360	101	96	90-110	1	10	
Fluoride	mg/L	0.32	2.5	2.5	2.7	2.8	94	98	90-110	4	10	
Sulfate	mg/L	51.2	50	50	99.2	110	96	117	90-110	10	10	M6

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2051539 2051540

Parameter	Units	92348528008 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Chloride	mg/L	382	50	50	474	481	184	198	90-110	2	10	M6
Fluoride	mg/L	0.12	2.5	2.5	2.5	2.5	95	95	90-110	0	10	
Sulfate	mg/L	22.5	50	50	71.5	71.4	98	98	90-110	0	10	

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348626

Sample: MW-4 **Lab ID: 92348626001** Collected: 07/20/17 09:55 Received: 07/21/17 09:30 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**0.684 ± 0.412 (0.168) C:NA T:91%**	pCi/L	08/10/17 22:01	13982-63-3	
Radium-228	EPA 904.0	**0.819 ± 0.404 (0.714) C:79% T:93%**	pCi/L	08/10/17 15:59	15262-20-1	

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348626

Sample: MW-7R **Lab ID: 92348626002** Collected: 07/20/17 15:20 Received: 07/21/17 09:30 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**-0.059 ± 0.271 (0.638) C:NA T:94%**	pCi/L	08/10/17 22:01	13982-63-3	
Radium-228	EPA 904.0	**0.585 ± 0.402 (0.770) C:76% T:77%**	pCi/L	08/10/17 15:59	15262-20-1	

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348626

Sample: EQ BLANK **Lab ID: 92348626003** Collected: 07/20/17 08:00 Received: 07/21/17 09:30 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**0.193 ± 0.488 (0.906) C:NA T:94%**	pCi/L	08/10/17 22:22	13982-63-3	
Radium-228	EPA 904.0	**0.597 ± 0.422 (0.816) C:77% T:72%**	pCi/L	08/10/17 15:59	15262-20-1	

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348626

Sample: AMB **Lab ID: 92348626004** Collected: 07/20/17 08:00 Received: 07/21/17 09:30 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**-0.058 ± 0.375 (0.814) C:NA T:101%**	pCi/L	08/10/17 22:22	13982-63-3	
Radium-228	EPA 904.0	**0.651 ± 0.361 (0.643) C:75% T:85%**	pCi/L	08/10/17 15:59	15262-20-1	

REPORT OF LABORATORY ANALYSIS

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Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

QUALITY CONTROL - RADIOCHEMISTRY

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348626

QC Batch: 266760 Analysis Method: EPA 904.0
QC Batch Method: EPA 904.0 Analysis Description: 904.0 Radium 228
Associated Lab Samples: 92348626001, 92348626002, 92348626003, 92348626004

METHOD BLANK: 1313661 Matrix: Water
Associated Lab Samples: 92348626001, 92348626002, 92348626003, 92348626004

Parameter	Act ± Unc (MDC) Carr Trac	Units	Analyzed	Qualifiers
Radium-228	0.976 ± 0.455 (0.770) C:74% T:81%	pCi/L	08/10/17 11:33	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

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(704)875-9092

QUALITY CONTROL - RADIOCHEMISTRY

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348626

QC Batch: 266759 Analysis Method: EPA 903.1
QC Batch Method: EPA 903.1 Analysis Description: 903.1 Radium-226
Associated Lab Samples: 92348626001, 92348626002, 92348626003, 92348626004

METHOD BLANK: 1313660 Matrix: Water
Associated Lab Samples: 92348626001, 92348626002, 92348626003, 92348626004

Parameter	Act ± Unc (MDC) Carr Trac	Units	Analyzed	Qualifiers
Radium-226	0.121 ± 0.277 (0.447) C:NA T:93%	pCi/L	08/10/17 21:26	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

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Huntersville, NC 28078
(704)875-9092

QUALIFIERS

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348626

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above adjusted reporting limit.

TNTC - Too Numerous To Count

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

Acid preservation may not be appropriate for 2 Chloroethylvinyl ether.

A separate vial preserved to a pH of 4-5 is recommended in SW846 Chapter 4 for the analysis of Acrolein and Acrylonitrile by EPA Method 8260.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Act - Activity

Unc - Uncertainty: SDWA = 1.96 sigma count uncertainty, all other matrices = Expanded Uncertainty (95% confidence interval). Gamma Spec = Expanded Uncertainty (95.4% Confidence Interval)

(MDC) - Minimum Detectable Concentration

Trac - Tracer Recovery (%)

Carr - Carrier Recovery (%)

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

LABORATORIES

PASI-A	Pace Analytical Services - Asheville
PASI-C	Pace Analytical Services - Charlotte
PASI-PA	Pace Analytical Services - Greensburg

ANALYTE QUALIFIERS

M1	Matrix spike recovery exceeded QC limits. Batch accepted based on laboratory control sample (LCS) recovery.
M6	Matrix spike and Matrix spike duplicate recovery not evaluated against control limits due to sample dilution.
R1	RPD value was outside control limits.

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9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: CHARRAH-BRICKHAVEN
Pace Project No.: 92348626

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
92348626001	**MW-4**	EPA 3010A	370167	EPA 6010	370841
92348626002	**MW-7R**	EPA 3010A	370167	EPA 6010	370841
92348626003	**EQ BLANK**	EPA 3010A	370167	EPA 6010	370841
92348626004	**AMB**	EPA 3010A	370167	EPA 6010	370841
92348626001	**MW-4**	EPA 3010A	370115	EPA 6020B	370251
92348626002	**MW-7R**	EPA 3010A	370115	EPA 6020B	370251
92348626003	**EQ BLANK**	EPA 3010A	370115	EPA 6020B	370251
92348626004	**AMB**	EPA 3010A	370115	EPA 6020B	370251
92348626001	**MW-4**	EPA 7470	370238	EPA 7470	370301
92348626002	**MW-7R**	EPA 7470	370238	EPA 7470	370301
92348626003	**EQ BLANK**	EPA 7470	370238	EPA 7470	370301
92348626004	**AMB**	EPA 7470	370238	EPA 7470	370301
92348626001	**MW-4**	EPA 8260	370146		
92348626002	**MW-7R**	EPA 8260	370146		
92348626003	**EQ BLANK**	EPA 8260	370146		
92348626004	**AMB**	EPA 8260	370146		
92348626005	**TRIP BLANK**	EPA 8260	370146		
92348626001	**MW-4**	EPA 903.1	266759		
92348626002	**MW-7R**	EPA 903.1	266759		
92348626003	**EQ BLANK**	EPA 903.1	266759		
92348626004	**AMB**	EPA 903.1	266759		
92348626001	**MW-4**	EPA 904.0	266760		
92348626002	**MW-7R**	EPA 904.0	266760		
92348626003	**EQ BLANK**	EPA 904.0	266760		
92348626004	**AMB**	EPA 904.0	266760		
92348626001	**MW-4**	SM 2540C	370480		
92348626002	**MW-7R**	SM 2540C	370480		
92348626003	**EQ BLANK**	SM 2540C	370562		
92348626004	**AMB**	SM 2540C	370562		
92348626001	**MW-4**	EPA 300.0	370139		
92348626002	**MW-7R**	EPA 300.0	370260		
92348626003	**EQ BLANK**	EPA 300.0	370260		
92348626004	**AMB**	EPA 300.0	370260		

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Laboratory receiving samples:
Asheville ☐ Eden ☐ Greenwood ☐ Huntersville ☒ Raleigh ☐ Mechanicsville ☐

Sample Condition Upon Receipt

Client Name: HDR Engineering Project #:

WO# : 92348626

92348626

Courier: ☐ Commercial ☐ Fed Ex ☒ Pace ☐ UPS ☐ USPS ☐ Other:____ ☐ Client

Custody Seal Present? ☐ Yes ☒ No Seals Intact? ☐ Yes ☒ No

Date/Initials Person Examining Contents: RP 7/21/17

Packing Material: ☐ Bubble Wrap ☒ Bubble Bags ☐ None ☐ Other:____

Thermometer: ☐ IR Gun ID: T1603 Type of Ice: ☒ Wet ☐ Blue ☐ None ☐ Samples on ice, cooling process has begun

Correction Factor: Cooler Temp Corrected (°C): 3.0 Biological Tissue Frozen? ☐ Yes ☒ No ☐ N/A

Temp should be above freezing to 6°C

USDA Regulated Soil (☐ N/A, water sample)

Did samples originate in a quarantine zone within the United States: CA, NY, or SC (check maps)? ☐ Yes ☒ No

Did samples originate from a foreign source (internationally, including Hawaii and Puerto Rico)? ☐ Yes ☒ No

				Comments/Discrepancy:
Chain of Custody Present?	☒ Yes	☐ No	☐ N/A	1.
Samples Arrived within Hold Time?	☒ Yes	☐ No	☐ N/A	2.
Short Hold Time Analysis (<72 hr.)?	☐ Yes	☒ No	☐ N/A	3.
Rush Turn Around Time Requested?	☐ Yes	☒ No	☐ N/A	4.
Sufficient Volume?	☒ Yes	☐ No	☐ N/A	5.
Correct Containers Used?	☒ Yes	☐ No	☐ N/A	6.
-Pace Containers Used?	☒ Yes	☐ No	☐ N/A	
Containers Intact?	☒ Yes	☐ No	☐ N/A	7.
Samples Field Filtered?	☐ Yes	☒ No	☐ N/A	8. Note if sediment is visible in the dissolved container
Sample Labels Match COC? -Includes Date/Time/ID/Analysis Matrix: Water	☐ Yes	☒ No	☐ N/A	9. ① ID - AMB - TIME on COC - 8:00 Sample 1500
Headspace in VOA Vials (>5-6mm)?	☐ Yes	☒ No	☐ N/A	10. ② Equip. Blank - sulfide bottle No ID, NO TIME, No Date as per COC
Trip Blank Present?	☒ Yes	☐ No	☐ N/A	11. ③ Metal Bottle-COC - NO TIME as per COC same ID
Trip Blank Custody Seals Present?	☒ Yes	☐ No	☐ N/A	

CLIENT NOTIFICATION/RESOLUTION Field Data Required? ☐ Yes ☐ No

Person Contacted: _____ Date/Time: _____

Comments/Sample Discrepancy: _____

Project Manager SCURF Review: JY Date: 7/24/17

Project Manager SRF Review: JY Date: 7/24/17

Note: Whenever there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office (i.e. Out of hold, incorrect preservative, out of temp, incorrect containers)

10-357429

Pace Analytical®

Document Name: Sample Condition Upon Receipt(SCUR)	Document Revised: Sept. 21, 2016 Page 2 of 2
Document No.: F-CAR-CS-033-Rev.01	Issuing Authority: Pace Quality Office

*Check mark top half of box if pH and/or dechlorination is verified and within the acceptance range for preservation samples.

**Bottom half of box is to list number of bottles

Project # **WO#: 92348626**

PM: KRG Due Date: 07/28/17

CLIENT: 92-HDR

Item#	BP4U-125 mL Plastic Unpreserved (N/A) (Cl-)	BP3U-250 mL Plastic Unpreserved (N/A)	BP2U-500 mL Plastic Unpreserved (N/A)	BP1U-1 liter Plastic Unpreserved (N/A)	BP3S-250 mL Plastic H2SO4 (pH < 2) (Cl-)	BP3N-250 mL plastic HNO3 (pH < 2)	BP3Z-250 mL Plastic ZN Acetate & NaOH (>9)	BP3C-250 mL Plastic NaOH (pH > 12) (Cl-)	WGFU-Wide-mouthed Glass jar Unpreserved	AG1U-1 liter Amber Unpreserved (N/A) (Cl-)	AG1H-1 liter Amber HCl (pH < 2)	AG3U-250 mL Amber Unpreserved (N/A) (Cl-)	AG1S-1 liter Amber H2SO4 (pH < 2)	AG3S-250 mL Amber H2SO4 (pH < 2)	AG3A(DG3A)-250 mL Amber NH4Cl (N/A)(Cl-)	DG9H-40 mL VOA HCl (N/A)	VG9T-40 mL VOA Na2S2O3 (N/A)	VG9U-40 mL VOA Unp (N/A)	DG9P-40 mL VOA H3PO4 (N/A)	VOAK (6 vials per kit)-5035 kit (N/A)	V/GK (3 vials per kit)-VPH/Gas kit (N/A)	SP5T-125 mL Sterile Plastic (N/A – lab)	SP2T-250 mL Sterile Plastic (N/A – lab)		BP3A-250 mL Plastic (NH2)2SO4 (9.3-9.7)	Cubitainer	VSGU-20 mL Scintillation vials (N/A)	GN Rachiem Bottle
1		1	1			2										3												3
2		1	1			2										3												3
3																												
4		1	1			2										3												3
5		1	1			2										3												3
6																2												
7																												
8																												
9																												
10																												
11																												
12																												

pH Adjustment Log for Preserved Samples

Sample ID	Type of Preservative	pH upon receipt	Date preservation adjusted	Time preservation adjusted	Amount of Preservative added	Lot #

Pace Analytical

CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

Page : 1 Of 1

Section A Required Client Information:		Section B Required Project Information:		Section C Invoice Information:	
Company:	HDR Engineering	Report To:	Sean Quarry	Attention:	
Address:	440 South Church Street	Copy To:		Company Name:	
	Charlotte, NC 28202			Address:	
Email:	sean.quarry@hdrinc.com	Purchase Order #:		Pace Quote:	
Phone:	(704)248-3632 Fax	Project Name:	Charrah-Brickhaven	Pace Project Manager:	kevin.godwin@pacelabs.com,
Requested Due Date:		Project #:		Pace Profile #:	7672-1

Regulatory Agency	
State / Location	NC

ITEM #	SAMPLE ID (One Character per box. (A-Z, 0-9 / , -) Sample Ids must be unique)	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED START DATE	COLLECTED START TIME	COLLECTED END DATE	COLLECTED END TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Preservatives: Unpreserved	H2SO4	HNO3	HCl	NaOH	Na2S2O3	Methanol	Other	Analyses Test Y/N	Trip BLANK	8260	300.0-Cl,F,Sulfate	TDS	Radium 226/228	6010/7470	6020 (B, Li)	Residual Chlorine (Y/N)	9234/6266
1	MW-4		G			7/20/17	0955		10			5	3							3	1	1	3	1	1		001 002
2	MW-7R		G			7/24/17	1520		10			5	3							3	1	1	3	1	1		
3																												
4	EQ BLANK		G			7/24/17	0820		10			5	3							3	1	1	3	1	1		003
5	AMB		G			7/24/17	0800		10			5	3							3	1	1	3	1	1		004
6	TRIP BLANK																		2								005
7																											
8																											
9																											
10																											
11																											
12																											

MATRIX CODE: Drinking Water DW; Water WT; Waste Water WW; Product P; Soil/Solid SL; Oil OL; Wipe WP; Air AR; Other OT; Tissue TS

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	SAMPLE CONDITIONS			
	Jesse Allred PACE	7/21/17	0930	RP Pace HVL	7/21/17	9:30	3.0	Y	N	Y

SAMPLER NAME AND SIGNATURE			
PRINT Name of SAMPLER:	Jesse Allred	PACE	
SIGNATURE of SAMPLER:	Jesse Allred	DATE Signed:	7-20-17

TEMP in C	Received on Ice (Y/N)	Custody Sealed Cooler (Y/N)	Samples Intact (Y/N)

Field Data Sheet

Client: HDR, CHARLOTTE Location: MONROE NC Project #: BRICKHAVEN GW3

Name and Afiliation (Sampler(s)): JFA PACE ANALYTICAL

Name and Afiliation (Inspector): NA

Well Information

Well ID: MW-4 Well Locked: (YES) / NO)

Well Diameter: 2 Construction: (PVC/Steel/Stainless Steel)

Total Well Depth: 25.74 ft Multi Factor*: .163 [*(Radius/12)2 x 3.14 x 7.48]

Static Water Level: 13.03 ft Casing Volume: 2.4 gallons

Height of Water Column: 14.71 ft Cal. 3 Volumes: 7.2 gallons

Pump Intake: 23.00 ft

Purge Information

Date Purged: 7/20/17 Start: 930 Finish: 950 Purge Rate: 100 mL/m

Purging Method: PERISTALTIC PUMP Total Volume Purged: ~~100~~ 2000 (gallons/mls)

Sampling Information

Date Collected: 7/20/17 Time Collected: 0955 (am/pm)

Sampling Equipment Used: PERISTALTIC PUMP Instrument ID: YSI PRO PLUS 14770

Bottle Type	Preservation	Analysis Required
		SUPPLIED BY LAB

Field Measurements/Observations

Sample Temp (°C): 23.0 Time: 955 Turbidity (ntu): 9.6 Time: 955

Diss Oxy (mg/L): 0.2 Time: 955 Fe 2+ mg/L: 2.0 Time: 955

Specific Cond. (uS): 1960 Time: 955 Res. Cl (mg/L)/(µg/L): — Time: —

Sample pH (s.u.): 6.2 Time: 955 Odor: ND Time: 955

ReDox (mV): -37.4 Time: 955 Appearance: FLAKES Time: 955

ReDox (EH value): YSI ProPlus +200mV 162.6 Other: ND Time: —

General/Weather Observations:

(sunny/cloudy/rainy) Temp. 83 (°F) Wind 0-5 (mph)

Sampler Signature: [signature] Date: 7-20-17

Stabilization Test

Time Purged	Temp. (°C)	Diss Oxy. (mg/L)	Spec. Cond. (uS)	pH (s.u.)	ReDox (mV)	Turbidity (ntu)	Volume removed (gallons/mls)	Water level (ft)	Other
935	22.4	0.5	1878	6.2	-43.4	37.0	500	~~13.63~~	13.63
940	22.8	0.4	1870	6.2	-39.8	21.4	1000	~~13.77~~	13.77
945	23.1	0.3	1872	6.2	-37.9	13.1	1500	13.85	
950	23.0	0.2	1952	6.2	-37.0	9.9	2000	13.88	

Field Data Sheet

Client: HDR, CHARAH Location: MARCARA NC Project #: BARCHARA 3Q

Name and Affiliation (Sampler(s)): JFA PACE ANALYTICAL

Name and Affiliation (Inspector): NA

Well Information

Well ID: MW 7R

Well Diameter: 2

Total Well Depth: 39.94 ft

Static Water Level: 21.30 ft

Height of Water Column: 18.64 ft

Well Locked: (YES / NO)

Construction: (PVC/Steel/Stainless Steel)

Multi Factor*: .163 [*(Radius/12)2 x 3.14 x 7.48]

Casing Volume: 3.04 gallons

Cal. 3 Volumes: 9.12 gallons

Pump Intake: 36.5 ft

Purge Information

Date Purged: 7/20/17 Start: 1155 Finish: 1515 Purge Rate: 100 mL/m

Purging Method: SS SUB PUMP Total Volume Purged: 20500 (gallons/mls)

Sampling Information

Date Collected: 7/20/17 Time Collected: 1520 (am/pm)

Sampling Equipment Used: SS SUB PUMP Instrument ID: YSI PRO PLUS 3470

Bottle Type	Preservation	Analysis Required
		SAMPLED KET

Field Measurements/Observations

Sample Temp (°C): 31.7 Time: 1520 Turbidity (ntu): 9.3 Time: 1520

Diss Oxy (mg/L): 0.8 Time: 1520 Fe 2+ mg/L: ND Time: 1520

Specific Cond. (uS): 1236 Time: 1520 Res. Cl (mg/L)/(µg/L): — Time: —

Sample pH (s.u.): 9.6 Time: 1520 Odor: NO Time: 1520

ReDox (mV): 43.6 Time: 1520 Appearance: CLEAR Time: 1520

ReDox (EH value): YSI ProPlus +200mV 243.6 Other: — Time: —

General/Weather Observations:

(sunny/cloudy/rainy) Temp. 90 (°F) Wind 3-5 (mph)

Sampler Signature: [signature] Date: 7-20-17

Stabilization Test

Time Purged ~~1200~~	Temp. (°C)	Diss Oxy. (mg/L)	Spec. Cond. (uS)	pH (s.u.)	ReDox (mV)	Turbidity (ntu)	Volume removed (gallons/mls)	Water level (ft)	Other
1200	22.3	1.0	1235	10.3	51.8	656	500	21.62	
1205	24.9	0.8	1228	10.3	36.3	925	1000	22.50	10 min
1215	30.5	0.6	1238	10.2	8.4	749.5	2000	22.94	
1225	28.6	0.7	1240	10.2	8.6	XXX	3000	23.56	
1235	27.7	0.6	1248	10.2	8.9	636.5	4000	24.18	

Pace Analytical	Document Name: Field Data Sheet	Document Issued: July 28, 2016 Page 2 of 2
	Document Number: F-CAR-FLD-001.rev.01	Issueing Authority: Pace Huntersville Quality Office

Client: HDR CHARAH

Location: MONCURE NC

Project: BRICKHAVEN 3Q

Well ID: MW 7R

Well Diameter	Multiplication Factor*
1	0.0408
1.2	0.0918
1.625	0.1080
2	0.1630
3	0.3670
4	0.6530
6	1.4680
8	2.6100

Stabilization Test

Time Purged	Temp. (°C)	Diss Oxy. (mg/L)	Spec. Cond. (uS)	pH (s.u.)	ReDox (mV)	Turbidity (ntu)	Volume Removed (gallons/mls) circle one	Water level (ft)	Other
1245	27.0	0.8	1220	10.20	14.7	261.4	5000	25.25	
1255	30.0	0.9	1231	10.1	19.8	188.2	6000	25.76	
1305	30	1.0	1234	10.0	27.7	121.4	7000	26.13	
1315	31.0	1.1	1236	9.9	34.9	75.6	8000	26.56	
1325	32.8	1.0	1245	9.9	40.9	68.7	9000	26.78	
1335	32.4	1.0	1241	9.9	40.9	44.5	10000	27.1	
1345	34.2	0.9	1246	9.8	43.1	15.4	11000	27.25	
1350	30.8	0.9	1244	9.9	43.6	12.9	12000	27.55	5 min
1355	29.8	0.8	1240	9.9	44.2	12.5	12500	27.75	10 min
1405	31.7	0.8	1242	9.8	44.7	17.2	13500	—	
1415	32.8	0.8	1244	9.8	45.1	28.6	14500	—	
1425	31.1	0.8	1240	9.8	44.6	22.5	15500	28.25	
1435	32.4	0.9	1242	9.7	45.5	18.4	16500	28.35	
1445	32.7	0.7	1244	9.6	45.3	15.6	17500	28.50	
1455	31.2	0.8	1239	9.6	46.3	14.4	18500	28.58	
1505	32.2	0.7	1240	9.6	45.8	11.4	19500	28.65	
1515	31.7	0.7	1239	9.6	43.6	9.3	20500	28.78	

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C

Appendix C – Electronic Data Deliverables (CD-ROM only)

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D

Appendix D – Interwell Statistical Analysis

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Table 1
Summary of Interwell Chemstat Statistics for Detected Groundwater Parameters Above the Method Detecting Limits (MDL)
Charah Inc. Moncure Mine RD Structured Fill Site
July 17 to 20, 2017

Well ID	Parameter	Units	Result	Total Monitoring Events	% ND (Background Well)	Rosner's Outlier	ND Adjustment	Shapiro-Wilks Normality Test (Background Well)	Background Well			SSI	Sen's Slope	Standard Value
									95%UPL	95% Chebyshev UPL	NPPL			
MW-1	Barium	ug/L	171	11	0	No	None	Normal	470	NA	NA	No	NA	700*
MW-2	Barium	ug/L	177	11	0	No	None	Normal	470	NA	NA	No	NA	700*
MW-3	Barium	ug/L	496	10	0	No	None	Normal	470	NA	NA	Yes	Downward	700*
MW-4	Barium	ug/L	332	11	0	No	None	Normal	470	NA	NA	No	NA	700*
MW-5	Barium	ug/L	103	11	0	No	None	Normal	470	NA	NA	No	NA	700*
MW-6	Barium	ug/L	99	11	0	No	None	Normal	470	NA	NA	No	NA	700*
MW-8	Barium	ug/L	**1190**	11	0	Yes	None	Normal	470	NA	NA	Yes	No Trend	700*
MW-2	Boron	ug/L	50	11	27.3	Yes	ROS[ε]	Normal	10.4	NA	NA	Yes	No Trend	700*
MW-1	Calcium	ug/L	159000	11	0	No	None	Normal	40,010	NA	NA	Yes	Upward	NE
MW-2	Calcium	ug/L	208000	11	0	No	None	Normal	40,010	NA	NA	Yes	Upward	NE
MW-3	Calcium	ug/L	138000	11	0	No	None	Normal	40,010	NA	NA	Yes	Downward	NE
MW-4	Calcium	ug/L	63900	11	0	No	None	Normal	40,010	NA	NA	Yes	No Trend	NE
MW-5	Calcium	ug/L	11400	11	0	No	None	Normal	40,010	NA	NA	No	NA	NE
MW-6	Calcium	ug/L	35400	11	0	No	None	Normal	40,010	NA	NA	No	NA	NE
MW-8	Calcium	ug/L	117000	11	0	No	None	Normal	40,010	NA	NA	Yes	No Trend	NE
MW-1	Chloride	mg/L	**603**	11	0	No	None	Normal	335	NA	NA	Yes	Upward	250*
MW-2	Chloride	mg/L	**1280**	11	0	No	None	Normal	335	NA	NA	Yes	Upward	250*
MW-3	Chloride	mg/L	**1010**	11	0	No	None	Normal	335	NA	NA	Yes	No Trend	250*
MW-4	Chloride	mg/L	**515**	10	0	No	None	Normal	335	NA	NA	Yes	No Trend	250*
MW-5	Chloride	mg/L	20	11	0	No	None	Normal	335	NA	NA	No	NA	250*
MW-6	Chloride	mg/L	245	11	0	No	None	Normal	335	NA	NA	No	NA	250*
MW-8	Chloride	mg/L	**473**	11	0	No	None	Normal	335	NA	NA	Yes	NA	250*
MW-3	Chromium	ug/L	9.4	11	100	No	None	NA	NA	NA	5	Yes	NA	10*
MW-4	Cobalt	ug/L	5.3	11	91	No	None	NA	NA	NA	5	Yes	NA	NE
MW-1	Fluoride	mg/L	0.17	11	0	No	None	Not Normal	NA	0.275	NA	No	NA	2*
MW-2	Fluoride	mg/L	0.4	11	0	No	None	Not Normal	NA	0.275	NA	Yes	Downward	2*
MW-3	Fluoride	mg/L	0.49	11	0	No	None	Not Normal	NA	0.275	NA	Yes	No Trend	2*
MW-4	Fluoride	mg/L	0.31	11	0	No	None	Not Normal	NA	0.275	NA	Yes	No Trend	2*
MW-5	Fluoride	mg/L	0.54	11	0	No	None	Not Normal	NA	0.275	NA	Yes	Downward	2*
MW-6	Fluoride	mg/L	0.37	11	0	No	None	Not Normal	NA	0.275	NA	Yes	No Trend	2*
MW-1	Lithium	ug/L	36.1	10	0	No	None	Normal	44.5	NA	NA	No	NA	NE
MW-2	Lithium	ug/L	154	10	0	Yes	None	Normal	44.5	NA	NA	Yes	Upward	NE
MW-3	Lithium	ug/L	97.1	10	0	No	None	Normal	44.5	NA	NA	Yes	No Trend	NE
MW-4	Lithium	ug/L	27.7	10	0	No	None	Normal	44.5	NA	NA	No	NA	NE
MW-5	Lithium	ug/L	9.3	10	0	No	None	Normal	44.5	NA	NA	No	NA	NE
MW-6	Lithium	ug/L	45.3	10	0	No	None	Normal	44.5	NA	NA	Yes	No Trend	NE
MW-8	Lithium	ug/L	27.7	10	0	No	None	Normal	44.5	NA	NA	No	NA	NE
MW-2	Molybdenum	ug/L	9.3	11	81	No	None	NA	NA	9.3	NA	Yes	Downward	NE
MW-3	Molybdenum	ug/L	6.1	11	81	No	None	NA	NA	9.3	NA	No	NA	NE
MW-4	Nickel	ug/L	5.2	11	91	No	None	NA	NA	NA	5	Yes	NA	100*
MW-1	Radium-226	pCi/L	0.601	11	18	No	ROS[ε]	Normal	1.21	NA	NA	No	NA	5**
MW-2	Radium-226	pCi/L	0.74	11	18	No	ROS[ε]	Normal	1.21	NA	NA	No	NA	5**
MW-3	Radium-226	pCi/L	1.19	11	18	No	ROS[ε]	Normal	1.21	NA	NA	No	NA	5**
MW-4	Radium-226	pCi/L	0.684	11	18	No	ROS[ε]	Normal	1.21	NA	NA	No	NA	5**
MW-5	Radium-226	pCi/L	0.12	11	18	No	ROS[ε]	Normal	1.21	NA	NA	No	NA	5**
MW-6	Radium-226	pCi/L	0.227	11	18	No	ROS[ε]	Normal	1.21	NA	NA	No	NA	5**
MW-8	Radium-226	pCi/L	1.05	11	18	No	ROS[ε]	Normal	1.21	NA	NA	No	NA	5**
MW-1	Radium-228	pCi/L	0.508	11	9	No	ND=1/2MDL	Normal	1.696	NA	NA	No	NA	5**
MW-2	Radium-228	pCi/L	1.54	11	9	No	ND=1/2MDL	Normal	1.696	NA	NA	No	NA	5**
MW-3	Radium-228	pCi/L	2.27	11	9	No	ND=1/2MDL	Normal	1.696	NA	NA	Yes	No Trend	5**
MW-4	Radium-228	pCi/L	0.819	11	9	No	ND=1/2MDL	Normal	1.696	NA	NA	No	NA	5**
MW-5	Radium-228	pCi/L	0.369	11	9	No	ND=1/2MDL	Normal	1.696	NA	NA	No	NA	5**
MW-6	Radium-228	pCi/L	0.68	11	9	No	ND=1/2MDL	Normal	1.696	NA	NA	No	NA	5**
MW-8	Radium-228	pCi/L	0.594	11	9	No	ND=1/2MDL	Normal	1.696	NA	NA	No	NA	5**
MW-1	Sulfate	mg/L	9.3	11	0	No	None	Normal	24.87	NA	NA	No	NA	250*
MW-2	Sulfate	mg/L	226	11	0	No	None	Normal	24.87	NA	NA	Yes	No Trend	250*
MW-3	Sulfate	mg/L	125	11	0	No	None	Normal	24.87	NA	NA	Yes	No Trend	250*
MW-4	Sulfate	mg/L	10.8	11	0	No	None	Normal	24.87	NA	NA	No	NA	250*
MW-5	Sulfate	mg/L	5.6	11	0	No	None	Normal	24.87	NA	NA	No	NA	250*
MW-6	Sulfate	mg/L	86.9	11	0	No	None	Normal	24.87	NA	NA	Yes	No Trend	250*
MW-8	Sulfate	mg/L	6.3	11	0	No	None	Normal	24.87	NA	NA	No	NA	250*
MW-1	Total Dissolved Solids	mg/L	**1060**	11	0	No	None	Not Normal	NA	3,552	NA	No	NA	500*
MW-2	Total Dissolved Solids	mg/L	**2670**	11	0	No	None	Not Normal	NA	3,552	NA	No	NA	500*
MW-3	Total Dissolved Solids	mg/L	**1870**	11	0	No	None	Not Normal	NA	3,552	NA	No	NA	500*
MW-4	Total Dissolved Solids	mg/L	**1150**	11	0	No	None	Not Normal	NA	3,552	NA	No	NA	500*
MW-5	Total Dissolved Solids	mg/L	228	11	0	No	None	Not Normal	NA	3,552	NA	No	NA	500*
MW-6	Total Dissolved Solids	mg/L	**692**	11	0	No	None	Not Normal	NA	3,552	NA	No	NA	500*
MW-8	Total Dissolved Solids	mg/L	**934**	11	0	No	None	Not Normal	NA	3,552	NA	No	NA	500*
MW-1	Zinc	ug/L	28.0	11	81.8	No	None	Not Normal	NA	15.35	NA	Yes	No Trend	1000*
MW-2	Zinc	ug/L	10.7	11	81.8	No	None	Not Normal	NA	15.35	NA	No	NA	1000*
MW-5	Zinc	ug/L	16.6	11	81.8	No	None	Not Normal	NA	15.35	NA	Yes	No Trend	1000*
MW-8	Zinc	ug/L	50.7	11	81.8	Yes	None	Not Normal	NA	15.35	NA	Yes	No Trend	1000*
BG-1	Barium	ug/L	327	11	0	No	None							
BG-1	Calcium	ug/L	29000	11	0	No	None							
BG-1	Chloride	mg/L	283	11	0	No	None							
BG-1	Fluoride	mg/L	0.11	11	0	No	None							
BG-1	Lithium	ug/L	19.8	11	0	No	None							
BG-1	Radium-226	pCi/L	0.151	11	18	No	ROS[ε]							
BG-1	Radium-228	pCi/L	0.132	11	9	No	ND=1/2MDL							
BG-1	Sulfate	mg/L	17.8	11	0	No	None							
BG-1	Total Dissolved Solids	mg/L	606	11	0	No	None							
BG-1	Vanadium	ug/L	5.50	11	54	No	None							

Background Well Data

Note:
ND - Not detected above the detection limit;
%ND = Percentage of historic data not detected above the MDL;
95%UPL -95% Upper Prediction Limit (one side);
NPPL - Non-parametric Prediction Limit;
SSI = Statistically Significant Increase over the background data;
Parameters with yellow high-light color are detected above their respective 2L standards.

ε-ROS = Regression on Order Statistics method for adjustment of ND data;
* - 2L standard;
**-MCL for Ra-226 and Ra-228 combined;
NE - Not Established. Groundwater standard (2L, MCL, or GWPS) was not established;
Result in bold number is above the 2L groundwater standard.

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Concentrations (ug/L)

Parameter: Barium

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

Total Measurements: 87
Total Non-Detect: 0
Percent Non-Detects: 0%
Total Background Measurements: 11
There is 1 background location

Loc.	Meas.	ND	Date	Conc.	Original
BG-1	11	0 (0%)	8/12/2015	380	380
			10/15/2015	443	443
			11/18/2015	344	344
			1/4/2016	310	310
			2/16/2016	354	354
			4/5/2016	302	302
			5/26/2016	330	330
			7/12/2016	363	363
			1/23/2017	321	321
			4/3/2017	320	320
			7/17/2017	327	327

There are 7 compliance locations

Loc.	Meas.	ND	Date	Conc.	Original
MW-1	11	0 (0%)	8/12/2015	230	230
			10/15/2015	117	117
			11/20/2015	153	153
			1/6/2016	220	220
			2/17/2016	70.3	70.3
			4/6/2016	129	129
			5/27/2016	121	121
			7/12/2016	225	225
			1/25/2017	131	131
			4/5/2017	213	213
			7/18/2017	171	171
MW-2	11	0 (0%)	8/12/2015	270	270
			10/15/2015	372	372
			11/19/2015	306	306
			1/6/2016	262	262
			2/17/2016	318	318
			4/6/2016	230	230
			5/27/2016	197	197
			7/12/2016	220	220
			1/26/2017	203	203
			4/5/2017	219	219
			7/18/2017	177	177
MW-3	10	0 (0%)	10/15/2015	860	860
			11/19/2015	718	718
			1/5/2016	802	802
			2/16/2016	855	855
			4/7/2016	578	578
			5/27/2016	728	728
			7/11/2016	728	728
			1/24/2017	531	531
			4/5/2017	353	353
			7/19/2017	496	496
MW-4	11	0 (0%)	8/12/2015	390	390
			10/15/2015	232	232
			11/19/2015	191	191
			1/4/2016	176	176
			2/16/2016	157	157
			4/7/2016	85.9	85.9
			5/25/2016	90.5	90.5
			7/13/2016	257	257

			1/25/2017	330	330
			4/5/2017	309	309
			7/20/2017	332	332
MW-5	11	0 (0%)	8/12/2015	160	160
			10/15/2015	306	306
			11/18/2015	93.2	93.2
			1/4/2016	102	102
			2/16/2016	129	129
			4/5/2016	91.4	91.4
			5/25/2016	100	100
			7/11/2016	93	93
			1/23/2017	90.7	90.7
			4/4/2017	116	116
			7/19/2017	103	103
MW-6	11	0 (0%)	8/12/2015	110	110
			10/19/2015	117	117
			11/20/2015	142	142
			1/5/2016	140	140
			2/17/2016	118	118
			4/5/2016	108	108
			5/26/2016	88.3	88.3
			7/11/2016	89.8	89.8
			1/24/2017	122	122
			4/4/2017	131	131
			7/19/2017	98.8	98.8
MW-8	11	0 (0%)	8/12/2015	1100	1100
			10/15/2015	1240	1240
			11/20/2015	1550	1550
			1/6/2016	1430	1430
			2/18/2016	1490	1490
			4/6/2016	1220	1220
			5/26/2016	1260	1260
			7/12/2016	1200	1200
			1/24/2017	1360	1360
			4/4/2017	1130	1130
			7/17/2017	1190	1190

There are 0 unused locations

Loc.	Meas.	ND	Date	Conc.	Original

Rosner's Test for Outliers

Parameter: Barium

All Locations

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

Data set mean = 395.022

10 most extreme of 87 measurements

by order of magnitude difference from the mean

1	11/20/2015	MW-8	1550	1154.98
2	2/18/2016	MW-8	1490	1094.98
3	1/6/2016	MW-8	1430	1034.98
4	1/24/2017	MW-8	1360	964.978
5	5/26/2016	MW-8	1260	864.978
6	10/15/2015	MW-8	1240	844.978
7	4/6/2016	MW-8	1220	824.978
8	7/12/2016	MW-8	1200	804.978
9	7/17/2017	MW-8	1190	794.978
10	4/4/2017	MW-8	1130	734.978

Iteration i = 9

Mean of 78 measurements = 287.524
Std Dev = 232.124
x(i+1) = 1130 from measurement 4/4/2017 from location MW-8
Rosner Statistic R = |1130 - 287.524|/232.124 = 3.62942
Lambda(87, 10, 0.05) = 3.295
3.62942 > 3.295 -- Measurement 4/4/2017 for location MW-8 is an outlier

---

Iteration i = 8

Mean of 79 measurements = 298.948
Std Dev = 251.993
x(i+1) = 1190 from measurement 7/17/2017 from location MW-8
Rosner Statistic R = |1190 - 298.948|/251.993 = 3.53602
Lambda(87, 9, 0.05) = 3.2996
Measurement 7/17/2017 for location MW-8 is an outlier

Iteration i = 7

Mean of 80 measurements = 310.211
Std Dev = 269.899
x(i+1) = 1200 from measurement 7/12/2016 from location MW-8
Rosner Statistic R = |1200 - 310.211|/269.899 = 3.29675
Lambda(87, 8, 0.05) = 3.3042
Measurement 7/12/2016 for location MW-8 is an outlier

Iteration i = 6

Mean of 81 measurements = 321.443
Std Dev = 286.624
x(i+1) = 1220 from measurement 4/6/2016 from location MW-8
Rosner Statistic R = |1220 - 321.443|/286.624 = 3.13496
Lambda(87, 7, 0.05) = 3.3088
Measurement 4/6/2016 for location MW-8 is an outlier

Iteration i = 5

Mean of 82 measurements = 332.645
Std Dev = 302.372
x(i+1) = 1240 from measurement 10/15/2015 from location MW-8
Rosner Statistic R = |1240 - 332.645|/302.372 = 3.00079
Lambda(87, 6, 0.05) = 3.3134
Measurement 10/15/2015 for location MW-8 is an outlier

Iteration i = 4

Mean of 83 measurements = 343.818
Std Dev = 317.294
x(i+1) = 1260 from measurement 5/26/2016 from location MW-8

Rosner Statistic R = |1260 - 343.818|/317.294 = 2.88749
Lambda(87, 5, 0.05) = 3.318
Measurement 5/26/2016 for location MW-8 is an outlier

Iteration i = 3
Mean of 84 measurements = 355.915
Std Dev = 334.298
x(i+1) = 1360 from measurement 1/24/2017 from location MW-8
Rosner Statistic R = |1360 - 355.915|/334.298 = 3.00356
Lambda(87, 4, 0.05) = 3.325
Measurement 1/24/2017 for location MW-8 is an outlier

Iteration i = 2
Mean of 85 measurements = 368.552
Std Dev = 352.133
x(i+1) = 1430 from measurement 1/6/2016 from location MW-8
Rosner Statistic R = |1430 - 368.552|/352.133 = 3.01434
Lambda(87, 3, 0.05) = 3.328
Measurement 1/6/2016 for location MW-8 is an outlier

Iteration i = 1
Mean of 86 measurements = 381.592
Std Dev = 370.355
x(i+1) = 1490 from measurement 2/18/2016 from location MW-8
Rosner Statistic R = |1490 - 381.592|/370.355 = 2.99283
Lambda(87, 2, 0.05) = 3.328
Measurement 2/18/2016 for location MW-8 is an outlier

Iteration i = 0
Mean of 87 measurements = 395.022
Std Dev = 388.921
x(i+1) = 1550 from measurement 11/20/2015 from location MW-8
Rosner Statistic R = |1550 - 395.022|/388.921 = 2.9697
Lambda(87, 1, 0.05) = 3.338
Measurement 11/20/2015 for location MW-8 is an outlier

Shapiro-Wilks Test of Normality

Parameter: Barium
All Locations
Normality Test of Parameter Concentrations
Original Data (Not Transformed)
Non-Detects Replaced with Detection Limit
K = 5 for 11 measurements

i	x(i)	x(n-i+1)	x(n-1+1)-x(i)	a(n-i+1)	b(i)
1	302	443	141	0.5601	78.9741
2	310	380	70	0.3315	23.205
3	320	363	43	0.226	9.718
4	321	354	33	0.1429	4.7157
5	327	344	17	0.0695	1.1815
6	330	330	0		
7	344	327	-17		
8	354	321	-33		
9	363	320	-43		
10	380	310	-70		
11	443	302	-141		

Sum of b values = 117.794
Sample Standard Deviation = 40.0736
W Statistic = 0.864037

5% Critical value of 0.85 is less than 0.864037
Data is normally distributed at 95% level of significance

1% Critical value of 0.792 is less than 0.864037
Data is normally distributed at 99% level of significance

Parametric Prediction Interval Analysis

Inter-Well Comparison

Parameter: Barium

Original Data (Not Transformed)

Non-Detects Replaced with 1/2 DL

Inter-Well Unified Guid. Formula 95% One-Sided Comparison

Background Samples = 11
Background Mean = 344.909
Background Std Dev = 40.0736

Number of comparisons = 7
Future Samples (k) = 7
Actual confidence level is 1.0 - (0.05/7) = 99.2857 %
t is Percentile of Student's T-Test (0.95/7) = 0.992857
Degrees of Freedom = 11 (background observations) - 1
t(0.992857, 11) = 2.99548

Well MW-1

Date	Samples	Mean	Interval	Significant
7/18/2017	1	171	[0, 470.286]	FALSE

Well MW-2

Date	Samples	Mean	Interval	Significant
7/18/2017	1	177	[0, 470.286]	FALSE

Well MW-3

Date	Samples	Mean	Interval	Significant
7/19/2017	**1**	**496**	**[0, 470.286]**	**TRUE**

Well MW-4

Date	Samples	Mean	Interval	Significant
7/20/2017	1	332	[0, 470.286]	FALSE

Well MW-5

Date	Samples	Mean	Interval	Significant
7/19/2017	1	103	[0, 470.286]	FALSE

Well MW-6

Date	Samples	Mean	Interval	Significant
7/19/2017	1	98.8	[0, 470.286]	FALSE

Well MW-8

Date	Samples	Mean	Interval	Significant
7/17/2017	**1**	**1190**	**[0, 470.286]**	**TRUE**

Sen's Slope Analysis

Parameter: Barium
Location: MW-3
Original Data (Not Transformed)
Non-Detects Replaced with Detection Limit

90% Confidence Level

Xj	Xk	(Xj - Xk)/(j-k)	Q
718 (11/19/2015)	860 (10/15/2015)	(718 - 860)/(2 - 1)	-142
802 (1/5/2016)	860 (10/15/2015)	(802 - 860)/(3 - 1)	-29
855 (2/16/2016)	860 (10/15/2015)	(855 - 860)/(4 - 1)	-1.66667
578 (4/7/2016)	860 (10/15/2015)	(578 - 860)/(5 - 1)	-70.5
728 (5/27/2016)	860 (10/15/2015)	(728 - 860)/(6 - 1)	-26.4
728 (7/11/2016)	860 (10/15/2015)	(728 - 860)/(7 - 1)	-22
531 (1/24/2017)	860 (10/15/2015)	(531 - 860)/(8 - 1)	-47
353 (4/5/2017)	860 (10/15/2015)	(353 - 860)/(9 - 1)	-63.375
496 (7/19/2017)	860 (10/15/2015)	(496 - 860)/(10 - 1)	-40.4444
802 (1/5/2016)	718 (11/19/2015)	(802 - 718)/(3 - 2)	84
855 (2/16/2016)	718 (11/19/2015)	(855 - 718)/(4 - 2)	68.5
578 (4/7/2016)	718 (11/19/2015)	(578 - 718)/(5 - 2)	-46.6667
728 (5/27/2016)	718 (11/19/2015)	(728 - 718)/(6 - 2)	2.5
728 (7/11/2016)	718 (11/19/2015)	(728 - 718)/(7 - 2)	2
531 (1/24/2017)	718 (11/19/2015)	(531 - 718)/(8 - 2)	-31.1667
353 (4/5/2017)	718 (11/19/2015)	(353 - 718)/(9 - 2)	-52.1429
496 (7/19/2017)	718 (11/19/2015)	(496 - 718)/(10 - 2)	-27.75
855 (2/16/2016)	802 (1/5/2016)	(855 - 802)/(4 - 3)	53
578 (4/7/2016)	802 (1/5/2016)	(578 - 802)/(5 - 3)	-112
728 (5/27/2016)	802 (1/5/2016)	(728 - 802)/(6 - 3)	-24.6667
728 (7/11/2016)	802 (1/5/2016)	(728 - 802)/(7 - 3)	-18.5
531 (1/24/2017)	802 (1/5/2016)	(531 - 802)/(8 - 3)	-54.2
353 (4/5/2017)	802 (1/5/2016)	(353 - 802)/(9 - 3)	-74.8333
496 (7/19/2017)	802 (1/5/2016)	(496 - 802)/(10 - 3)	-43.7143
578 (4/7/2016)	855 (2/16/2016)	(578 - 855)/(5 - 4)	-277
728 (5/27/2016)	855 (2/16/2016)	(728 - 855)/(6 - 4)	-63.5
728 (7/11/2016)	855 (2/16/2016)	(728 - 855)/(7 - 4)	-42.3333
531 (1/24/2017)	855 (2/16/2016)	(531 - 855)/(8 - 4)	-81
353 (4/5/2017)	855 (2/16/2016)	(353 - 855)/(9 - 4)	-100.4
496 (7/19/2017)	855 (2/16/2016)	(496 - 855)/(10 - 4)	-59.8333
728 (5/27/2016)	578 (4/7/2016)	(728 - 578)/(6 - 5)	150
728 (7/11/2016)	578 (4/7/2016)	(728 - 578)/(7 - 5)	75
531 (1/24/2017)	578 (4/7/2016)	(531 - 578)/(8 - 5)	-15.6667
353 (4/5/2017)	578 (4/7/2016)	(353 - 578)/(9 - 5)	-56.25
496 (7/19/2017)	578 (4/7/2016)	(496 - 578)/(10 - 5)	-16.4
728 (7/11/2016)	728 (5/27/2016)	(728 - 728)/(7 - 6)	0
531 (1/24/2017)	728 (5/27/2016)	(531 - 728)/(8 - 6)	-98.5
353 (4/5/2017)	728 (5/27/2016)	(353 - 728)/(9 - 6)	-125
496 (7/19/2017)	728 (5/27/2016)	(496 - 728)/(10 - 6)	-58
531 (1/24/2017)	728 (7/11/2016)	(531 - 728)/(8 - 7)	-197
353 (4/5/2017)	728 (7/11/2016)	(353 - 728)/(9 - 7)	-187.5
496 (7/19/2017)	728 (7/11/2016)	(496 - 728)/(10 - 7)	-77.3333
353 (4/5/2017)	531 (1/24/2017)	(353 - 531)/(9 - 8)	-178
496 (7/19/2017)	531 (1/24/2017)	(496 - 531)/(10 - 8)	-17.5
496 (7/19/2017)	353 (4/5/2017)	(496 - 353)/(10 - 9)	143

Number of Q values = 45

Ordered Q Values

n	Q
1	-277
2	-197
3	-187.5

4	-178
5	-142
6	-125
7	-112
8	-100.4
9	-98.5
10	-81
11	-77.3333
12	-74.8333
13	-70.5
14	-63.5
15	-63.375
16	-59.8333
17	-58
18	-56.25
19	-54.2
20	-52.1429
21	-47
22	-46.6667
23	-43.7143
24	-42.3333
25	-40.4444
26	-31.1667
27	-29
28	-27.75
29	-26.4
30	-24.6667
31	-22
32	-18.5
33	-17.5
34	-16.4
35	-15.6667
36	-1.66667
37	0
38	2
39	2.5
40	53
41	68.5
42	75
43	84
44	143
45	150

Sen's Estimator (Median Q) is -43.7143

Tied Group	Value	Members
1	728	2

Time Period	Observations
10/15/2015	1
11/19/2015	1
1/5/2016	1
2/16/2016	1
4/7/2016	1
5/27/2016	1
7/11/2016	1
1/24/2017	1
4/5/2017	1
7/19/2017	1

There are 0 time periods with multiple data

A = 18
B = 0
C = 0
D = 0
E = 2
F = 0
a = 2250
b = 6480
c = 180
Group Variance = 124
For 90% confidence interval (two-tailed), Z at (1-0.9)/2 = 1.64485

C = 18.3163
M1 = (45 - 18.3163)/2.0 = 13.3418
M2 = (45 + 18.3163)/2.0 + 1 = 32.6582
Lower limit is -70.5 = Q(13)
Upper limit is -17.5 = Q(33)
-17.5 < 0 indicating a downward trend in data.

Sen's Slope Analysis

Parameter: Barium

Location: MW-8

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

90% Confidence Level

Xj	Xk	(Xj - Xk)/(j-k)	Q
1240 (10/15/2015)	1100 (8/12/2015)	(1240 - 1100)/(2 - 1)	140
1550 (11/20/2015)	1100 (8/12/2015)	(1550 - 1100)/(3 - 1)	225
1430 (1/6/2016)	1100 (8/12/2015)	(1430 - 1100)/(4 - 1)	110
1490 (2/18/2016)	1100 (8/12/2015)	(1490 - 1100)/(5 - 1)	97.5
1220 (4/6/2016)	1100 (8/12/2015)	(1220 - 1100)/(6 - 1)	24
1260 (5/26/2016)	1100 (8/12/2015)	(1260 - 1100)/(7 - 1)	26.6667
1200 (7/12/2016)	1100 (8/12/2015)	(1200 - 1100)/(8 - 1)	14.2857
1360 (1/24/2017)	1100 (8/12/2015)	(1360 - 1100)/(9 - 1)	32.5
1130 (4/4/2017)	1100 (8/12/2015)	(1130 - 1100)/(10 - 1)	3.33333
1190 (7/17/2017)	1100 (8/12/2015)	(1190 - 1100)/(11 - 1)	9
1550 (11/20/2015)	1240 (10/15/2015)	(1550 - 1240)/(3 - 2)	310
1430 (1/6/2016)	1240 (10/15/2015)	(1430 - 1240)/(4 - 2)	95
1490 (2/18/2016)	1240 (10/15/2015)	(1490 - 1240)/(5 - 2)	83.3333
1220 (4/6/2016)	1240 (10/15/2015)	(1220 - 1240)/(6 - 2)	-5
1260 (5/26/2016)	1240 (10/15/2015)	(1260 - 1240)/(7 - 2)	4
1200 (7/12/2016)	1240 (10/15/2015)	(1200 - 1240)/(8 - 2)	-6.66667
1360 (1/24/2017)	1240 (10/15/2015)	(1360 - 1240)/(9 - 2)	17.1429
1130 (4/4/2017)	1240 (10/15/2015)	(1130 - 1240)/(10 - 2)	-13.75
1190 (7/17/2017)	1240 (10/15/2015)	(1190 - 1240)/(11 - 2)	-5.55556
1430 (1/6/2016)	1550 (11/20/2015)	(1430 - 1550)/(4 - 3)	-120
1490 (2/18/2016)	1550 (11/20/2015)	(1490 - 1550)/(5 - 3)	-30
1220 (4/6/2016)	1550 (11/20/2015)	(1220 - 1550)/(6 - 3)	-110
1260 (5/26/2016)	1550 (11/20/2015)	(1260 - 1550)/(7 - 3)	-72.5
1200 (7/12/2016)	1550 (11/20/2015)	(1200 - 1550)/(8 - 3)	-70
1360 (1/24/2017)	1550 (11/20/2015)	(1360 - 1550)/(9 - 3)	-31.6667
1130 (4/4/2017)	1550 (11/20/2015)	(1130 - 1550)/(10 - 3)	-60
1190 (7/17/2017)	1550 (11/20/2015)	(1190 - 1550)/(11 - 3)	-45
1490 (2/18/2016)	1430 (1/6/2016)	(1490 - 1430)/(5 - 4)	60
1220 (4/6/2016)	1430 (1/6/2016)	(1220 - 1430)/(6 - 4)	-105
1260 (5/26/2016)	1430 (1/6/2016)	(1260 - 1430)/(7 - 4)	-56.6667
1200 (7/12/2016)	1430 (1/6/2016)	(1200 - 1430)/(8 - 4)	-57.5
1360 (1/24/2017)	1430 (1/6/2016)	(1360 - 1430)/(9 - 4)	-14
1130 (4/4/2017)	1430 (1/6/2016)	(1130 - 1430)/(10 - 4)	-50
1190 (7/17/2017)	1430 (1/6/2016)	(1190 - 1430)/(11 - 4)	-34.2857
1220 (4/6/2016)	1490 (2/18/2016)	(1220 - 1490)/(6 - 5)	-270
1260 (5/26/2016)	1490 (2/18/2016)	(1260 - 1490)/(7 - 5)	-115
1200 (7/12/2016)	1490 (2/18/2016)	(1200 - 1490)/(8 - 5)	-96.6667
1360 (1/24/2017)	1490 (2/18/2016)	(1360 - 1490)/(9 - 5)	-32.5
1130 (4/4/2017)	1490 (2/18/2016)	(1130 - 1490)/(10 - 5)	-72
1190 (7/17/2017)	1490 (2/18/2016)	(1190 - 1490)/(11 - 5)	-50
1260 (5/26/2016)	1220 (4/6/2016)	(1260 - 1220)/(7 - 6)	40
1200 (7/12/2016)	1220 (4/6/2016)	(1200 - 1220)/(8 - 6)	-10
1360 (1/24/2017)	1220 (4/6/2016)	(1360 - 1220)/(9 - 6)	46.6667
1130 (4/4/2017)	1220 (4/6/2016)	(1130 - 1220)/(10 - 6)	-22.5
1190 (7/17/2017)	1220 (4/6/2016)	(1190 - 1220)/(11 - 6)	-6
1200 (7/12/2016)	1260 (5/26/2016)	(1200 - 1260)/(8 - 7)	-60
1360 (1/24/2017)	1260 (5/26/2016)	(1360 - 1260)/(9 - 7)	50
1130 (4/4/2017)	1260 (5/26/2016)	(1130 - 1260)/(10 - 7)	-43.3333
1190 (7/17/2017)	1260 (5/26/2016)	(1190 - 1260)/(11 - 7)	-17.5
1360 (1/24/2017)	1200 (7/12/2016)	(1360 - 1200)/(9 - 8)	160
1130 (4/4/2017)	1200 (7/12/2016)	(1130 - 1200)/(10 - 8)	-35
1190 (7/17/2017)	1200 (7/12/2016)	(1190 - 1200)/(11 - 8)	-3.33333
1130 (4/4/2017)	1360 (1/24/2017)	(1130 - 1360)/(10 - 9)	-230
1190 (7/17/2017)	1360 (1/24/2017)	(1190 - 1360)/(11 - 9)	-85

Number of Q values = 55

Ordered Q Values

n	Q
1	-270
2	-230
3	-120
4	-115
5	-110
6	-105
7	-96.6667
8	-85
9	-72.5
10	-72
11	-70
12	-60
13	-60
14	-57.5
15	-56.6667
16	-50
17	-50
18	-45
19	-43.3333
20	-35
21	-34.2857
22	-32.5
23	-31.6667
24	-30
25	-22.5
26	-17.5
27	-14
28	-13.75
29	-10
30	-6.66667
31	-6
32	-5.55556
33	-5
34	-3.33333
35	3.33333
36	4
37	9
38	14.2857
39	17.1429
40	24
41	26.6667
42	32.5
43	40
44	46.6667
45	50
46	60
47	60
48	83.3333
49	95
50	97.5
51	110
52	140
53	160
54	225
55	310

Sen's Estimator (Median Q) is -13.75

Time Period	Observations
8/12/2015	1
10/15/2015	1
11/20/2015	1
1/6/2016	1
2/18/2016	1

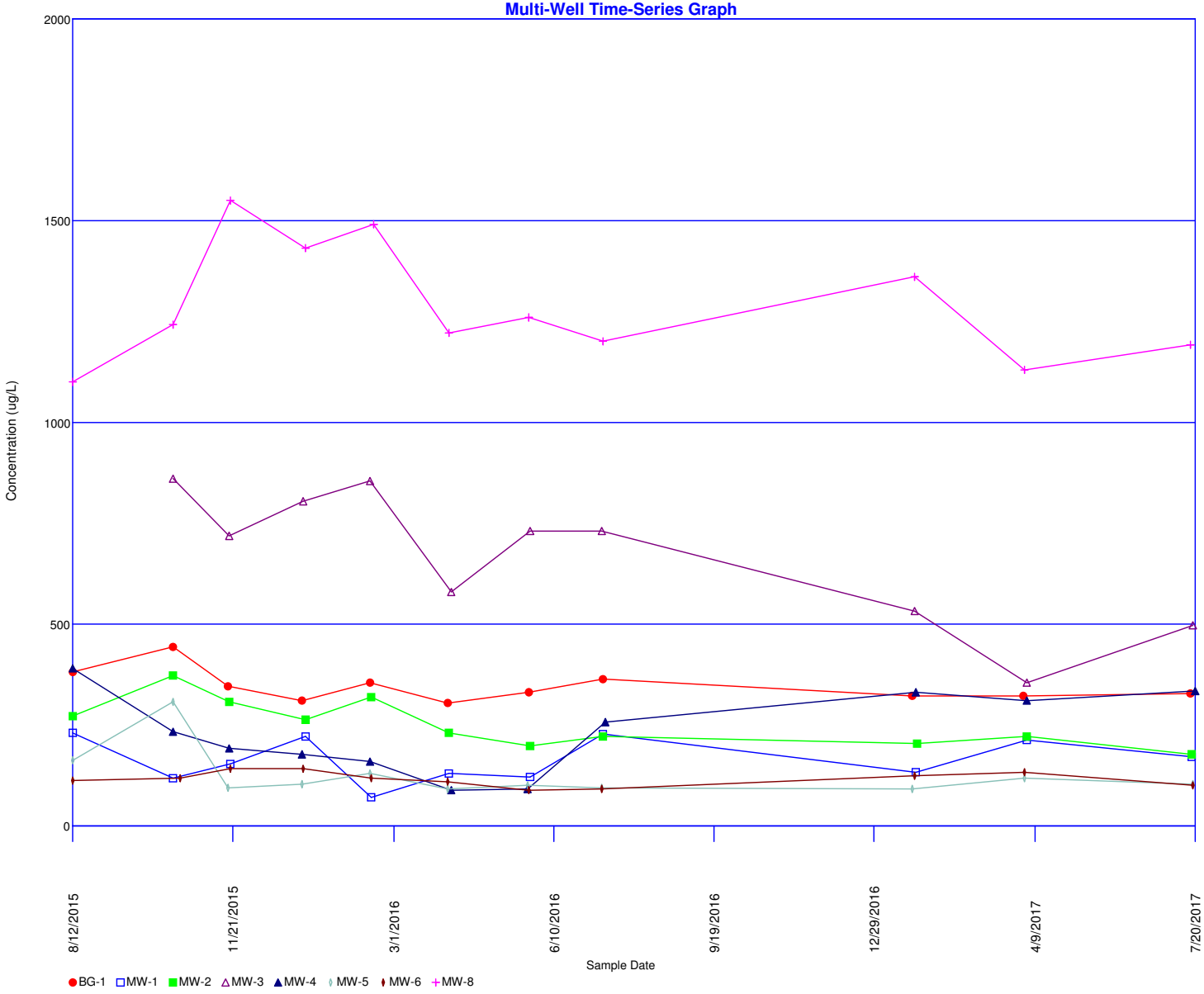
4/6/2016	1
5/26/2016	1
7/12/2016	1
1/24/2017	1
4/4/2017	1
7/17/2017	1

There are 0 time periods with multiple data

A = 0
B = 0
C = 0
D = 0
E = 0
F = 0
a = 2970
b = 8910
c = 220
Group Variance = 165
For 90% confidence interval (two-tailed), Z at (1-0.9)/2 = 1.64485
C = 21.1285
M1 = (55 - 21.1285)/2.0 = 16.9357
M2 = (55 + 21.1285)/2.0 + 1 = 39.0643
Lower limit is -50 = Q(17)
Upper limit is 17.1429 = Q(39)
-50 < 0 < 17.1429 indicating no trend in data.

Barium

Multi-Well Time-Series Graph



Concentrations (ug/L)

Parameter: Boron

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

Total Measurements: 88
Total Non-Detect: 21
Percent Non-Detects: 23.8636%
Total Background Measurements: 11
There is 1 background location

Loc.	Meas.	ND	Date	Conc.	Original
BG-1	11	3 (27.2727%)	8/12/2015	8.5 J	8.5 J
			10/15/2015	6.1	6.1
			11/18/2015	5.9	5.9
			1/4/2016	7.5	7.5
			2/16/2016	5.5	5.5
			4/5/2016	6	6
			5/26/2016	6.1	6.1
			7/12/2016	7	7
			1/23/2017	ND<25 U	ND<25 U
			4/3/2017	ND<25 U	ND<25 U
			7/17/2017	ND<0.57 U	ND<0.57 U

There are 7 compliance locations

Loc.	Meas.	ND	Date	Conc.	Original
MW-1	11	3 (27.2727%)	8/12/2015	41	41
			10/15/2015	14.6	14.6
			11/20/2015	14.5	14.5
			1/6/2016	9.6	9.6
			2/17/2016	10	10
			4/6/2016	10.6	10.6
			5/27/2016	9.7	9.7
			7/12/2016	7.9	7.9
			1/25/2017	ND<25 U	ND<25 U
			4/5/2017	ND<25 U	ND<25 U
			7/18/2017	ND<0.57 U	ND<0.57 U
MW-2	11	0 (0%)	8/12/2015	51	51
			10/15/2015	25.7	25.7
			11/19/2015	40.9	40.9
			1/6/2016	37.8	37.8
			2/17/2016	37.4	37.4
			4/6/2016	47.3	47.3
			5/27/2016	40.5	40.5
			7/12/2016	39.4	39.4
			1/26/2017	52.1	52.1
			4/5/2017	54	54
			7/18/2017	50.2	50.2
MW-3	11	3 (27.2727%)	8/12/2015	49	49
			10/15/2015	38	38
			11/19/2015	49.4	49.4
			1/5/2016	42	42
			2/16/2016	35.8	35.8
			4/7/2016	42.7	42.7
			5/27/2016	39	39
			7/11/2016	41.9	41.9
			1/24/2017	ND<25 U	ND<25 U
			4/5/2017	ND<25 U	ND<25 U
			7/19/2017	ND<0.57 U	ND<0.57 U
MW-4	11	4 (36.3636%)	8/12/2015	12 J	12 J
			10/15/2015	6.2	6.2
			11/19/2015	6.2	6.2
			1/4/2016	7.2	7.2
			2/16/2016	5.7	5.7
			4/7/2016	6.8	6.8
			5/25/2016	6.4	6.4

			7/13/2016	ND<5 U	ND<5 U
			1/25/2017	ND<25 U	ND<25 U
			4/5/2017	ND<25 U	ND<25 U
			7/20/2017	ND<0.57 U	ND<0.57 U
MW-5	11	2 (18.1818%)	8/12/2015	16 J	16 J
			10/15/2015	9	9
			11/18/2015	9.9	9.9
			1/4/2016	10.8	10.8
			2/16/2016	10.2	10.2
			4/5/2016	12.1	12.1
			5/25/2016	10.7	10.7
			7/11/2016	9.8	9.8
			1/23/2017	39.3	39.3
			4/4/2017	ND<25 U	ND<25 U
			7/19/2017	ND<0.57 U	ND<0.57 U
MW-6	11	3 (27.2727%)	8/12/2015	8.1 J	8.1 J
			10/19/2015	6.7	6.7
			11/20/2015	9.1	9.1
			1/5/2016	8.9	8.9
			2/17/2016	6.6	6.6
			4/5/2016	10.8	10.8
			5/26/2016	6.1	6.1
			7/11/2016	7.7	7.7
			1/24/2017	ND<25 U	ND<25 U
			4/4/2017	ND<25 U	ND<25 U
			7/19/2017	ND<0.57 U	ND<0.57 U
MW-8	11	3 (27.2727%)	8/12/2015	9.9 J	9.9 J
			10/15/2015	6.3	6.3
			11/20/2015	9	9
			1/6/2016	9.2	9.2
			2/18/2016	8.7	8.7
			4/6/2016	8.9	8.9
			5/26/2016	9.3	9.3
			7/12/2016	9.6	9.6
			1/24/2017	ND<25 U	ND<25 U
			4/4/2017	ND<25 U	ND<25 U
			7/17/2017	ND<0.57 U	ND<0.57 U

There are 0 unused locations

Loc.	Meas.	ND	Date	Conc.	Original

	A	B	C	D	E	F
1	ROS Adjustment of data below Detection Limit using ROS Method					
2	Boron					
3	Well	Date	B	D_B	Unit	NROS_B
4	BG-1	8/12/2015	8.5	1	ug/L	8.5
5	BG-1	10/15/2015	6.1	1	ug/L	6.1
6	BG-1	11/18/2015	5.9	1	ug/L	5.9
7	BG-1	1/4/2016	7.5	1	ug/L	7.5
8	BG-1	2/16/2016	5.5	1	ug/L	5.5
9	BG-1	4/5/2016	6	1	ug/L	6
10	BG-1	5/26/2016	6.1	1	ug/L	6.1
11	BG-1	7/12/2016	7	1	ug/L	7
12	BG-1	1/23/2017	-25	0	ug/L	3.75162
13	BG-1	4/3/2017	-25	0	ug/L	4.44175
14	BG-1	7/17/2017	-0.57	0	ug/L	4.13714

Rosner's Test for Outliers

Parameter: Boron

All Locations

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

Data set mean = 18.1085

10 most extreme of 88 measurements

by order of magnitude difference from the mean

1	4/5/2017	MW-2	54	35.8915
2	1/26/2017	MW-2	52.1	33.9915
3	8/12/2015	MW-2	51	32.8915
4	7/18/2017	MW-2	50.2	32.0915
5	11/19/2015	MW-3	49.4	31.2915
6	8/12/2015	MW-3	49	30.8915
7	4/6/2016	MW-2	47.3	29.1915
8	4/7/2016	MW-3	42.7	24.5915
9	1/5/2016	MW-3	42	23.8915
10	7/11/2016	MW-3	41.9	23.7915

Iteration i = 9

Mean of 79 measurements = 14.631
Std Dev = 12.1061
x(i+1) = 41.9 from measurement 7/11/2016 from location MW-3
Rosner Statistic R = |41.9 - 14.631|/12.1061 = 2.25251
Lambda(88, 10, 0.05) = 3.3
2.25251 < 3.3 -- No outliers detected for i = 9

Iteration i = 8

Mean of 80 measurements = 14.9731
Std Dev = 12.4123
x(i+1) = 42 from measurement 1/5/2016 from location MW-3
Rosner Statistic R = |42 - 14.9731|/12.4123 = 2.17743
Lambda(88, 9, 0.05) = 3.3044
2.17743 < 3.3044 -- No outliers detected for i = 8

Iteration i = 7

Mean of 81 measurements = 15.3154
Std Dev = 12.7134
x(i+1) = 42.7 from measurement 4/7/2016 from location MW-3
Rosner Statistic R = |42.7 - 15.3154|/12.7134 = 2.154
Lambda(88, 8, 0.05) = 3.3088
2.154 < 3.3088 -- No outliers detected for i = 7

Iteration i = 6

Mean of 82 measurements = 15.7055
Std Dev = 13.1191
x(i+1) = 47.3 from measurement 4/6/2016 from location MW-2
Rosner Statistic R = |47.3 - 15.7055|/13.1191 = 2.40829
Lambda(88, 7, 0.05) = 3.3132
2.40829 < 3.3132 -- No outliers detected for i = 6

Iteration i = 5

Mean of 83 measurements = 16.1066
Std Dev = 13.5413
x(i+1) = 49 from measurement 8/12/2015 from location MW-3
Rosner Statistic R = |49 - 16.1066|/13.5413 = 2.42911
Lambda(88, 6, 0.05) = 3.3176
2.42911 < 3.3176 -- No outliers detected for i = 5

Iteration i = 4

Mean of 84 measurements = 16.503
Std Dev = 13.9411
x(i+1) = 49.4 from measurement 11/19/2015 from location MW-3

Rosner Statistic R = |49.4 - 16.503|/13.9411 = 2.35972
Lambda(88, 5, 0.05) = 3.322
2.35972 < 3.322 -- No outliers detected for i = 4

Iteration i = 3
Mean of 85 measurements = 16.8994
Std Dev = 14.3317
x(i+1) = 50.2 from measurement 7/18/2017 from location MW-2
Rosner Statistic R = |50.2 - 16.8994|/14.3317 = 2.32356
Lambda(88, 4, 0.05) = 3.33
2.32356 < 3.33 -- No outliers detected for i = 3

Iteration i = 2
Mean of 86 measurements = 17.2959
Std Dev = 14.7141
x(i+1) = 51 from measurement 8/12/2015 from location MW-2
Rosner Statistic R = |51 - 17.2959|/14.7141 = 2.2906
Lambda(88, 3, 0.05) = 3.332
2.2906 < 3.332 -- No outliers detected for i = 2

Iteration i = 1
Mean of 87 measurements = 17.696
Std Dev = 15.0967
x(i+1) = 52.1 from measurement 1/26/2017 from location MW-2
Rosner Statistic R = |52.1 - 17.696|/15.0967 = 2.27891
Lambda(88, 2, 0.05) = 3.332
2.27891 < 3.332 -- No outliers detected for i = 1

Iteration i = 0
Mean of 88 measurements = 18.1085
Std Dev = 15.5005
x(i+1) = 54 from measurement 4/5/2017 from location MW-2
Rosner Statistic R = |54 - 18.1085|/15.5005 = 2.3155
Lambda(88, 1, 0.05) = 3.342
2.3155 < 3.342 -- No outliers detected for i = 0

Shapiro-Wilks Test of Normality

Parameter: Boron
All Locations
Normality Test of Parameter Concentrations
Original Data (Not Transformed)
Non-Detects Replaced with Detection Limit
K = 5 for 11 measurements

i	x(i)	x(n-i+1)	x(n-1+1)-x(i)	a(n-i+1)	b(i)
1	3.75	8.5	4.75	0.5601	2.66048
2	4.14	7.5	3.36	0.3315	1.11384
3	4.44	7	2.56	0.226	0.57856
4	5.5	6.1	0.6	0.1429	0.08574
5	5.9	6.1	0.2	0.0695	0.0139
6	6	6	0		
7	6.1	5.9	-0.2		
8	6.1	5.5	-0.6		
9	7	4.44	-2.56		
10	7.5	4.14	-3.36		
11	8.5	3.75	-4.75		

Sum of b values = 4.45252
Sample Standard Deviation = 1.43637
W Statistic = 0.960898

5% Critical value of 0.85 is less than 0.960898
Data is normally distributed at 95% level of significance

1% Critical value of 0.792 is less than 0.960898
Data is normally distributed at 99% level of significance

Parametric Prediction Interval Analysis

Inter-Well Comparison

Parameter: Boron

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

Inter-Well Unified Guid. Formula 95% One-Sided Comparison

Background Samples = 11
Background Mean = 5.90273
Background Std Dev = 1.43637

Number of comparisons = 7
Future Samples (k) = 7
Actual confidence level is 1.0 - (0.05/7) = 99.2857 %
t is Percentile of Student's T-Test (0.95/7) = 0.992857
Degrees of Freedom = 11 (background observations) - 1
t(0.992857, 11) = 2.99548

Well MW-1

Date	Samples	Mean	Interval	Significant
7/18/2017	1	0.57	[0, 10.3967]	FALSE

Well MW-2

Date	Samples	Mean	Interval	Significant
7/18/2017	**1**	**50.2**	**[0, 10.3967]**	**TRUE**

Well MW-3

Date	Samples	Mean	Interval	Significant
7/19/2017	1	0.57	[0, 10.3967]	FALSE

Well MW-4

Date	Samples	Mean	Interval	Significant
7/20/2017	1	0.57	[0, 10.3967]	FALSE

Well MW-5

Date	Samples	Mean	Interval	Significant
7/19/2017	1	0.57	[0, 10.3967]	FALSE

Well MW-6

Date	Samples	Mean	Interval	Significant
7/19/2017	1	0.57	[0, 10.3967]	FALSE

Well MW-8

Date	Samples	Mean	Interval	Significant
7/17/2017	1	0.57	[0, 10.3967]	FALSE

Sen's Slope Analysis

Parameter: Boron

Location: MW-2

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

90% Confidence Level

Xj	Xk	(Xj - Xk)/(j-k)	Q
25.7 (10/15/2015)	51 (8/12/2015)	(25.7 - 51)/(2 - 1)	-25.3
40.9 (11/19/2015)	51 (8/12/2015)	(40.9 - 51)/(3 - 1)	-5.05
37.8 (1/6/2016)	51 (8/12/2015)	(37.8 - 51)/(4 - 1)	-4.4
37.4 (2/17/2016)	51 (8/12/2015)	(37.4 - 51)/(5 - 1)	-3.4
47.3 (4/6/2016)	51 (8/12/2015)	(47.3 - 51)/(6 - 1)	-0.74
40.5 (5/27/2016)	51 (8/12/2015)	(40.5 - 51)/(7 - 1)	-1.75
39.4 (7/12/2016)	51 (8/12/2015)	(39.4 - 51)/(8 - 1)	-1.65714
52.1 (1/26/2017)	51 (8/12/2015)	(52.1 - 51)/(9 - 1)	0.1375
54 (4/5/2017)	51 (8/12/2015)	(54 - 51)/(10 - 1)	0.333333
50.2 (7/18/2017)	51 (8/12/2015)	(50.2 - 51)/(11 - 1)	-0.08
40.9 (11/19/2015)	25.7 (10/15/2015)	(40.9 - 25.7)/(3 - 2)	15.2
37.8 (1/6/2016)	25.7 (10/15/2015)	(37.8 - 25.7)/(4 - 2)	6.05
37.4 (2/17/2016)	25.7 (10/15/2015)	(37.4 - 25.7)/(5 - 2)	3.9
47.3 (4/6/2016)	25.7 (10/15/2015)	(47.3 - 25.7)/(6 - 2)	5.4
40.5 (5/27/2016)	25.7 (10/15/2015)	(40.5 - 25.7)/(7 - 2)	2.96
39.4 (7/12/2016)	25.7 (10/15/2015)	(39.4 - 25.7)/(8 - 2)	2.28333
52.1 (1/26/2017)	25.7 (10/15/2015)	(52.1 - 25.7)/(9 - 2)	3.77143
54 (4/5/2017)	25.7 (10/15/2015)	(54 - 25.7)/(10 - 2)	3.5375
50.2 (7/18/2017)	25.7 (10/15/2015)	(50.2 - 25.7)/(11 - 2)	2.72222
37.8 (1/6/2016)	40.9 (11/19/2015)	(37.8 - 40.9)/(4 - 3)	-3.1
37.4 (2/17/2016)	40.9 (11/19/2015)	(37.4 - 40.9)/(5 - 3)	-1.75
47.3 (4/6/2016)	40.9 (11/19/2015)	(47.3 - 40.9)/(6 - 3)	2.13333
40.5 (5/27/2016)	40.9 (11/19/2015)	(40.5 - 40.9)/(7 - 3)	-0.1
39.4 (7/12/2016)	40.9 (11/19/2015)	(39.4 - 40.9)/(8 - 3)	-0.3
52.1 (1/26/2017)	40.9 (11/19/2015)	(52.1 - 40.9)/(9 - 3)	1.86667
54 (4/5/2017)	40.9 (11/19/2015)	(54 - 40.9)/(10 - 3)	1.87143
50.2 (7/18/2017)	40.9 (11/19/2015)	(50.2 - 40.9)/(11 - 3)	1.1625
37.4 (2/17/2016)	37.8 (1/6/2016)	(37.4 - 37.8)/(5 - 4)	-0.4
47.3 (4/6/2016)	37.8 (1/6/2016)	(47.3 - 37.8)/(6 - 4)	4.75
40.5 (5/27/2016)	37.8 (1/6/2016)	(40.5 - 37.8)/(7 - 4)	0.9
39.4 (7/12/2016)	37.8 (1/6/2016)	(39.4 - 37.8)/(8 - 4)	0.4
52.1 (1/26/2017)	37.8 (1/6/2016)	(52.1 - 37.8)/(9 - 4)	2.86
54 (4/5/2017)	37.8 (1/6/2016)	(54 - 37.8)/(10 - 4)	2.7
50.2 (7/18/2017)	37.8 (1/6/2016)	(50.2 - 37.8)/(11 - 4)	1.77143
47.3 (4/6/2016)	37.4 (2/17/2016)	(47.3 - 37.4)/(6 - 5)	9.9
40.5 (5/27/2016)	37.4 (2/17/2016)	(40.5 - 37.4)/(7 - 5)	1.55
39.4 (7/12/2016)	37.4 (2/17/2016)	(39.4 - 37.4)/(8 - 5)	0.666667
52.1 (1/26/2017)	37.4 (2/17/2016)	(52.1 - 37.4)/(9 - 5)	3.675
54 (4/5/2017)	37.4 (2/17/2016)	(54 - 37.4)/(10 - 5)	3.32
50.2 (7/18/2017)	37.4 (2/17/2016)	(50.2 - 37.4)/(11 - 5)	2.13333
40.5 (5/27/2016)	47.3 (4/6/2016)	(40.5 - 47.3)/(7 - 6)	-6.8
39.4 (7/12/2016)	47.3 (4/6/2016)	(39.4 - 47.3)/(8 - 6)	-3.95
52.1 (1/26/2017)	47.3 (4/6/2016)	(52.1 - 47.3)/(9 - 6)	1.6
54 (4/5/2017)	47.3 (4/6/2016)	(54 - 47.3)/(10 - 6)	1.675
50.2 (7/18/2017)	47.3 (4/6/2016)	(50.2 - 47.3)/(11 - 6)	0.58
39.4 (7/12/2016)	40.5 (5/27/2016)	(39.4 - 40.5)/(8 - 7)	-1.1
52.1 (1/26/2017)	40.5 (5/27/2016)	(52.1 - 40.5)/(9 - 7)	5.8
54 (4/5/2017)	40.5 (5/27/2016)	(54 - 40.5)/(10 - 7)	4.5
50.2 (7/18/2017)	40.5 (5/27/2016)	(50.2 - 40.5)/(11 - 7)	2.425
52.1 (1/26/2017)	39.4 (7/12/2016)	(52.1 - 39.4)/(9 - 8)	12.7
54 (4/5/2017)	39.4 (7/12/2016)	(54 - 39.4)/(10 - 8)	7.3
50.2 (7/18/2017)	39.4 (7/12/2016)	(50.2 - 39.4)/(11 - 8)	3.6
54 (4/5/2017)	52.1 (1/26/2017)	(54 - 52.1)/(10 - 9)	1.9
50.2 (7/18/2017)	52.1 (1/26/2017)	(50.2 - 52.1)/(11 - 9)	-0.95

50.2 (7/18/2017)	54 (4/5/2017)	(50.2 - 54)/(11 - 10)	-3.8

Number of Q values = 55

Ordered Q Values

n	Q
1	-25.3
2	-6.8
3	-5.05
4	-4.4
5	-3.95
6	-3.8
7	-3.4
8	-3.1
9	-1.75
10	-1.75
11	-1.65714
12	-1.1
13	-0.95
14	-0.74
15	-0.4
16	-0.3
17	-0.1
18	-0.08
19	0.1375
20	0.333333
21	0.4
22	0.58
23	0.666667
24	0.9
25	1.1625
26	1.55
27	1.6
28	1.675
29	1.77143
30	1.86667
31	1.87143
32	1.9
33	2.13333
34	2.13333
35	2.28333
36	2.425
37	2.7
38	2.72222
39	2.86
40	2.96
41	3.32
42	3.5375
43	3.6
44	3.675
45	3.77143
46	3.9
47	4.5
48	4.75
49	5.4
50	5.8
51	6.05
52	7.3
53	9.9
54	12.7
55	15.2

Sen's Estimator (Median Q) is 1.675

Time Period	Observations
8/12/2015	1
10/15/2015	1
11/19/2015	1
1/6/2016	1
2/17/2016	1

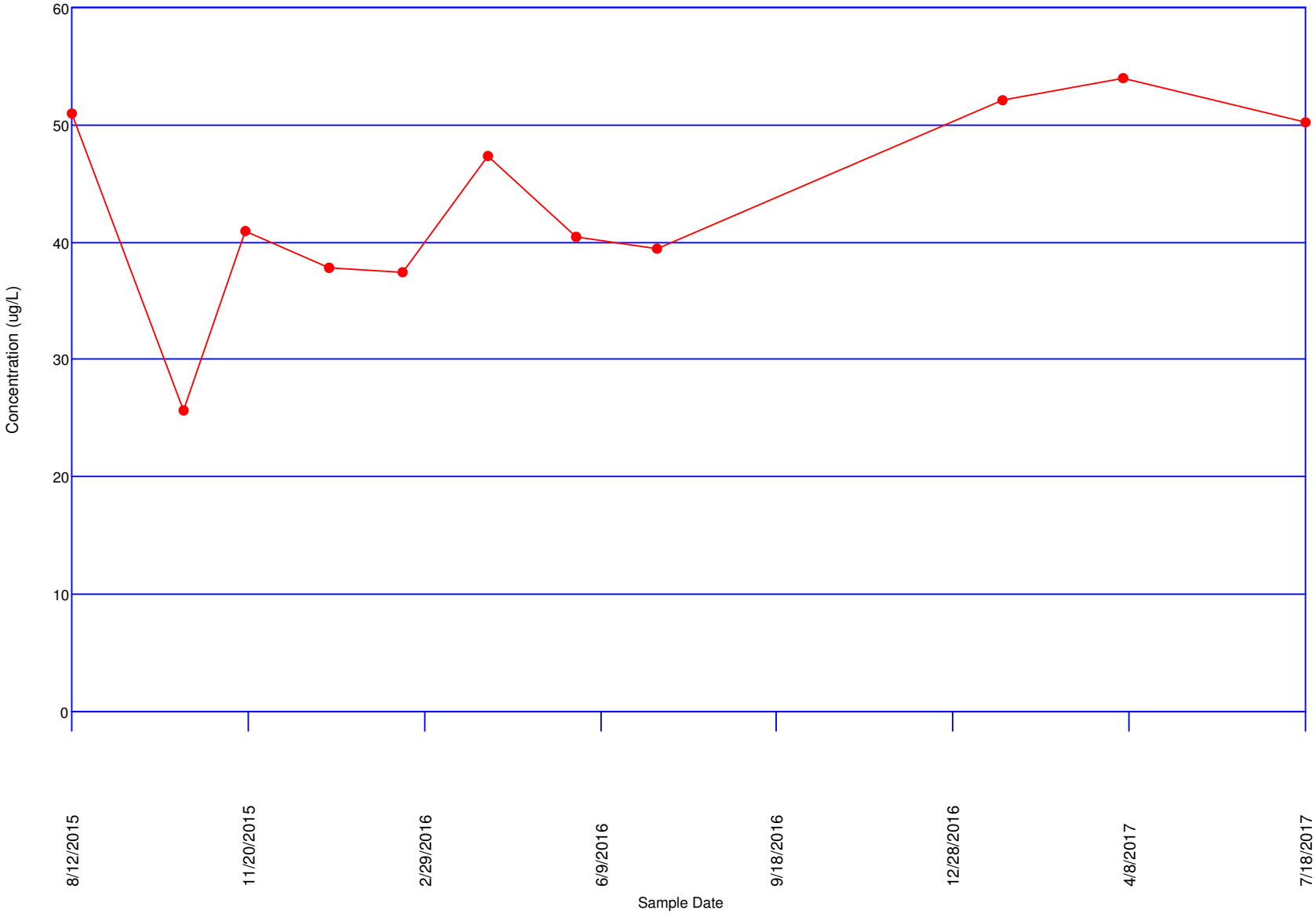
4/6/2016	1
5/27/2016	1
7/12/2016	1
1/26/2017	1
4/5/2017	1
7/18/2017	1

There are 0 time periods with multiple data

A = 0
B = 0
C = 0
D = 0
E = 0
F = 0
a = 2970
b = 8910
c = 220
Group Variance = 165
For 90% confidence interval (two-tailed), Z at (1-0.9)/2 = 1.64485
C = 21.1285
M1 = (55 - 21.1285)/2.0 = 16.9357
M2 = (55 + 21.1285)/2.0 + 1 = 39.0643
Lower limit is -0.1 = Q(17)
Upper limit is 2.86 = Q(39)
-0.1 < 0 < 2.86 indicating no trend in data.

Boron

Time-Series Graph of MW-2



Concentrations (ug/L)

Parameter: Calcium

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

Total Measurements: 88
Total Non-Detect: 0
Percent Non-Detects: 0%
Total Background Measurements: 11
There is 1 background location

Loc.	Meas.	ND	Date	Conc.	Original
BG-1	11	0 (0%)	8/12/2015	32000 B	32000 B
			10/15/2015	38200	38200
			11/18/2015	31700	31700
			1/4/2016	28600	28600
			2/16/2016	29500	29500
			4/5/2016	27300	27300
			5/26/2016	29500	29500
			7/12/2016	31600	31600
			1/23/2017	28100	28100
			4/3/2017	27400	27400
			7/17/2017	29000	29000

There are 7 compliance locations

Loc.	Meas.	ND	Date	Conc.	Original
MW-1	11	0 (0%)	8/12/2015	150000 B	150000 B
			10/15/2015	36500	36500
			11/20/2015	58700	58700
			1/6/2016	108000	108000
			2/17/2016	57700	57700
			4/6/2016	79900	79900
			5/27/2016	87800	87800
			7/12/2016	127000	127000
			1/25/2017	112000	112000
			4/5/2017	157000	157000
			7/18/2017	159000	159000
MW-2	11	0 (0%)	8/12/2015	100000 B	100000 B
			10/15/2015	153000	153000
			11/19/2015	189000	189000
			1/6/2016	188000	188000
			2/17/2016	207000	207000
			4/6/2016	192000	192000
			5/27/2016	130000	130000
			7/12/2016	159000	159000
			1/26/2017	214000	214000
			4/5/2017	215000	215000
			7/18/2017	208000	208000
MW-3	11	0 (0%)	8/12/2015	180000 B	180000 B
			10/15/2015	185000	185000
			11/19/2015	157000	157000
			1/5/2016	188000	188000
			2/16/2016	174000	174000
			4/7/2016	181000	181000
			5/27/2016	161000	161000
			7/11/2016	182000	182000
			1/24/2017	160000	160000
			4/5/2017	117000	117000
			7/19/2017	138000	138000
MW-4	11	0 (0%)	8/12/2015	46000 B	46000 B
			10/15/2015	46200	46200
			11/19/2015	39200	39200
			1/4/2016	35200	35200
			2/16/2016	35200	35200
			4/7/2016	17900	17900
			5/25/2016	18600	18600

			7/13/2016	53500	53500
			1/25/2017	68200	68200
			4/5/2017	63500	63500
			7/20/2017	63900	63900
MW-5	11	0 (0%)	8/12/2015	18000 B	18000 B
			10/15/2015	16900	16900
			11/18/2015	12400	12400
			1/4/2016	13500	13500
			2/16/2016	16900	16900
			4/5/2016	10100	10100
			5/25/2016	11900	11900
			7/11/2016	9990	9990
			1/23/2017	9140	9140
			4/4/2017	11700	11700
			7/19/2017	11400	11400
MW-6	11	0 (0%)	8/12/2015	38000 B	38000 B
			10/19/2015	38100	38100
			11/20/2015	37600	37600
			1/5/2016	35600	35600
			2/17/2016	39200	39200
			4/5/2016	33600	33600
			5/26/2016	33200	33200
			7/11/2016	35400	35400
			1/24/2017	34500	34500
			4/4/2017	37500	37500
			7/19/2017	35400	35400
MW-8	11	0 (0%)	8/12/2015	110000 B	110000 B
			10/15/2015	117000	117000
			11/20/2015	194000	194000
			1/6/2016	162000	162000
			2/18/2016	137000	137000
			4/6/2016	159000	159000
			5/26/2016	144000	144000
			7/12/2016	125000	125000
			1/24/2017	169000	169000
			4/4/2017	107000	107000
			7/17/2017	117000	117000

There are 0 unused locations

Loc.	Meas.	ND	Date	Conc.	Original

Rosner's Test for Outliers

Parameter: Calcium

All Locations

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

Data set mean = 88783.3

10 most extreme of 88 measurements

by order of magnitude difference from the mean

1	4/5/2017	MW-2	215000	126217
2	1/26/2017	MW-2	214000	125217
3	7/18/2017	MW-2	208000	119217
4	2/17/2016	MW-2	207000	118217
5	11/20/2015	MW-8	194000	105217
6	4/6/2016	MW-2	192000	103217
7	11/19/2015	MW-2	189000	100217
8	1/6/2016	MW-2	188000	99216.7
9	1/5/2016	MW-3	188000	99216.7
10	10/15/2015	MW-3	185000	96216.7

Iteration i = 9

Mean of 79 measurements = 76176.3
Std Dev = 57853.7
x(i+1) = 185000 from measurement 10/15/2015 from location MW-3
Rosner Statistic R = |185000 - 76176.3|/57853.7 = 1.88101
Lambda(88, 10, 0.05) = 3.3
1.88101 < 3.3 -- No outliers detected for i = 9

Iteration i = 8

Mean of 80 measurements = 77574.1
Std Dev = 58830.2
x(i+1) = 188000 from measurement 1/5/2016 from location MW-3
Rosner Statistic R = |188000 - 77574.1|/58830.2 = 1.87703
Lambda(88, 9, 0.05) = 3.3044
1.87703 < 3.3044 -- No outliers detected for i = 8

Iteration i = 7

Mean of 81 measurements = 78937.4
Std Dev = 59735
x(i+1) = 188000 from measurement 1/6/2016 from location MW-2
Rosner Statistic R = |188000 - 78937.4|/59735 = 1.82577
Lambda(88, 8, 0.05) = 3.3088
1.82577 < 3.3088 -- No outliers detected for i = 7

Iteration i = 6

Mean of 82 measurements = 80279.6
Std Dev = 60596.6
x(i+1) = 189000 from measurement 11/19/2015 from location MW-2
Rosner Statistic R = |189000 - 80279.6|/60596.6 = 1.79417
Lambda(88, 7, 0.05) = 3.3132
1.79417 < 3.3132 -- No outliers detected for i = 6

Iteration i = 5

Mean of 83 measurements = 81625.7
Std Dev = 61461.7
x(i+1) = 192000 from measurement 4/6/2016 from location MW-2
Rosner Statistic R = |192000 - 81625.7|/61461.7 = 1.79582
Lambda(88, 6, 0.05) = 3.3176
1.79582 < 3.3176 -- No outliers detected for i = 5

Iteration i = 4

Mean of 84 measurements = 82963.5
Std Dev = 62308.6
x(i+1) = 194000 from measurement 11/20/2015 from location MW-8

Rosner Statistic R = |194000 - 82963.5|/62308.6 = 1.78204
Lambda(88, 5, 0.05) = 3.322
1.78204 < 3.322 -- No outliers detected for i = 4

Iteration i = 3

Mean of 85 measurements = 84422.7
Std Dev = 63381
x(i+1) = 207000 from measurement 2/17/2016 from location MW-2
Rosner Statistic R = |207000 - 84422.7|/63381 = 1.93398
Lambda(88, 4, 0.05) = 3.33
1.93398 < 3.33 -- No outliers detected for i = 3

Iteration i = 2

Mean of 86 measurements = 85859.7
Std Dev = 64400.8
x(i+1) = 208000 from measurement 7/18/2017 from location MW-2
Rosner Statistic R = |208000 - 85859.7|/64400.8 = 1.89657
Lambda(88, 3, 0.05) = 3.332
1.89657 < 3.332 -- No outliers detected for i = 2

Iteration i = 1

Mean of 87 measurements = 87332.5
Std Dev = 65482.6
x(i+1) = 214000 from measurement 1/26/2017 from location MW-2
Rosner Statistic R = |214000 - 87332.5|/65482.6 = 1.93437
Lambda(88, 2, 0.05) = 3.332
1.93437 < 3.332 -- No outliers detected for i = 1

Iteration i = 0

Mean of 88 measurements = 88783.3
Std Dev = 66512.4
x(i+1) = 215000 from measurement 4/5/2017 from location MW-2
Rosner Statistic R = |215000 - 88783.3|/66512.4 = 1.89764
Lambda(88, 1, 0.05) = 3.342
1.89764 < 3.342 -- No outliers detected for i = 0

Shapiro-Wilks Test of Normality

Parameter: Calcium
All Locations
Normality Test of Parameter Concentrations
Original Data (Not Transformed)
Non-Detects Replaced with Detection Limit
K = 5 for 11 measurements

i	x(i)	x(n-i+1)	x(n-1+1)-x(i)	a(n-i+1)	b(i)
1	27300	38200	10900	0.5601	6105.09
2	27400	32000	4600	0.3315	1524.9
3	28100	31700	3600	0.226	813.6
4	28600	31600	3000	0.1429	428.7
5	29000	29500	500	0.0695	34.75
6	29500	29500	0		
7	29500	29000	-500		
8	31600	28600	-3000		
9	31700	28100	-3600		
10	32000	27400	-4600		
11	38200	27300	-10900		

Sum of b values = 8907.04
Sample Standard Deviation = 3115.21
W Statistic = 0.817507

5% Critical value of 0.85 exceeds 0.817507
Evidence of non-normality at 95% level of significance

1% Critical value of 0.792 is less than 0.817507
Data is normally distributed at 99% level of significance

Parametric Prediction Interval Analysis

Inter-Well Comparison

Parameter: Calcium

Original Data (Not Transformed)

Non-Detects Replaced with 1/2 DL

Inter-Well Unified Guid. Formula 95% One-Sided Comparison

Background Samples = 11
Background Mean = 30263.6
Background Std Dev = 3115.21

Number of comparisons = 7
Future Samples (k) = 7
Actual confidence level is 1.0 - (0.05/7) = 99.2857 %
t is Percentile of Student's T-Test (0.95/7) = 0.992857
Degrees of Freedom = 11 (background observations) - 1
t(0.992857, 11) = 2.99548

Well MW-1

Date	Samples	Mean	Interval	Significant
7/18/2017	1	159000	[0, 40010.1]	TRUE

Well MW-2

Date	Samples	Mean	Interval	Significant
7/18/2017	1	208000	[0, 40010.1]	TRUE

Well MW-3

Date	Samples	Mean	Interval	Significant
7/19/2017	1	138000	[0, 40010.1]	TRUE

Well MW-4

Date	Samples	Mean	Interval	Significant
7/20/2017	1	63900	[0, 40010.1]	TRUE

Well MW-5

Date	Samples	Mean	Interval	Significant
7/19/2017	1	11400	[0, 40010.1]	FALSE

Well MW-6

Date	Samples	Mean	Interval	Significant
7/19/2017	1	35400	[0, 40010.1]	FALSE

Well MW-8

Date	Samples	Mean	Interval	Significant
7/17/2017	1	117000	[0, 40010.1]	TRUE

Sen's Slope Analysis

Parameter: Calcium

Location: MW-1

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

90% Confidence Level

Xj	Xk	(Xj - Xk)/(j-k)	Q
36500 (10/15/2015)	150000 B (8/12/2015)	(36500 - 150000)/(2 - 1)	-113500
58700 (11/20/2015)	150000 B (8/12/2015)	(58700 - 150000)/(3 - 1)	-45650
108000 (1/6/2016)	150000 B (8/12/2015)	(108000 - 150000)/(4 - 1)	-14000
57700 (2/17/2016)	150000 B (8/12/2015)	(57700 - 150000)/(5 - 1)	-23075
79900 (4/6/2016)	150000 B (8/12/2015)	(79900 - 150000)/(6 - 1)	-14020
87800 (5/27/2016)	150000 B (8/12/2015)	(87800 - 150000)/(7 - 1)	-10366.7
127000 (7/12/2016)	150000 B (8/12/2015)	(127000 - 150000)/(8 - 1)	-3285.71
112000 (1/25/2017)	150000 B (8/12/2015)	(112000 - 150000)/(9 - 1)	-4750
157000 (4/5/2017)	150000 B (8/12/2015)	(157000 - 150000)/(10 - 1)	777.778
159000 (7/18/2017)	150000 B (8/12/2015)	(159000 - 150000)/(11 - 1)	900
58700 (11/20/2015)	36500 (10/15/2015)	(58700 - 36500)/(3 - 2)	22200
108000 (1/6/2016)	36500 (10/15/2015)	(108000 - 36500)/(4 - 2)	35750
57700 (2/17/2016)	36500 (10/15/2015)	(57700 - 36500)/(5 - 2)	7066.67
79900 (4/6/2016)	36500 (10/15/2015)	(79900 - 36500)/(6 - 2)	10850
87800 (5/27/2016)	36500 (10/15/2015)	(87800 - 36500)/(7 - 2)	10260
127000 (7/12/2016)	36500 (10/15/2015)	(127000 - 36500)/(8 - 2)	15083.3
112000 (1/25/2017)	36500 (10/15/2015)	(112000 - 36500)/(9 - 2)	10785.7
157000 (4/5/2017)	36500 (10/15/2015)	(157000 - 36500)/(10 - 2)	15062.5
159000 (7/18/2017)	36500 (10/15/2015)	(159000 - 36500)/(11 - 2)	13611.1
108000 (1/6/2016)	58700 (11/20/2015)	(108000 - 58700)/(4 - 3)	49300
57700 (2/17/2016)	58700 (11/20/2015)	(57700 - 58700)/(5 - 3)	-500
79900 (4/6/2016)	58700 (11/20/2015)	(79900 - 58700)/(6 - 3)	7066.67
87800 (5/27/2016)	58700 (11/20/2015)	(87800 - 58700)/(7 - 3)	7275
127000 (7/12/2016)	58700 (11/20/2015)	(127000 - 58700)/(8 - 3)	13660
112000 (1/25/2017)	58700 (11/20/2015)	(112000 - 58700)/(9 - 3)	8883.33
157000 (4/5/2017)	58700 (11/20/2015)	(157000 - 58700)/(10 - 3)	14042.9
159000 (7/18/2017)	58700 (11/20/2015)	(159000 - 58700)/(11 - 3)	12537.5
57700 (2/17/2016)	108000 (1/6/2016)	(57700 - 108000)/(5 - 4)	-50300
79900 (4/6/2016)	108000 (1/6/2016)	(79900 - 108000)/(6 - 4)	-14050
87800 (5/27/2016)	108000 (1/6/2016)	(87800 - 108000)/(7 - 4)	-6733.33
127000 (7/12/2016)	108000 (1/6/2016)	(127000 - 108000)/(8 - 4)	4750
112000 (1/25/2017)	108000 (1/6/2016)	(112000 - 108000)/(9 - 4)	800
157000 (4/5/2017)	108000 (1/6/2016)	(157000 - 108000)/(10 - 4)	8166.67
159000 (7/18/2017)	108000 (1/6/2016)	(159000 - 108000)/(11 - 4)	7285.71
79900 (4/6/2016)	57700 (2/17/2016)	(79900 - 57700)/(6 - 5)	22200
87800 (5/27/2016)	57700 (2/17/2016)	(87800 - 57700)/(7 - 5)	15050
127000 (7/12/2016)	57700 (2/17/2016)	(127000 - 57700)/(8 - 5)	23100
112000 (1/25/2017)	57700 (2/17/2016)	(112000 - 57700)/(9 - 5)	13575
157000 (4/5/2017)	57700 (2/17/2016)	(157000 - 57700)/(10 - 5)	19860
159000 (7/18/2017)	57700 (2/17/2016)	(159000 - 57700)/(11 - 5)	16883.3
87800 (5/27/2016)	79900 (4/6/2016)	(87800 - 79900)/(7 - 6)	7900
127000 (7/12/2016)	79900 (4/6/2016)	(127000 - 79900)/(8 - 6)	23550
112000 (1/25/2017)	79900 (4/6/2016)	(112000 - 79900)/(9 - 6)	10700
157000 (4/5/2017)	79900 (4/6/2016)	(157000 - 79900)/(10 - 6)	19275
159000 (7/18/2017)	79900 (4/6/2016)	(159000 - 79900)/(11 - 6)	15820
127000 (7/12/2016)	87800 (5/27/2016)	(127000 - 87800)/(8 - 7)	39200
112000 (1/25/2017)	87800 (5/27/2016)	(112000 - 87800)/(9 - 7)	12100
157000 (4/5/2017)	87800 (5/27/2016)	(157000 - 87800)/(10 - 7)	23066.7
159000 (7/18/2017)	87800 (5/27/2016)	(159000 - 87800)/(11 - 7)	17800
112000 (1/25/2017)	127000 (7/12/2016)	(112000 - 127000)/(9 - 8)	-15000
157000 (4/5/2017)	127000 (7/12/2016)	(157000 - 127000)/(10 - 8)	15000
159000 (7/18/2017)	127000 (7/12/2016)	(159000 - 127000)/(11 - 8)	10666.7
157000 (4/5/2017)	112000 (1/25/2017)	(157000 - 112000)/(10 - 9)	45000
159000 (7/18/2017)	112000 (1/25/2017)	(159000 - 112000)/(11 - 9)	23500

159000 (7/18/2017)	157000 (4/5/2017)	(159000 - 157000)/(11 - 10)	2000

Number of Q values = 55

Ordered Q Values

n	Q
1	-113500
2	-50300
3	-45650
4	-23075
5	-15000
6	-14050
7	-14020
8	-14000
9	-10366.7
10	-6733.33
11	-4750
12	-3285.71
13	-500
14	777.778
15	800
16	900
17	2000
18	4750
19	7066.67
20	7066.67
21	7275
22	7285.71
23	7900
24	8166.67
25	8883.33
26	10260
27	10666.7
28	10700
29	10785.7
30	10850
31	12100
32	12537.5
33	13575
34	13611.1
35	13660
36	14042.9
37	15000
38	15050
39	15062.5
40	15083.3
41	15820
42	16883.3
43	17800
44	19275
45	19860
46	22200
47	22200
48	23066.7
49	23100
50	23500
51	23550
52	35750
53	39200
54	45000
55	49300

Sen's Estimator (Median Q) is 10700

Time Period	Observations
8/12/2015	1
10/15/2015	1
11/20/2015	1
1/6/2016	1
2/17/2016	1

4/6/2016	1
5/27/2016	1
7/12/2016	1
1/25/2017	1
4/5/2017	1
7/18/2017	1

There are 0 time periods with multiple data

A = 0
B = 0
C = 0
D = 0
E = 0
F = 0
a = 2970
b = 8910
c = 220
Group Variance = 165
For 90% confidence interval (two-tailed), Z at (1-0.9)/2 = 1.64485
C = 21.1285
M1 = (55 - 21.1285)/2.0 = 16.9357
M2 = (55 + 21.1285)/2.0 + 1 = 39.0643
Lower limit is 2000 = Q(17)
Upper limit is 15062.5 = Q(39)
2000 > 0 indicating an upward trend in data.

Sen's Slope Analysis

Parameter: Calcium
Location: MW-2
Original Data (Not Transformed)
Non-Detects Replaced with Detection Limit

90% Confidence Level

Xj	Xk	(Xj - Xk)/(j-k)	Q
153000 (10/15/2015)	100000 B (8/12/2015)	(153000 - 100000)/(2 - 1)	53000
189000 (11/19/2015)	100000 B (8/12/2015)	(189000 - 100000)/(3 - 1)	44500
188000 (1/6/2016)	100000 B (8/12/2015)	(188000 - 100000)/(4 - 1)	29333.3
207000 (2/17/2016)	100000 B (8/12/2015)	(207000 - 100000)/(5 - 1)	26750
192000 (4/6/2016)	100000 B (8/12/2015)	(192000 - 100000)/(6 - 1)	18400
130000 (5/27/2016)	100000 B (8/12/2015)	(130000 - 100000)/(7 - 1)	5000
159000 (7/12/2016)	100000 B (8/12/2015)	(159000 - 100000)/(8 - 1)	8428.57
214000 (1/26/2017)	100000 B (8/12/2015)	(214000 - 100000)/(9 - 1)	14250
215000 (4/5/2017)	100000 B (8/12/2015)	(215000 - 100000)/(10 - 1)	12777.8
208000 (7/18/2017)	100000 B (8/12/2015)	(208000 - 100000)/(11 - 1)	10800
189000 (11/19/2015)	153000 (10/15/2015)	(189000 - 153000)/(3 - 2)	36000
188000 (1/6/2016)	153000 (10/15/2015)	(188000 - 153000)/(4 - 2)	17500
207000 (2/17/2016)	153000 (10/15/2015)	(207000 - 153000)/(5 - 2)	18000
192000 (4/6/2016)	153000 (10/15/2015)	(192000 - 153000)/(6 - 2)	9750
130000 (5/27/2016)	153000 (10/15/2015)	(130000 - 153000)/(7 - 2)	-4600
159000 (7/12/2016)	153000 (10/15/2015)	(159000 - 153000)/(8 - 2)	1000
214000 (1/26/2017)	153000 (10/15/2015)	(214000 - 153000)/(9 - 2)	8714.29
215000 (4/5/2017)	153000 (10/15/2015)	(215000 - 153000)/(10 - 2)	7750
208000 (7/18/2017)	153000 (10/15/2015)	(208000 - 153000)/(11 - 2)	6111.11
188000 (1/6/2016)	189000 (11/19/2015)	(188000 - 189000)/(4 - 3)	-1000
207000 (2/17/2016)	189000 (11/19/2015)	(207000 - 189000)/(5 - 3)	9000
192000 (4/6/2016)	189000 (11/19/2015)	(192000 - 189000)/(6 - 3)	1000
130000 (5/27/2016)	189000 (11/19/2015)	(130000 - 189000)/(7 - 3)	-14750
159000 (7/12/2016)	189000 (11/19/2015)	(159000 - 189000)/(8 - 3)	-6000
214000 (1/26/2017)	189000 (11/19/2015)	(214000 - 189000)/(9 - 3)	4166.67
215000 (4/5/2017)	189000 (11/19/2015)	(215000 - 189000)/(10 - 3)	3714.29
208000 (7/18/2017)	189000 (11/19/2015)	(208000 - 189000)/(11 - 3)	2375
207000 (2/17/2016)	188000 (1/6/2016)	(207000 - 188000)/(5 - 4)	19000
192000 (4/6/2016)	188000 (1/6/2016)	(192000 - 188000)/(6 - 4)	2000
130000 (5/27/2016)	188000 (1/6/2016)	(130000 - 188000)/(7 - 4)	-19333.3
159000 (7/12/2016)	188000 (1/6/2016)	(159000 - 188000)/(8 - 4)	-7250
214000 (1/26/2017)	188000 (1/6/2016)	(214000 - 188000)/(9 - 4)	5200
215000 (4/5/2017)	188000 (1/6/2016)	(215000 - 188000)/(10 - 4)	4500
208000 (7/18/2017)	188000 (1/6/2016)	(208000 - 188000)/(11 - 4)	2857.14
192000 (4/6/2016)	207000 (2/17/2016)	(192000 - 207000)/(6 - 5)	-15000
130000 (5/27/2016)	207000 (2/17/2016)	(130000 - 207000)/(7 - 5)	-38500
159000 (7/12/2016)	207000 (2/17/2016)	(159000 - 207000)/(8 - 5)	-16000
214000 (1/26/2017)	207000 (2/17/2016)	(214000 - 207000)/(9 - 5)	1750
215000 (4/5/2017)	207000 (2/17/2016)	(215000 - 207000)/(10 - 5)	1600
208000 (7/18/2017)	207000 (2/17/2016)	(208000 - 207000)/(11 - 5)	166.667
130000 (5/27/2016)	192000 (4/6/2016)	(130000 - 192000)/(7 - 6)	-62000
159000 (7/12/2016)	192000 (4/6/2016)	(159000 - 192000)/(8 - 6)	-16500
214000 (1/26/2017)	192000 (4/6/2016)	(214000 - 192000)/(9 - 6)	7333.33
215000 (4/5/2017)	192000 (4/6/2016)	(215000 - 192000)/(10 - 6)	5750
208000 (7/18/2017)	192000 (4/6/2016)	(208000 - 192000)/(11 - 6)	3200
159000 (7/12/2016)	130000 (5/27/2016)	(159000 - 130000)/(8 - 7)	29000
214000 (1/26/2017)	130000 (5/27/2016)	(214000 - 130000)/(9 - 7)	42000
215000 (4/5/2017)	130000 (5/27/2016)	(215000 - 130000)/(10 - 7)	28333.3
208000 (7/18/2017)	130000 (5/27/2016)	(208000 - 130000)/(11 - 7)	19500
214000 (1/26/2017)	159000 (7/12/2016)	(214000 - 159000)/(9 - 8)	55000
215000 (4/5/2017)	159000 (7/12/2016)	(215000 - 159000)/(10 - 8)	28000
208000 (7/18/2017)	159000 (7/12/2016)	(208000 - 159000)/(11 - 8)	16333.3
215000 (4/5/2017)	214000 (1/26/2017)	(215000 - 214000)/(10 - 9)	1000
208000 (7/18/2017)	214000 (1/26/2017)	(208000 - 214000)/(11 - 9)	-3000

208000 (7/18/2017)	215000 (4/5/2017)	(208000 - 215000)/(11 - 10)	-7000

Number of Q values = 55

Ordered Q Values

n	Q
1	-62000
2	-38500
3	-19333.3
4	-16500
5	-16000
6	-15000
7	-14750
8	-7250
9	-7000
10	-6000
11	-4600
12	-3000
13	-1000
14	166.667
15	1000
16	1000
17	1000
18	1600
19	1750
20	2000
21	2375
22	2857.14
23	3200
24	3714.29
25	4166.67
26	4500
27	5000
28	5200
29	5750
30	6111.11
31	7333.33
32	7750
33	8428.57
34	8714.29
35	9000
36	9750
37	10800
38	12777.8
39	14250
40	16333.3
41	17500
42	18000
43	18400
44	19000
45	19500
46	26750
47	28000
48	28333.3
49	29000
50	29333.3
51	36000
52	42000
53	44500
54	53000
55	55000

Sen's Estimator (Median Q) is 5200

Time Period	Observations
8/12/2015	1
10/15/2015	1
11/19/2015	1
1/6/2016	1
2/17/2016	1

4/6/2016	1
5/27/2016	1
7/12/2016	1
1/26/2017	1
4/5/2017	1
7/18/2017	1

There are 0 time periods with multiple data

A = 0
B = 0
C = 0
D = 0
E = 0
F = 0
a = 2970
b = 8910
c = 220
Group Variance = 165
For 90% confidence interval (two-tailed), Z at (1-0.9)/2 = 1.64485
C = 21.1285
M1 = (55 - 21.1285)/2.0 = 16.9357
M2 = (55 + 21.1285)/2.0 + 1 = 39.0643
Lower limit is 1000 = Q(17)
Upper limit is 14250 = Q(39)
1000 > 0 indicating an upward trend in data.

Sen's Slope Analysis

Parameter: Calcium

Location: MW-3

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

90% Confidence Level

Xj	Xk	(Xj - Xk)/(j-k)	Q
185000 (10/15/2015)	180000 B (8/12/2015)	(185000 - 180000)/(2 - 1)	5000
157000 (11/19/2015)	180000 B (8/12/2015)	(157000 - 180000)/(3 - 1)	-11500
188000 (1/5/2016)	180000 B (8/12/2015)	(188000 - 180000)/(4 - 1)	2666.67
174000 (2/16/2016)	180000 B (8/12/2015)	(174000 - 180000)/(5 - 1)	-1500
181000 (4/7/2016)	180000 B (8/12/2015)	(181000 - 180000)/(6 - 1)	200
161000 (5/27/2016)	180000 B (8/12/2015)	(161000 - 180000)/(7 - 1)	-3166.67
182000 (7/11/2016)	180000 B (8/12/2015)	(182000 - 180000)/(8 - 1)	285.714
160000 (1/24/2017)	180000 B (8/12/2015)	(160000 - 180000)/(9 - 1)	-2500
117000 (4/5/2017)	180000 B (8/12/2015)	(117000 - 180000)/(10 - 1)	-7000
138000 (7/19/2017)	180000 B (8/12/2015)	(138000 - 180000)/(11 - 1)	-4200
157000 (11/19/2015)	185000 (10/15/2015)	(157000 - 185000)/(3 - 2)	-28000
188000 (1/5/2016)	185000 (10/15/2015)	(188000 - 185000)/(4 - 2)	1500
174000 (2/16/2016)	185000 (10/15/2015)	(174000 - 185000)/(5 - 2)	-3666.67
181000 (4/7/2016)	185000 (10/15/2015)	(181000 - 185000)/(6 - 2)	-1000
161000 (5/27/2016)	185000 (10/15/2015)	(161000 - 185000)/(7 - 2)	-4800
182000 (7/11/2016)	185000 (10/15/2015)	(182000 - 185000)/(8 - 2)	-500
160000 (1/24/2017)	185000 (10/15/2015)	(160000 - 185000)/(9 - 2)	-3571.43
117000 (4/5/2017)	185000 (10/15/2015)	(117000 - 185000)/(10 - 2)	-8500
138000 (7/19/2017)	185000 (10/15/2015)	(138000 - 185000)/(11 - 2)	-5222.22
188000 (1/5/2016)	157000 (11/19/2015)	(188000 - 157000)/(4 - 3)	31000
174000 (2/16/2016)	157000 (11/19/2015)	(174000 - 157000)/(5 - 3)	8500
181000 (4/7/2016)	157000 (11/19/2015)	(181000 - 157000)/(6 - 3)	8000
161000 (5/27/2016)	157000 (11/19/2015)	(161000 - 157000)/(7 - 3)	1000
182000 (7/11/2016)	157000 (11/19/2015)	(182000 - 157000)/(8 - 3)	5000
160000 (1/24/2017)	157000 (11/19/2015)	(160000 - 157000)/(9 - 3)	500
117000 (4/5/2017)	157000 (11/19/2015)	(117000 - 157000)/(10 - 3)	-5714.29
138000 (7/19/2017)	157000 (11/19/2015)	(138000 - 157000)/(11 - 3)	-2375
174000 (2/16/2016)	188000 (1/5/2016)	(174000 - 188000)/(5 - 4)	-14000
181000 (4/7/2016)	188000 (1/5/2016)	(181000 - 188000)/(6 - 4)	-3500
161000 (5/27/2016)	188000 (1/5/2016)	(161000 - 188000)/(7 - 4)	-9000
182000 (7/11/2016)	188000 (1/5/2016)	(182000 - 188000)/(8 - 4)	-1500
160000 (1/24/2017)	188000 (1/5/2016)	(160000 - 188000)/(9 - 4)	-5600
117000 (4/5/2017)	188000 (1/5/2016)	(117000 - 188000)/(10 - 4)	-11833.3
138000 (7/19/2017)	188000 (1/5/2016)	(138000 - 188000)/(11 - 4)	-7142.86
181000 (4/7/2016)	174000 (2/16/2016)	(181000 - 174000)/(6 - 5)	7000
161000 (5/27/2016)	174000 (2/16/2016)	(161000 - 174000)/(7 - 5)	-6500
182000 (7/11/2016)	174000 (2/16/2016)	(182000 - 174000)/(8 - 5)	2666.67
160000 (1/24/2017)	174000 (2/16/2016)	(160000 - 174000)/(9 - 5)	-3500
117000 (4/5/2017)	174000 (2/16/2016)	(117000 - 174000)/(10 - 5)	-11400
138000 (7/19/2017)	174000 (2/16/2016)	(138000 - 174000)/(11 - 5)	-6000
161000 (5/27/2016)	181000 (4/7/2016)	(161000 - 181000)/(7 - 6)	-20000
182000 (7/11/2016)	181000 (4/7/2016)	(182000 - 181000)/(8 - 6)	500
160000 (1/24/2017)	181000 (4/7/2016)	(160000 - 181000)/(9 - 6)	-7000
117000 (4/5/2017)	181000 (4/7/2016)	(117000 - 181000)/(10 - 6)	-16000
138000 (7/19/2017)	181000 (4/7/2016)	(138000 - 181000)/(11 - 6)	-8600
182000 (7/11/2016)	161000 (5/27/2016)	(182000 - 161000)/(8 - 7)	21000
160000 (1/24/2017)	161000 (5/27/2016)	(160000 - 161000)/(9 - 7)	-500
117000 (4/5/2017)	161000 (5/27/2016)	(117000 - 161000)/(10 - 7)	-14666.7
138000 (7/19/2017)	161000 (5/27/2016)	(138000 - 161000)/(11 - 7)	-5750
160000 (1/24/2017)	182000 (7/11/2016)	(160000 - 182000)/(9 - 8)	-22000
117000 (4/5/2017)	182000 (7/11/2016)	(117000 - 182000)/(10 - 8)	-32500
138000 (7/19/2017)	182000 (7/11/2016)	(138000 - 182000)/(11 - 8)	-14666.7
117000 (4/5/2017)	160000 (1/24/2017)	(117000 - 160000)/(10 - 9)	-43000
138000 (7/19/2017)	160000 (1/24/2017)	(138000 - 160000)/(11 - 9)	-11000

138000 (7/19/2017)	117000 (4/5/2017)	(138000 - 117000)/(11 - 10)	21000

Number of Q values = 55

Ordered Q Values

n	Q
1	-43000
2	-32500
3	-28000
4	-22000
5	-20000
6	-16000
7	-14666.7
8	-14666.7
9	-14000
10	-11833.3
11	-11500
12	-11400
13	-11000
14	-9000
15	-8600
16	-8500
17	-7142.86
18	-7000
19	-7000
20	-6500
21	-6000
22	-5750
23	-5714.29
24	-5600
25	-5222.22
26	-4800
27	-4200
28	-3666.67
29	-3571.43
30	-3500
31	-3500
32	-3166.67
33	-2500
34	-2375
35	-1500
36	-1500
37	-1000
38	-500
39	-500
40	200
41	285.714
42	500
43	500
44	1000
45	1500
46	2666.67
47	2666.67
48	5000
49	5000
50	7000
51	8000
52	8500
53	21000
54	21000
55	31000

Sen's Estimator (Median Q) is -3666.67

Time Period	Observations
8/12/2015	1
10/15/2015	1
11/19/2015	1
1/5/2016	1
2/16/2016	1

4/7/2016	1
5/27/2016	1
7/11/2016	1
1/24/2017	1
4/5/2017	1
7/19/2017	1

There are 0 time periods with multiple data

A = 0
B = 0
C = 0
D = 0
E = 0
F = 0
a = 2970
b = 8910
c = 220
Group Variance = 165
For 90% confidence interval (two-tailed), Z at (1-0.9)/2 = 1.64485
C = 21.1285
M1 = (55 - 21.1285)/2.0 = 16.9357
M2 = (55 + 21.1285)/2.0 + 1 = 39.0643
Lower limit is -7142.86 = Q(17)
Upper limit is -500 = Q(39)
-500 < 0 indicating a downward trend in data.

Sen's Slope Analysis

Parameter: Calcium

Location: MW-4

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

90% Confidence Level

Xj	Xk	(Xj - Xk)/(j-k)	Q
46200 (10/15/2015)	46000 B (8/12/2015)	(46200 - 46000)/(2 - 1)	200
39200 (11/19/2015)	46000 B (8/12/2015)	(39200 - 46000)/(3 - 1)	-3400
35200 (1/4/2016)	46000 B (8/12/2015)	(35200 - 46000)/(4 - 1)	-3600
35200 (2/16/2016)	46000 B (8/12/2015)	(35200 - 46000)/(5 - 1)	-2700
17900 (4/7/2016)	46000 B (8/12/2015)	(17900 - 46000)/(6 - 1)	-5620
18600 (5/25/2016)	46000 B (8/12/2015)	(18600 - 46000)/(7 - 1)	-4566.67
53500 (7/13/2016)	46000 B (8/12/2015)	(53500 - 46000)/(8 - 1)	1071.43
68200 (1/25/2017)	46000 B (8/12/2015)	(68200 - 46000)/(9 - 1)	2775
63500 (4/5/2017)	46000 B (8/12/2015)	(63500 - 46000)/(10 - 1)	1944.44
63900 (7/20/2017)	46000 B (8/12/2015)	(63900 - 46000)/(11 - 1)	1790
39200 (11/19/2015)	46200 (10/15/2015)	(39200 - 46200)/(3 - 2)	-7000
35200 (1/4/2016)	46200 (10/15/2015)	(35200 - 46200)/(4 - 2)	-5500
35200 (2/16/2016)	46200 (10/15/2015)	(35200 - 46200)/(5 - 2)	-3666.67
17900 (4/7/2016)	46200 (10/15/2015)	(17900 - 46200)/(6 - 2)	-7075
18600 (5/25/2016)	46200 (10/15/2015)	(18600 - 46200)/(7 - 2)	-5520
53500 (7/13/2016)	46200 (10/15/2015)	(53500 - 46200)/(8 - 2)	1216.67
68200 (1/25/2017)	46200 (10/15/2015)	(68200 - 46200)/(9 - 2)	3142.86
63500 (4/5/2017)	46200 (10/15/2015)	(63500 - 46200)/(10 - 2)	2162.5
63900 (7/20/2017)	46200 (10/15/2015)	(63900 - 46200)/(11 - 2)	1966.67
35200 (1/4/2016)	39200 (11/19/2015)	(35200 - 39200)/(4 - 3)	-4000
35200 (2/16/2016)	39200 (11/19/2015)	(35200 - 39200)/(5 - 3)	-2000
17900 (4/7/2016)	39200 (11/19/2015)	(17900 - 39200)/(6 - 3)	-7100
18600 (5/25/2016)	39200 (11/19/2015)	(18600 - 39200)/(7 - 3)	-5150
53500 (7/13/2016)	39200 (11/19/2015)	(53500 - 39200)/(8 - 3)	2860
68200 (1/25/2017)	39200 (11/19/2015)	(68200 - 39200)/(9 - 3)	4833.33
63500 (4/5/2017)	39200 (11/19/2015)	(63500 - 39200)/(10 - 3)	3471.43
63900 (7/20/2017)	39200 (11/19/2015)	(63900 - 39200)/(11 - 3)	3087.5
35200 (2/16/2016)	35200 (1/4/2016)	(35200 - 35200)/(5 - 4)	0
17900 (4/7/2016)	35200 (1/4/2016)	(17900 - 35200)/(6 - 4)	-8650
18600 (5/25/2016)	35200 (1/4/2016)	(18600 - 35200)/(7 - 4)	-5533.33
53500 (7/13/2016)	35200 (1/4/2016)	(53500 - 35200)/(8 - 4)	4575
68200 (1/25/2017)	35200 (1/4/2016)	(68200 - 35200)/(9 - 4)	6600
63500 (4/5/2017)	35200 (1/4/2016)	(63500 - 35200)/(10 - 4)	4716.67
63900 (7/20/2017)	35200 (1/4/2016)	(63900 - 35200)/(11 - 4)	4100
17900 (4/7/2016)	35200 (2/16/2016)	(17900 - 35200)/(6 - 5)	-17300
18600 (5/25/2016)	35200 (2/16/2016)	(18600 - 35200)/(7 - 5)	-8300
53500 (7/13/2016)	35200 (2/16/2016)	(53500 - 35200)/(8 - 5)	6100
68200 (1/25/2017)	35200 (2/16/2016)	(68200 - 35200)/(9 - 5)	8250
63500 (4/5/2017)	35200 (2/16/2016)	(63500 - 35200)/(10 - 5)	5660
63900 (7/20/2017)	35200 (2/16/2016)	(63900 - 35200)/(11 - 5)	4783.33
18600 (5/25/2016)	17900 (4/7/2016)	(18600 - 17900)/(7 - 6)	700
53500 (7/13/2016)	17900 (4/7/2016)	(53500 - 17900)/(8 - 6)	17800
68200 (1/25/2017)	17900 (4/7/2016)	(68200 - 17900)/(9 - 6)	16766.7
63500 (4/5/2017)	17900 (4/7/2016)	(63500 - 17900)/(10 - 6)	11400
63900 (7/20/2017)	17900 (4/7/2016)	(63900 - 17900)/(11 - 6)	9200
53500 (7/13/2016)	18600 (5/25/2016)	(53500 - 18600)/(8 - 7)	34900
68200 (1/25/2017)	18600 (5/25/2016)	(68200 - 18600)/(9 - 7)	24800
63500 (4/5/2017)	18600 (5/25/2016)	(63500 - 18600)/(10 - 7)	14966.7
63900 (7/20/2017)	18600 (5/25/2016)	(63900 - 18600)/(11 - 7)	11325
68200 (1/25/2017)	53500 (7/13/2016)	(68200 - 53500)/(9 - 8)	14700
63500 (4/5/2017)	53500 (7/13/2016)	(63500 - 53500)/(10 - 8)	5000
63900 (7/20/2017)	53500 (7/13/2016)	(63900 - 53500)/(11 - 8)	3466.67
63500 (4/5/2017)	68200 (1/25/2017)	(63500 - 68200)/(10 - 9)	-4700
63900 (7/20/2017)	68200 (1/25/2017)	(63900 - 68200)/(11 - 9)	-2150

63900 (7/20/2017)	63500 (4/5/2017)	(63900 - 63500)/(11 - 10)	400

Number of Q values = 55

Ordered Q Values

n	Q
1	-17300
2	-8650
3	-8300
4	-7100
5	-7075
6	-7000
7	-5620
8	-5533.33
9	-5520
10	-5500
11	-5150
12	-4700
13	-4566.67
14	-4000
15	-3666.67
16	-3600
17	-3400
18	-2700
19	-2150
20	-2000
21	0
22	200
23	400
24	700
25	1071.43
26	1216.67
27	1790
28	1944.44
29	1966.67
30	2162.5
31	2775
32	2860
33	3087.5
34	3142.86
35	3466.67
36	3471.43
37	4100
38	4575
39	4716.67
40	4783.33
41	4833.33
42	5000
43	5660
44	6100
45	6600
46	8250
47	9200
48	11325
49	11400
50	14700
51	14966.7
52	16766.7
53	17800
54	24800
55	34900

Sen's Estimator (Median Q) is 1944.44

Tied Group	Value	Members
1	35200	2

Time Period	Observations
8/12/2015	1
10/15/2015	1

11/19/2015	1
1/4/2016	1
2/16/2016	1
4/7/2016	1
5/25/2016	1
7/13/2016	1
1/25/2017	1
4/5/2017	1
7/20/2017	1

There are 0 time periods with multiple data

A = 18
B = 0
C = 0
D = 0
E = 2
F = 0
a = 2970
b = 8910
c = 220
Group Variance = 164
For 90% confidence interval (two-tailed), Z at (1-0.9)/2 = 1.64485
C = 21.0644
M1 = (55 - 21.0644)/2.0 = 16.9678
M2 = (55 + 21.0644)/2.0 + 1 = 39.0322
Lower limit is -3400 = Q(17)
Upper limit is 4716.67 = Q(39)
-3400 < 0 < 4716.67 indicating no trend in data.

Sen's Slope Analysis

Parameter: Calcium
Location: MW-8
Original Data (Not Transformed)
Non-Detects Replaced with Detection Limit

90% Confidence Level

Xj	Xk	(Xj - Xk)/(j-k)	Q
117000 (10/15/2015)	110000 B (8/12/2015)	(117000 - 110000)/(2 - 1)	7000
194000 (11/20/2015)	110000 B (8/12/2015)	(194000 - 110000)/(3 - 1)	42000
162000 (1/6/2016)	110000 B (8/12/2015)	(162000 - 110000)/(4 - 1)	17333.3
137000 (2/18/2016)	110000 B (8/12/2015)	(137000 - 110000)/(5 - 1)	6750
159000 (4/6/2016)	110000 B (8/12/2015)	(159000 - 110000)/(6 - 1)	9800
144000 (5/26/2016)	110000 B (8/12/2015)	(144000 - 110000)/(7 - 1)	5666.67
125000 (7/12/2016)	110000 B (8/12/2015)	(125000 - 110000)/(8 - 1)	2142.86
169000 (1/24/2017)	110000 B (8/12/2015)	(169000 - 110000)/(9 - 1)	7375
107000 (4/4/2017)	110000 B (8/12/2015)	(107000 - 110000)/(10 - 1)	-333.333
117000 (7/17/2017)	110000 B (8/12/2015)	(117000 - 110000)/(11 - 1)	700
194000 (11/20/2015)	117000 (10/15/2015)	(194000 - 117000)/(3 - 2)	77000
162000 (1/6/2016)	117000 (10/15/2015)	(162000 - 117000)/(4 - 2)	22500
137000 (2/18/2016)	117000 (10/15/2015)	(137000 - 117000)/(5 - 2)	6666.67
159000 (4/6/2016)	117000 (10/15/2015)	(159000 - 117000)/(6 - 2)	10500
144000 (5/26/2016)	117000 (10/15/2015)	(144000 - 117000)/(7 - 2)	5400
125000 (7/12/2016)	117000 (10/15/2015)	(125000 - 117000)/(8 - 2)	1333.33
169000 (1/24/2017)	117000 (10/15/2015)	(169000 - 117000)/(9 - 2)	7428.57
107000 (4/4/2017)	117000 (10/15/2015)	(107000 - 117000)/(10 - 2)	-1250
117000 (7/17/2017)	117000 (10/15/2015)	(117000 - 117000)/(11 - 2)	0
162000 (1/6/2016)	194000 (11/20/2015)	(162000 - 194000)/(4 - 3)	-32000
137000 (2/18/2016)	194000 (11/20/2015)	(137000 - 194000)/(5 - 3)	-28500
159000 (4/6/2016)	194000 (11/20/2015)	(159000 - 194000)/(6 - 3)	-11666.7
144000 (5/26/2016)	194000 (11/20/2015)	(144000 - 194000)/(7 - 3)	-12500
125000 (7/12/2016)	194000 (11/20/2015)	(125000 - 194000)/(8 - 3)	-13800
169000 (1/24/2017)	194000 (11/20/2015)	(169000 - 194000)/(9 - 3)	-4166.67
107000 (4/4/2017)	194000 (11/20/2015)	(107000 - 194000)/(10 - 3)	-12428.6
117000 (7/17/2017)	194000 (11/20/2015)	(117000 - 194000)/(11 - 3)	-9625
137000 (2/18/2016)	162000 (1/6/2016)	(137000 - 162000)/(5 - 4)	-25000
159000 (4/6/2016)	162000 (1/6/2016)	(159000 - 162000)/(6 - 4)	-1500
144000 (5/26/2016)	162000 (1/6/2016)	(144000 - 162000)/(7 - 4)	-6000
125000 (7/12/2016)	162000 (1/6/2016)	(125000 - 162000)/(8 - 4)	-9250
169000 (1/24/2017)	162000 (1/6/2016)	(169000 - 162000)/(9 - 4)	1400
107000 (4/4/2017)	162000 (1/6/2016)	(107000 - 162000)/(10 - 4)	-9166.67
117000 (7/17/2017)	162000 (1/6/2016)	(117000 - 162000)/(11 - 4)	-6428.57
159000 (4/6/2016)	137000 (2/18/2016)	(159000 - 137000)/(6 - 5)	22000
144000 (5/26/2016)	137000 (2/18/2016)	(144000 - 137000)/(7 - 5)	3500
125000 (7/12/2016)	137000 (2/18/2016)	(125000 - 137000)/(8 - 5)	-4000
169000 (1/24/2017)	137000 (2/18/2016)	(169000 - 137000)/(9 - 5)	8000
107000 (4/4/2017)	137000 (2/18/2016)	(107000 - 137000)/(10 - 5)	-6000
117000 (7/17/2017)	137000 (2/18/2016)	(117000 - 137000)/(11 - 5)	-3333.33
144000 (5/26/2016)	159000 (4/6/2016)	(144000 - 159000)/(7 - 6)	-15000
125000 (7/12/2016)	159000 (4/6/2016)	(125000 - 159000)/(8 - 6)	-17000
169000 (1/24/2017)	159000 (4/6/2016)	(169000 - 159000)/(9 - 6)	3333.33
107000 (4/4/2017)	159000 (4/6/2016)	(107000 - 159000)/(10 - 6)	-13000
117000 (7/17/2017)	159000 (4/6/2016)	(117000 - 159000)/(11 - 6)	-8400
125000 (7/12/2016)	144000 (5/26/2016)	(125000 - 144000)/(8 - 7)	-19000
169000 (1/24/2017)	144000 (5/26/2016)	(169000 - 144000)/(9 - 7)	12500
107000 (4/4/2017)	144000 (5/26/2016)	(107000 - 144000)/(10 - 7)	-12333.3
117000 (7/17/2017)	144000 (5/26/2016)	(117000 - 144000)/(11 - 7)	-6750
169000 (1/24/2017)	125000 (7/12/2016)	(169000 - 125000)/(9 - 8)	44000
107000 (4/4/2017)	125000 (7/12/2016)	(107000 - 125000)/(10 - 8)	-9000
117000 (7/17/2017)	125000 (7/12/2016)	(117000 - 125000)/(11 - 8)	-2666.67
107000 (4/4/2017)	169000 (1/24/2017)	(107000 - 169000)/(10 - 9)	-62000
117000 (7/17/2017)	169000 (1/24/2017)	(117000 - 169000)/(11 - 9)	-26000

117000 (7/17/2017)	107000 (4/4/2017)	(117000 - 107000)/(11 - 10)	10000

Number of Q values = 55

Ordered Q Values

n	Q
1	-62000
2	-32000
3	-28500
4	-26000
5	-25000
6	-19000
7	-17000
8	-15000
9	-13800
10	-13000
11	-12500
12	-12428.6
13	-12333.3
14	-11666.7
15	-9625
16	-9250
17	-9166.67
18	-9000
19	-8400
20	-6750
21	-6428.57
22	-6000
23	-6000
24	-4166.67
25	-4000
26	-3333.33
27	-2666.67
28	-1500
29	-1250
30	-333.333
31	0
32	700
33	1333.33
34	1400
35	2142.86
36	3333.33
37	3500
38	5400
39	5666.67
40	6666.67
41	6750
42	7000
43	7375
44	7428.57
45	8000
46	9800
47	10000
48	10500
49	12500
50	17333.3
51	22000
52	22500
53	42000
54	44000
55	77000

Sen's Estimator (Median Q) is -1500

Tied Group	Value	Members
1	117000	2

Time Period	Observations
8/12/2015	1
10/15/2015	1

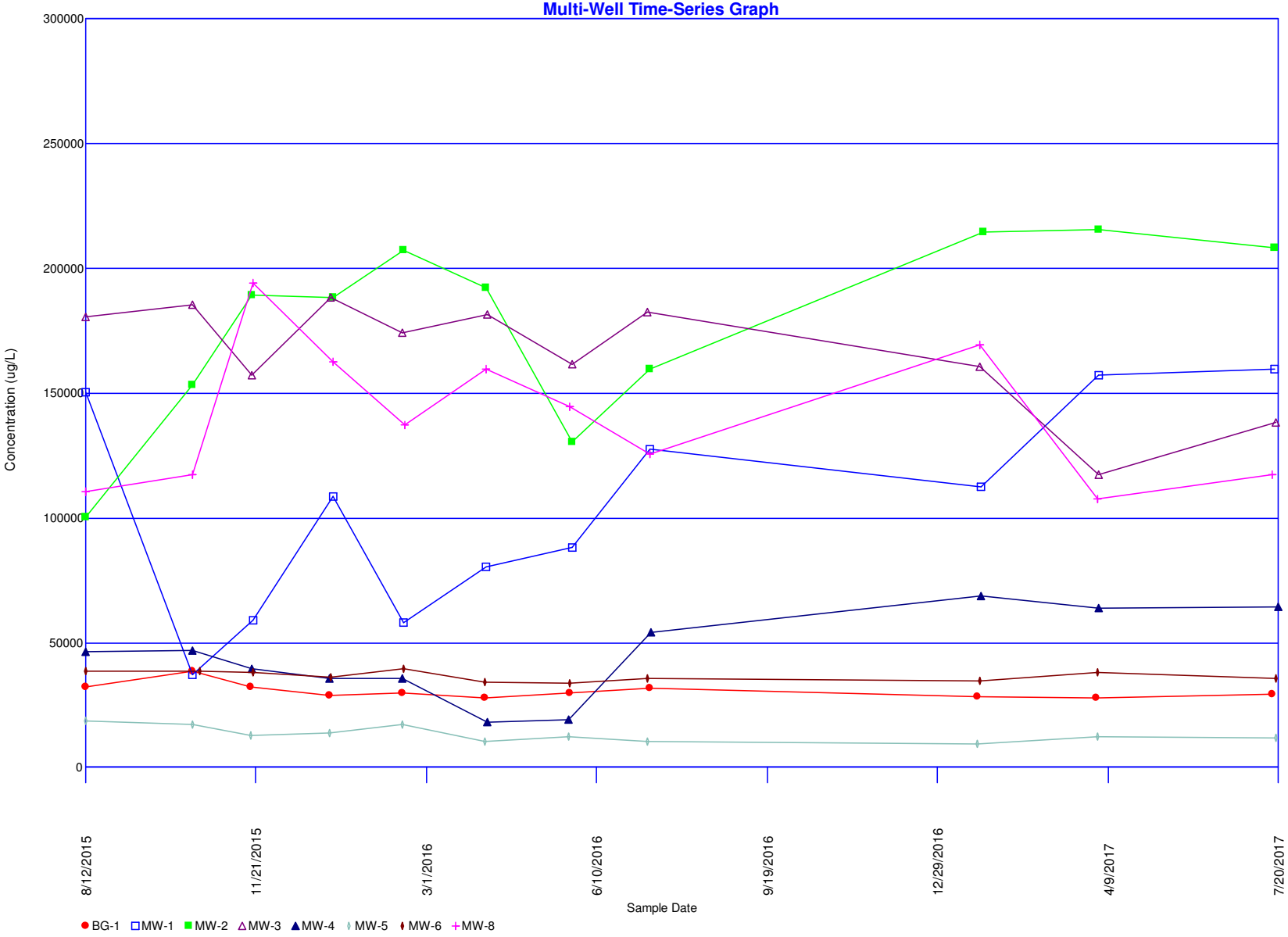
11/20/2015	1
1/6/2016	1
2/18/2016	1
4/6/2016	1
5/26/2016	1
7/12/2016	1
1/24/2017	1
4/4/2017	1
7/17/2017	1

There are 0 time periods with multiple data

A = 18
B = 0
C = 0
D = 0
E = 2
F = 0
a = 2970
b = 8910
c = 220
Group Variance = 164
For 90% confidence interval (two-tailed), Z at (1-0.9)/2 = 1.64485
C = 21.0644
M1 = (55 - 21.0644)/2.0 = 16.9678
M2 = (55 + 21.0644)/2.0 + 1 = 39.0322
Lower limit is -9166.67 = Q(17)
Upper limit is 5666.67 = Q(39)
-9166.67 < 0 < 5666.67 indicating no trend in data.

Calcium

Multi-Well Time-Series Graph



Concentrations (mg/L)

Parameter: Chloride

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

Total Measurements: 88
Total Non-Detect: 0
Percent Non-Detects: 0%
Total Background Measurements: 11
There is 1 background location

Loc.	Meas.	ND	Date	Conc.	Original
BG-1	11	0 (0%)	8/12/2015	270	270
			10/15/2015	311	311
			11/18/2015	283	283
			1/4/2016	285	285
			2/16/2016	277	277
			4/5/2016	264	264
			5/26/2016	250	250
			7/12/2016	292	292
			1/23/2017	303	303
			4/3/2017	280	280
			7/17/2017	283	283

There are 7 compliance locations

Loc.	Meas.	ND	Date	Conc.	Original
MW-1	11	0 (0%)	8/12/2015	580	580
			10/15/2015	72	72
			11/20/2015	172	172
			1/6/2016	446	446
			2/17/2016	167	167
			4/6/2016	342	342
			5/27/2016	307	307
			7/12/2016	547	547
			1/25/2017	401	401
			4/5/2017	668	668
			7/18/2017	603	603
MW-2	11	0 (0%)	8/12/2015	790	790
			10/15/2015	972	972
			11/19/2015	1050	1050
			1/6/2016	910	910
			2/17/2016	1190	1190
			4/6/2016	1230	1230
			5/27/2016	933	933
			7/12/2016	1160	1160
			1/26/2017	1320	1320
			4/5/2017	1360	1360
			7/18/2017	1280	1280
MW-3	11	0 (0%)	8/12/2015	990	990
			10/15/2015	1160	1160
			11/19/2015	1230	1230
			1/5/2016	1270	1270
			2/16/2016	1280	1280
			4/7/2016	1270	1270
			5/27/2016	1130	1130
			7/11/2016	1190	1190
			1/24/2017	1060	1060
			4/5/2017	1040	1040
			7/19/2017	1010	1010
MW-4	10	0 (0%)	10/15/2015	344	344
			11/19/2015	294	294
			1/4/2016	307	307
			2/16/2016	188	188
			4/7/2016	174	174
			5/25/2016	144	144
			7/13/2016	423	423

			1/25/2017	513	513
			4/5/2017	567	567
			7/20/2017	515	515
MW-5	12	0 (0%)	8/12/2015	20 J	20 J
			8/12/2015	22	22
			10/15/2015	22.2	22.2
			11/18/2015	21.7	21.7
			1/4/2016	21.9	21.9
			2/16/2016	21.3	21.3
			4/5/2016	18	18
			5/25/2016	19.3	19.3
			7/11/2016	17.6	17.6
			1/23/2017	18.2	18.2
			4/4/2017	17.8	17.8
			7/19/2017	19.6	19.6
MW-6	11	0 (0%)	8/12/2015	230	230
			10/19/2015	241	241
			11/20/2015	242	242
			1/5/2016	252	252
			2/17/2016	242	242
			4/5/2016	15.3	15.3
			5/26/2016	243	243
			7/11/2016	239	239
			1/24/2017	263	263
			4/4/2017	276	276
			7/19/2017	245	245
MW-8	11	0 (0%)	8/12/2015	480	480
			10/15/2015	515	515
			11/20/2015	939	939
			1/6/2016	755	755
			2/18/2016	663	663
			4/6/2016	685	685
			5/26/2016	396	396
			7/12/2016	504	504
			1/24/2017	660	660
			4/4/2017	437	437
			7/17/2017	473	473

There are 0 unused locations

Loc.	Meas.	ND	Date	Conc.	Original

Rosner's Test for Outliers

Parameter: Chloride

All Locations

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

Data set mean = 510.59

10 most extreme of 88 measurements

by order of magnitude difference from the mean

1	4/5/2017	MW-2	1360	849.41
2	1/26/2017	MW-2	1320	809.41
3	7/18/2017	MW-2	1280	769.41
4	2/16/2016	MW-3	1280	769.41
5	4/7/2016	MW-3	1270	759.41
6	1/5/2016	MW-3	1270	759.41
7	11/19/2015	MW-3	1230	719.41
8	4/6/2016	MW-2	1230	719.41
9	2/17/2016	MW-2	1190	679.41
10	7/11/2016	MW-3	1190	679.41

Iteration i = 9

Mean of 79 measurements = 424.075
Std Dev = 336.962
x(i+1) = 1190 from measurement 7/11/2016 from location MW-3
Rosner Statistic R = |1190 - 424.075|/336.962 = 2.27303
Lambda(88, 10, 0.05) = 3.3
2.27303 < 3.3 -- No outliers detected for i = 9

Iteration i = 8

Mean of 80 measurements = 433.649
Std Dev = 345.6
x(i+1) = 1190 from measurement 2/17/2016 from location MW-2
Rosner Statistic R = |1190 - 433.649|/345.6 = 2.18852
Lambda(88, 9, 0.05) = 3.3044
2.18852 < 3.3044 -- No outliers detected for i = 8

Iteration i = 7

Mean of 81 measurements = 443.48
Std Dev = 354.649
x(i+1) = 1230 from measurement 4/6/2016 from location MW-2
Rosner Statistic R = |1230 - 443.48|/354.649 = 2.21774
Lambda(88, 8, 0.05) = 3.3088
2.21774 < 3.3088 -- No outliers detected for i = 7

Iteration i = 6

Mean of 82 measurements = 453.072
Std Dev = 362.997
x(i+1) = 1230 from measurement 11/19/2015 from location MW-3
Rosner Statistic R = |1230 - 453.072|/362.997 = 2.14031
Lambda(88, 7, 0.05) = 3.3132
2.14031 < 3.3132 -- No outliers detected for i = 6

Iteration i = 5

Mean of 83 measurements = 462.914
Std Dev = 371.754
x(i+1) = 1270 from measurement 1/5/2016 from location MW-3
Rosner Statistic R = |1270 - 462.914|/371.754 = 2.17102
Lambda(88, 6, 0.05) = 3.3176
2.17102 < 3.3176 -- No outliers detected for i = 5

Iteration i = 4

Mean of 84 measurements = 472.523
Std Dev = 379.856
x(i+1) = 1270 from measurement 4/7/2016 from location MW-3

Rosner Statistic R = |1270 - 472.523|/379.856 = 2.09942
Lambda(88, 5, 0.05) = 3.322
2.09942 < 3.322 -- No outliers detected for i = 4

Iteration i = 3
Mean of 85 measurements = 482.022
Std Dev = 387.612
x(i+1) = 1280 from measurement 2/16/2016 from location MW-3
Rosner Statistic R = |1280 - 482.022|/387.612 = 2.0587
Lambda(88, 4, 0.05) = 3.33
2.0587 < 3.33 -- No outliers detected for i = 3

Iteration i = 2
Mean of 86 measurements = 491.301
Std Dev = 394.817
x(i+1) = 1280 from measurement 7/18/2017 from location MW-2
Rosner Statistic R = |1280 - 491.301|/394.817 = 1.99763
Lambda(88, 3, 0.05) = 3.332
1.99763 < 3.332 -- No outliers detected for i = 2

Iteration i = 1
Mean of 87 measurements = 500.826
Std Dev = 402.444
x(i+1) = 1320 from measurement 1/26/2017 from location MW-2
Rosner Statistic R = |1320 - 500.826|/402.444 = 2.0355
Lambda(88, 2, 0.05) = 3.332
2.0355 < 3.332 -- No outliers detected for i = 1

Iteration i = 0
Mean of 88 measurements = 510.59
Std Dev = 410.473
x(i+1) = 1360 from measurement 4/5/2017 from location MW-2
Rosner Statistic R = |1360 - 510.59|/410.473 = 2.06935
Lambda(88, 1, 0.05) = 3.342
2.06935 < 3.342 -- No outliers detected for i = 0

Shapiro-Wilks Test of Normality

Parameter: Chloride
All Locations
Normality Test of Parameter Concentrations
Original Data (Not Transformed)
Non-Detects Replaced with Detection Limit
K = 5 for 11 measurements

i	x(i)	x(n-i+1)	x(n-1+1)-x(i)	a(n-i+1)	b(i)
1	250	311	61	0.5601	34.1661
2	264	303	39	0.3315	12.9285
3	270	292	22	0.226	4.972
4	277	285	8	0.1429	1.1432
5	280	283	3	0.0695	0.2085
6	283	283	0		
7	283	280	-3		
8	285	277	-8		
9	292	270	-22		
10	303	264	-39		
11	311	250	-61		

Sum of b values = 53.4183
Sample Standard Deviation = 17.0662
W Statistic = 0.979732

5% Critical value of 0.85 is less than 0.979732
Data is normally distributed at 95% level of significance

1% Critical value of 0.792 is less than 0.979732
Data is normally distributed at 99% level of significance

Parametric Prediction Interval Analysis

Inter-Well Comparison
Parameter: Chloride
Original Data (Not Transformed)
Non-Detects Replaced with 1/2 DL

Inter-Well Unified Guid. Formula 95% One-Sided Comparison

Background Samples = 11
Background Mean = 281.636
Background Std Dev = 17.0662

Number of comparisons = 7
Future Samples (k) = 7
Actual confidence level is 1.0 - (0.05/7) = 99.2857 %
t is Percentile of Student's T-Test (0.95/7) = 0.992857
Degrees of Freedom = 11 (background observations) - 1
t(0.992857, 11) = 2.99548

Well MW-1

Date	Samples	Mean	Interval	Significant
7/18/2017	1	603	[0, 335.031]	TRUE

Well MW-2

Date	Samples	Mean	Interval	Significant
7/18/2017	1	1280	[0, 335.031]	TRUE

Well MW-3

Date	Samples	Mean	Interval	Significant
7/19/2017	1	1010	[0, 335.031]	TRUE

Well MW-4

Date	Samples	Mean	Interval	Significant
7/20/2017	1	515	[0, 335.031]	TRUE

Well MW-5

Date	Samples	Mean	Interval	Significant
7/19/2017	1	19.6	[0, 335.031]	FALSE

Well MW-6

Date	Samples	Mean	Interval	Significant
7/19/2017	1	245	[0, 335.031]	FALSE

Well MW-8

Date	Samples	Mean	Interval	Significant
7/17/2017	1	473	[0, 335.031]	TRUE

Sen's Slope Analysis

Parameter: Chloride
Location: MW-1
Original Data (Not Transformed)
Non-Detects Replaced with Detection Limit

90% Confidence Level

Xj	Xk	(Xj - Xk)/(j-k)	Q
72 (10/15/2015)	580 (8/12/2015)	(72 - 580)/(2 - 1)	-508
172 (11/20/2015)	580 (8/12/2015)	(172 - 580)/(3 - 1)	-204
446 (1/6/2016)	580 (8/12/2015)	(446 - 580)/(4 - 1)	-44.6667
167 (2/17/2016)	580 (8/12/2015)	(167 - 580)/(5 - 1)	-103.25
342 (4/6/2016)	580 (8/12/2015)	(342 - 580)/(6 - 1)	-47.6
307 (5/27/2016)	580 (8/12/2015)	(307 - 580)/(7 - 1)	-45.5
547 (7/12/2016)	580 (8/12/2015)	(547 - 580)/(8 - 1)	-4.71429
401 (1/25/2017)	580 (8/12/2015)	(401 - 580)/(9 - 1)	-22.375
668 (4/5/2017)	580 (8/12/2015)	(668 - 580)/(10 - 1)	9.77778
603 (7/18/2017)	580 (8/12/2015)	(603 - 580)/(11 - 1)	2.3
172 (11/20/2015)	72 (10/15/2015)	(172 - 72)/(3 - 2)	100
446 (1/6/2016)	72 (10/15/2015)	(446 - 72)/(4 - 2)	187
167 (2/17/2016)	72 (10/15/2015)	(167 - 72)/(5 - 2)	31.6667
342 (4/6/2016)	72 (10/15/2015)	(342 - 72)/(6 - 2)	67.5
307 (5/27/2016)	72 (10/15/2015)	(307 - 72)/(7 - 2)	47
547 (7/12/2016)	72 (10/15/2015)	(547 - 72)/(8 - 2)	79.1667
401 (1/25/2017)	72 (10/15/2015)	(401 - 72)/(9 - 2)	47
668 (4/5/2017)	72 (10/15/2015)	(668 - 72)/(10 - 2)	74.5
603 (7/18/2017)	72 (10/15/2015)	(603 - 72)/(11 - 2)	59
446 (1/6/2016)	172 (11/20/2015)	(446 - 172)/(4 - 3)	274
167 (2/17/2016)	172 (11/20/2015)	(167 - 172)/(5 - 3)	-2.5
342 (4/6/2016)	172 (11/20/2015)	(342 - 172)/(6 - 3)	56.6667
307 (5/27/2016)	172 (11/20/2015)	(307 - 172)/(7 - 3)	33.75
547 (7/12/2016)	172 (11/20/2015)	(547 - 172)/(8 - 3)	75
401 (1/25/2017)	172 (11/20/2015)	(401 - 172)/(9 - 3)	38.1667
668 (4/5/2017)	172 (11/20/2015)	(668 - 172)/(10 - 3)	70.8571
603 (7/18/2017)	172 (11/20/2015)	(603 - 172)/(11 - 3)	53.875
167 (2/17/2016)	446 (1/6/2016)	(167 - 446)/(5 - 4)	-279
342 (4/6/2016)	446 (1/6/2016)	(342 - 446)/(6 - 4)	-52
307 (5/27/2016)	446 (1/6/2016)	(307 - 446)/(7 - 4)	-46.3333
547 (7/12/2016)	446 (1/6/2016)	(547 - 446)/(8 - 4)	25.25
401 (1/25/2017)	446 (1/6/2016)	(401 - 446)/(9 - 4)	-9
668 (4/5/2017)	446 (1/6/2016)	(668 - 446)/(10 - 4)	37
603 (7/18/2017)	446 (1/6/2016)	(603 - 446)/(11 - 4)	22.4286
342 (4/6/2016)	167 (2/17/2016)	(342 - 167)/(6 - 5)	175
307 (5/27/2016)	167 (2/17/2016)	(307 - 167)/(7 - 5)	70
547 (7/12/2016)	167 (2/17/2016)	(547 - 167)/(8 - 5)	126.667
401 (1/25/2017)	167 (2/17/2016)	(401 - 167)/(9 - 5)	58.5
668 (4/5/2017)	167 (2/17/2016)	(668 - 167)/(10 - 5)	100.2
603 (7/18/2017)	167 (2/17/2016)	(603 - 167)/(11 - 5)	72.6667
307 (5/27/2016)	342 (4/6/2016)	(307 - 342)/(7 - 6)	-35
547 (7/12/2016)	342 (4/6/2016)	(547 - 342)/(8 - 6)	102.5
401 (1/25/2017)	342 (4/6/2016)	(401 - 342)/(9 - 6)	19.6667
668 (4/5/2017)	342 (4/6/2016)	(668 - 342)/(10 - 6)	81.5
603 (7/18/2017)	342 (4/6/2016)	(603 - 342)/(11 - 6)	52.2
547 (7/12/2016)	307 (5/27/2016)	(547 - 307)/(8 - 7)	240
401 (1/25/2017)	307 (5/27/2016)	(401 - 307)/(9 - 7)	47
668 (4/5/2017)	307 (5/27/2016)	(668 - 307)/(10 - 7)	120.333
603 (7/18/2017)	307 (5/27/2016)	(603 - 307)/(11 - 7)	74
401 (1/25/2017)	547 (7/12/2016)	(401 - 547)/(9 - 8)	-146
668 (4/5/2017)	547 (7/12/2016)	(668 - 547)/(10 - 8)	60.5
603 (7/18/2017)	547 (7/12/2016)	(603 - 547)/(11 - 8)	18.6667
668 (4/5/2017)	401 (1/25/2017)	(668 - 401)/(10 - 9)	267
603 (7/18/2017)	401 (1/25/2017)	(603 - 401)/(11 - 9)	101

Number of Q values = 55

Ordered Q Values

n	Q
1	-508
2	-279
3	-204
4	-146
5	-103.25
6	-65
7	-52
8	-47.6
9	-46.3333
10	-45.5
11	-44.6667
12	-35
13	-22.375
14	-9
15	-4.71429
16	-2.5
17	2.3
18	9.77778
19	18.6667
20	19.6667
21	22.4286
22	25.25
23	31.6667
24	33.75
25	37
26	38.1667
27	47
28	47
29	47
30	52.2
31	53.875
32	56.6667
33	58.5
34	59
35	60.5
36	67.5
37	70
38	70.8571
39	72.6667
40	74
41	74.5
42	75
43	79.1667
44	81.5
45	100
46	100.2
47	101
48	102.5
49	120.333
50	126.667
51	175
52	187
53	240
54	267
55	274

Sen's Estimator (Median Q) is 47

Time Period	Observations
8/12/2015	1
10/15/2015	1
11/20/2015	1
1/6/2016	1
2/17/2016	1

4/6/2016	1
5/27/2016	1
7/12/2016	1
1/25/2017	1
4/5/2017	1
7/18/2017	1

There are 0 time periods with multiple data

A = 0
B = 0
C = 0
D = 0
E = 0
F = 0
a = 2970
b = 8910
c = 220
Group Variance = 165
For 90% confidence interval (two-tailed), Z at (1-0.9)/2 = 1.64485
C = 21.1285
M1 = (55 - 21.1285)/2.0 = 16.9357
M2 = (55 + 21.1285)/2.0 + 1 = 39.0643
Lower limit is 2.3 = Q(17)
Upper limit is 72.6667 = Q(39)
2.3 > 0 indicating an upward trend in data.

Sen's Slope Analysis

Parameter: Chloride
Location: MW-2
Original Data (Not Transformed)
Non-Detects Replaced with Detection Limit

90% Confidence Level

Xj	Xk	(Xj - Xk)/(j-k)	Q
972 (10/15/2015)	790 (8/12/2015)	(972 - 790)/(2 - 1)	182
1050 (11/19/2015)	790 (8/12/2015)	(1050 - 790)/(3 - 1)	130
910 (1/6/2016)	790 (8/12/2015)	(910 - 790)/(4 - 1)	40
1190 (2/17/2016)	790 (8/12/2015)	(1190 - 790)/(5 - 1)	100
1230 (4/6/2016)	790 (8/12/2015)	(1230 - 790)/(6 - 1)	88
933 (5/27/2016)	790 (8/12/2015)	(933 - 790)/(7 - 1)	23.8333
1160 (7/12/2016)	790 (8/12/2015)	(1160 - 790)/(8 - 1)	52.8571
1320 (1/26/2017)	790 (8/12/2015)	(1320 - 790)/(9 - 1)	66.25
1360 (4/5/2017)	790 (8/12/2015)	(1360 - 790)/(10 - 1)	63.3333
1280 (7/18/2017)	790 (8/12/2015)	(1280 - 790)/(11 - 1)	49
1050 (11/19/2015)	972 (10/15/2015)	(1050 - 972)/(3 - 2)	78
910 (1/6/2016)	972 (10/15/2015)	(910 - 972)/(4 - 2)	-31
1190 (2/17/2016)	972 (10/15/2015)	(1190 - 972)/(5 - 2)	72.6667
1230 (4/6/2016)	972 (10/15/2015)	(1230 - 972)/(6 - 2)	64.5
933 (5/27/2016)	972 (10/15/2015)	(933 - 972)/(7 - 2)	-7.8
1160 (7/12/2016)	972 (10/15/2015)	(1160 - 972)/(8 - 2)	31.3333
1320 (1/26/2017)	972 (10/15/2015)	(1320 - 972)/(9 - 2)	49.7143
1360 (4/5/2017)	972 (10/15/2015)	(1360 - 972)/(10 - 2)	48.5
1280 (7/18/2017)	972 (10/15/2015)	(1280 - 972)/(11 - 2)	34.2222
910 (1/6/2016)	1050 (11/19/2015)	(910 - 1050)/(4 - 3)	-140
1190 (2/17/2016)	1050 (11/19/2015)	(1190 - 1050)/(5 - 3)	70
1230 (4/6/2016)	1050 (11/19/2015)	(1230 - 1050)/(6 - 3)	60
933 (5/27/2016)	1050 (11/19/2015)	(933 - 1050)/(7 - 3)	-29.25
1160 (7/12/2016)	1050 (11/19/2015)	(1160 - 1050)/(8 - 3)	22
1320 (1/26/2017)	1050 (11/19/2015)	(1320 - 1050)/(9 - 3)	45
1360 (4/5/2017)	1050 (11/19/2015)	(1360 - 1050)/(10 - 3)	44.2857
1280 (7/18/2017)	1050 (11/19/2015)	(1280 - 1050)/(11 - 3)	28.75
1190 (2/17/2016)	910 (1/6/2016)	(1190 - 910)/(5 - 4)	280
1230 (4/6/2016)	910 (1/6/2016)	(1230 - 910)/(6 - 4)	160
933 (5/27/2016)	910 (1/6/2016)	(933 - 910)/(7 - 4)	7.66667
1160 (7/12/2016)	910 (1/6/2016)	(1160 - 910)/(8 - 4)	62.5
1320 (1/26/2017)	910 (1/6/2016)	(1320 - 910)/(9 - 4)	82
1360 (4/5/2017)	910 (1/6/2016)	(1360 - 910)/(10 - 4)	75
1280 (7/18/2017)	910 (1/6/2016)	(1280 - 910)/(11 - 4)	52.8571
1230 (4/6/2016)	1190 (2/17/2016)	(1230 - 1190)/(6 - 5)	40
933 (5/27/2016)	1190 (2/17/2016)	(933 - 1190)/(7 - 5)	-128.5
1160 (7/12/2016)	1190 (2/17/2016)	(1160 - 1190)/(8 - 5)	-10
1320 (1/26/2017)	1190 (2/17/2016)	(1320 - 1190)/(9 - 5)	32.5
1360 (4/5/2017)	1190 (2/17/2016)	(1360 - 1190)/(10 - 5)	34
1280 (7/18/2017)	1190 (2/17/2016)	(1280 - 1190)/(11 - 5)	15
933 (5/27/2016)	1230 (4/6/2016)	(933 - 1230)/(7 - 6)	-297
1160 (7/12/2016)	1230 (4/6/2016)	(1160 - 1230)/(8 - 6)	-35
1320 (1/26/2017)	1230 (4/6/2016)	(1320 - 1230)/(9 - 6)	30
1360 (4/5/2017)	1230 (4/6/2016)	(1360 - 1230)/(10 - 6)	32.5
1280 (7/18/2017)	1230 (4/6/2016)	(1280 - 1230)/(11 - 6)	10
1160 (7/12/2016)	933 (5/27/2016)	(1160 - 933)/(8 - 7)	227
1320 (1/26/2017)	933 (5/27/2016)	(1320 - 933)/(9 - 7)	193.5
1360 (4/5/2017)	933 (5/27/2016)	(1360 - 933)/(10 - 7)	142.333
1280 (7/18/2017)	933 (5/27/2016)	(1280 - 933)/(11 - 7)	86.75
1320 (1/26/2017)	1160 (7/12/2016)	(1320 - 1160)/(9 - 8)	160
1360 (4/5/2017)	1160 (7/12/2016)	(1360 - 1160)/(10 - 8)	100
1280 (7/18/2017)	1160 (7/12/2016)	(1280 - 1160)/(11 - 8)	40
1360 (4/5/2017)	1320 (1/26/2017)	(1360 - 1320)/(10 - 9)	40
1280 (7/18/2017)	1320 (1/26/2017)	(1280 - 1320)/(11 - 9)	-20

1280 (7/18/2017)	1360 (4/5/2017)	(1280 - 1360)/(11 - 10)	-80

Number of Q values = 55

Ordered Q Values

n	Q
1	-297
2	-140
3	-128.5
4	-80
5	-35
6	-31
7	-29.25
8	-20
9	-10
10	-7.8
11	7.66667
12	10
13	15
14	22
15	23.8333
16	28.75
17	30
18	31.3333
19	32.5
20	32.5
21	34
22	34.2222
23	40
24	40
25	40
26	40
27	44.2857
28	45
29	48.5
30	49
31	49.7143
32	52.8571
33	52.8571
34	60
35	62.5
36	63.3333
37	64.5
38	66.25
39	70
40	72.6667
41	75
42	78
43	82
44	86.75
45	88
46	100
47	100
48	130
49	142.333
50	160
51	160
52	182
53	193.5
54	227
55	280

Sen's Estimator (Median Q) is 45

Time Period	Observations
8/12/2015	1
10/15/2015	1
11/19/2015	1
1/6/2016	1
2/17/2016	1

4/6/2016	1
5/27/2016	1
7/12/2016	1
1/26/2017	1
4/5/2017	1
7/18/2017	1

There are 0 time periods with multiple data

A = 0
B = 0
C = 0
D = 0
E = 0
F = 0
a = 2970
b = 8910
c = 220
Group Variance = 165
For 90% confidence interval (two-tailed), Z at (1-0.9)/2 = 1.64485
C = 21.1285
M1 = (55 - 21.1285)/2.0 = 16.9357
M2 = (55 + 21.1285)/2.0 + 1 = 39.0643
Lower limit is 30 = Q(17)
Upper limit is 70 = Q(39)
30 > 0 indicating an upward trend in data.

Sen's Slope Analysis

Parameter: Chloride
Location: MW-3
Original Data (Not Transformed)
Non-Detects Replaced with Detection Limit

90% Confidence Level

Xj	Xk	(Xj - Xk)/(j-k)	Q
1160 (10/15/2015)	990 (8/12/2015)	(1160 - 990)/(2 - 1)	170
1230 (11/19/2015)	990 (8/12/2015)	(1230 - 990)/(3 - 1)	120
1270 (1/5/2016)	990 (8/12/2015)	(1270 - 990)/(4 - 1)	93.3333
1280 (2/16/2016)	990 (8/12/2015)	(1280 - 990)/(5 - 1)	72.5
1270 (4/7/2016)	990 (8/12/2015)	(1270 - 990)/(6 - 1)	56
1130 (5/27/2016)	990 (8/12/2015)	(1130 - 990)/(7 - 1)	23.3333
1190 (7/11/2016)	990 (8/12/2015)	(1190 - 990)/(8 - 1)	28.5714
1060 (1/24/2017)	990 (8/12/2015)	(1060 - 990)/(9 - 1)	8.75
1040 (4/5/2017)	990 (8/12/2015)	(1040 - 990)/(10 - 1)	5.55556
1010 (7/19/2017)	990 (8/12/2015)	(1010 - 990)/(11 - 1)	2
1230 (11/19/2015)	1160 (10/15/2015)	(1230 - 1160)/(3 - 2)	70
1270 (1/5/2016)	1160 (10/15/2015)	(1270 - 1160)/(4 - 2)	55
1280 (2/16/2016)	1160 (10/15/2015)	(1280 - 1160)/(5 - 2)	40
1270 (4/7/2016)	1160 (10/15/2015)	(1270 - 1160)/(6 - 2)	27.5
1130 (5/27/2016)	1160 (10/15/2015)	(1130 - 1160)/(7 - 2)	-6
1190 (7/11/2016)	1160 (10/15/2015)	(1190 - 1160)/(8 - 2)	5
1060 (1/24/2017)	1160 (10/15/2015)	(1060 - 1160)/(9 - 2)	-14.2857
1040 (4/5/2017)	1160 (10/15/2015)	(1040 - 1160)/(10 - 2)	-15
1010 (7/19/2017)	1160 (10/15/2015)	(1010 - 1160)/(11 - 2)	-16.6667
1270 (1/5/2016)	1230 (11/19/2015)	(1270 - 1230)/(4 - 3)	40
1280 (2/16/2016)	1230 (11/19/2015)	(1280 - 1230)/(5 - 3)	25
1270 (4/7/2016)	1230 (11/19/2015)	(1270 - 1230)/(6 - 3)	13.3333
1130 (5/27/2016)	1230 (11/19/2015)	(1130 - 1230)/(7 - 3)	-25
1190 (7/11/2016)	1230 (11/19/2015)	(1190 - 1230)/(8 - 3)	-8
1060 (1/24/2017)	1230 (11/19/2015)	(1060 - 1230)/(9 - 3)	-28.3333
1040 (4/5/2017)	1230 (11/19/2015)	(1040 - 1230)/(10 - 3)	-27.1429
1010 (7/19/2017)	1230 (11/19/2015)	(1010 - 1230)/(11 - 3)	-27.5
1280 (2/16/2016)	1270 (1/5/2016)	(1280 - 1270)/(5 - 4)	10
1270 (4/7/2016)	1270 (1/5/2016)	(1270 - 1270)/(6 - 4)	0
1130 (5/27/2016)	1270 (1/5/2016)	(1130 - 1270)/(7 - 4)	-46.6667
1190 (7/11/2016)	1270 (1/5/2016)	(1190 - 1270)/(8 - 4)	-20
1060 (1/24/2017)	1270 (1/5/2016)	(1060 - 1270)/(9 - 4)	-42
1040 (4/5/2017)	1270 (1/5/2016)	(1040 - 1270)/(10 - 4)	-38.3333
1010 (7/19/2017)	1270 (1/5/2016)	(1010 - 1270)/(11 - 4)	-37.1429
1270 (4/7/2016)	1280 (2/16/2016)	(1270 - 1280)/(6 - 5)	-10
1130 (5/27/2016)	1280 (2/16/2016)	(1130 - 1280)/(7 - 5)	-75
1190 (7/11/2016)	1280 (2/16/2016)	(1190 - 1280)/(8 - 5)	-30
1060 (1/24/2017)	1280 (2/16/2016)	(1060 - 1280)/(9 - 5)	-55
1040 (4/5/2017)	1280 (2/16/2016)	(1040 - 1280)/(10 - 5)	-48
1010 (7/19/2017)	1280 (2/16/2016)	(1010 - 1280)/(11 - 5)	-45
1130 (5/27/2016)	1270 (4/7/2016)	(1130 - 1270)/(7 - 6)	-140
1190 (7/11/2016)	1270 (4/7/2016)	(1190 - 1270)/(8 - 6)	-40
1060 (1/24/2017)	1270 (4/7/2016)	(1060 - 1270)/(9 - 6)	-70
1040 (4/5/2017)	1270 (4/7/2016)	(1040 - 1270)/(10 - 6)	-57.5
1010 (7/19/2017)	1270 (4/7/2016)	(1010 - 1270)/(11 - 6)	-52
1190 (7/11/2016)	1130 (5/27/2016)	(1190 - 1130)/(8 - 7)	60
1060 (1/24/2017)	1130 (5/27/2016)	(1060 - 1130)/(9 - 7)	-35
1040 (4/5/2017)	1130 (5/27/2016)	(1040 - 1130)/(10 - 7)	-30
1010 (7/19/2017)	1130 (5/27/2016)	(1010 - 1130)/(11 - 7)	-30
1060 (1/24/2017)	1190 (7/11/2016)	(1060 - 1190)/(9 - 8)	-130
1040 (4/5/2017)	1190 (7/11/2016)	(1040 - 1190)/(10 - 8)	-75
1010 (7/19/2017)	1190 (7/11/2016)	(1010 - 1190)/(11 - 8)	-60
1040 (4/5/2017)	1060 (1/24/2017)	(1040 - 1060)/(10 - 9)	-20
1010 (7/19/2017)	1060 (1/24/2017)	(1010 - 1060)/(11 - 9)	-25

1010 (7/19/2017)	1040 (4/5/2017)	(1010 - 1040)/(11 - 10)	-30

Number of Q values = 55

Ordered Q Values

n	Q
1	-140
2	-130
3	-75
4	-75
5	-70
6	-60
7	-57.5
8	-55
9	-52
10	-48
11	-46.6667
12	-45
13	-42
14	-40
15	-38.3333
16	-37.1429
17	-35
18	-30
19	-30
20	-30
21	-30
22	-28.3333
23	-27.5
24	-27.1429
25	-25
26	-25
27	-20
28	-20
29	-16.6667
30	-15
31	-14.2857
32	-10
33	-8
34	-6
35	0
36	2
37	5
38	5.55556
39	8.75
40	10
41	13.3333
42	23.3333
43	25
44	27.5
45	28.5714
46	40
47	40
48	55
49	56
50	60
51	70
52	72.5
53	93.3333
54	120
55	170

Sen's Estimator (Median Q) is -20

Tied Group	Value	Members
1	1270	2

Time Period	Observations
8/12/2015	1
10/15/2015	1

11/19/2015	1
1/5/2016	1
2/16/2016	1
4/7/2016	1
5/27/2016	1
7/11/2016	1
1/24/2017	1
4/5/2017	1
7/19/2017	1

There are 0 time periods with multiple data

A = 18
B = 0
C = 0
D = 0
E = 2
F = 0
a = 2970
b = 8910
c = 220
Group Variance = 164
For 90% confidence interval (two-tailed), Z at (1-0.9)/2 = 1.64485
C = 21.0644
M1 = (55 - 21.0644)/2.0 = 16.9678
M2 = (55 + 21.0644)/2.0 + 1 = 39.0322
Lower limit is -35 = Q(17)
Upper limit is 8.75 = Q(39)
-35 < 0 < 8.75 indicating no trend in data.

Sen's Slope Analysis

Parameter: Chloride
Location: MW-4
Original Data (Not Transformed)
Non-Detects Replaced with Detection Limit

90% Confidence Level

Xj	Xk	(Xj - Xk)/(j-k)	Q
294 (11/19/2015)	344 (10/15/2015)	(294 - 344)/(2 - 1)	-50
307 (1/4/2016)	344 (10/15/2015)	(307 - 344)/(3 - 1)	-18.5
188 (2/16/2016)	344 (10/15/2015)	(188 - 344)/(4 - 1)	-52
174 (4/7/2016)	344 (10/15/2015)	(174 - 344)/(5 - 1)	-42.5
144 (5/25/2016)	344 (10/15/2015)	(144 - 344)/(6 - 1)	-40
423 (7/13/2016)	344 (10/15/2015)	(423 - 344)/(7 - 1)	13.1667
513 (1/25/2017)	344 (10/15/2015)	(513 - 344)/(8 - 1)	24.1429
567 (4/5/2017)	344 (10/15/2015)	(567 - 344)/(9 - 1)	27.875
515 (7/20/2017)	344 (10/15/2015)	(515 - 344)/(10 - 1)	19
307 (1/4/2016)	294 (11/19/2015)	(307 - 294)/(3 - 2)	13
188 (2/16/2016)	294 (11/19/2015)	(188 - 294)/(4 - 2)	-53
174 (4/7/2016)	294 (11/19/2015)	(174 - 294)/(5 - 2)	-40
144 (5/25/2016)	294 (11/19/2015)	(144 - 294)/(6 - 2)	-37.5
423 (7/13/2016)	294 (11/19/2015)	(423 - 294)/(7 - 2)	25.8
513 (1/25/2017)	294 (11/19/2015)	(513 - 294)/(8 - 2)	36.5
567 (4/5/2017)	294 (11/19/2015)	(567 - 294)/(9 - 2)	39
515 (7/20/2017)	294 (11/19/2015)	(515 - 294)/(10 - 2)	27.625
188 (2/16/2016)	307 (1/4/2016)	(188 - 307)/(4 - 3)	-119
174 (4/7/2016)	307 (1/4/2016)	(174 - 307)/(5 - 3)	-66.5
144 (5/25/2016)	307 (1/4/2016)	(144 - 307)/(6 - 3)	-54.3333
423 (7/13/2016)	307 (1/4/2016)	(423 - 307)/(7 - 3)	29
513 (1/25/2017)	307 (1/4/2016)	(513 - 307)/(8 - 3)	41.2
567 (4/5/2017)	307 (1/4/2016)	(567 - 307)/(9 - 3)	43.3333
515 (7/20/2017)	307 (1/4/2016)	(515 - 307)/(10 - 3)	29.7143
174 (4/7/2016)	188 (2/16/2016)	(174 - 188)/(5 - 4)	-14
144 (5/25/2016)	188 (2/16/2016)	(144 - 188)/(6 - 4)	-22
423 (7/13/2016)	188 (2/16/2016)	(423 - 188)/(7 - 4)	78.3333
513 (1/25/2017)	188 (2/16/2016)	(513 - 188)/(8 - 4)	81.25
567 (4/5/2017)	188 (2/16/2016)	(567 - 188)/(9 - 4)	75.8
515 (7/20/2017)	188 (2/16/2016)	(515 - 188)/(10 - 4)	54.5
144 (5/25/2016)	174 (4/7/2016)	(144 - 174)/(6 - 5)	-30
423 (7/13/2016)	174 (4/7/2016)	(423 - 174)/(7 - 5)	124.5
513 (1/25/2017)	174 (4/7/2016)	(513 - 174)/(8 - 5)	113
567 (4/5/2017)	174 (4/7/2016)	(567 - 174)/(9 - 5)	98.25
515 (7/20/2017)	174 (4/7/2016)	(515 - 174)/(10 - 5)	68.2
423 (7/13/2016)	144 (5/25/2016)	(423 - 144)/(7 - 6)	279
513 (1/25/2017)	144 (5/25/2016)	(513 - 144)/(8 - 6)	184.5
567 (4/5/2017)	144 (5/25/2016)	(567 - 144)/(9 - 6)	141
515 (7/20/2017)	144 (5/25/2016)	(515 - 144)/(10 - 6)	92.75
513 (1/25/2017)	423 (7/13/2016)	(513 - 423)/(8 - 7)	90
567 (4/5/2017)	423 (7/13/2016)	(567 - 423)/(9 - 7)	72
515 (7/20/2017)	423 (7/13/2016)	(515 - 423)/(10 - 7)	30.6667
567 (4/5/2017)	513 (1/25/2017)	(567 - 513)/(9 - 8)	54
515 (7/20/2017)	513 (1/25/2017)	(515 - 513)/(10 - 8)	1
515 (7/20/2017)	567 (4/5/2017)	(515 - 567)/(10 - 9)	-52

Number of Q values = 45

Ordered Q Values

n	Q
1	-119
2	-66.5
3	-54.3333

4	-53
5	-52
6	-52
7	-50
8	-42.5
9	-40
10	-40
11	-37.5
12	-30
13	-22
14	-18.5
15	-14
16	1
17	13
18	13.1667
19	19
20	24.1429
21	25.8
22	27.625
23	27.875
24	29
25	29.7143
26	30.6667
27	36.5
28	39
29	41.2
30	43.3333
31	54
32	54.5
33	68.2
34	72
35	75.8
36	78.3333
37	81.25
38	90
39	92.75
40	98.25
41	113
42	124.5
43	141
44	184.5
45	279

Sen's Estimator (Median Q) is 27.875

Time Period	Observations
10/15/2015	1
11/19/2015	1
1/4/2016	1
2/16/2016	1
4/7/2016	1
5/25/2016	1
7/13/2016	1
1/25/2017	1
4/5/2017	1
7/20/2017	1

There are 0 time periods with multiple data

A = 0
B = 0
C = 0
D = 0
E = 0
F = 0
a = 2250
b = 6480
c = 180
Group Variance = 125
For 90% confidence interval (two-tailed), Z at (1-0.9)/2 = 1.64485
C = 18.39
M1 = (45 - 18.39)/2.0 = 13.305
M2 = (45 + 18.39)/2.0 + 1 = 32.695

Lower limit is -22 = Q(13)
Upper limit is 68.2 = Q(33)
-22 < 0 < 68.2 indicating no trend in data.

Sen's Slope Analysis

Parameter: Chloride
Location: MW-8
Original Data (Not Transformed)
Non-Detects Replaced with Detection Limit

90% Confidence Level

Xj	Xk	(Xj - Xk)/(j-k)	Q
515 (10/15/2015)	480 (8/12/2015)	(515 - 480)/(2 - 1)	35
939 (11/20/2015)	480 (8/12/2015)	(939 - 480)/(3 - 1)	229.5
755 (1/6/2016)	480 (8/12/2015)	(755 - 480)/(4 - 1)	91.6667
663 (2/18/2016)	480 (8/12/2015)	(663 - 480)/(5 - 1)	45.75
685 (4/6/2016)	480 (8/12/2015)	(685 - 480)/(6 - 1)	41
396 (5/26/2016)	480 (8/12/2015)	(396 - 480)/(7 - 1)	-14
504 (7/12/2016)	480 (8/12/2015)	(504 - 480)/(8 - 1)	3.42857
660 (1/24/2017)	480 (8/12/2015)	(660 - 480)/(9 - 1)	22.5
437 (4/4/2017)	480 (8/12/2015)	(437 - 480)/(10 - 1)	-4.77778
473 (7/17/2017)	480 (8/12/2015)	(473 - 480)/(11 - 1)	-0.7
939 (11/20/2015)	515 (10/15/2015)	(939 - 515)/(3 - 2)	424
755 (1/6/2016)	515 (10/15/2015)	(755 - 515)/(4 - 2)	120
663 (2/18/2016)	515 (10/15/2015)	(663 - 515)/(5 - 2)	49.3333
685 (4/6/2016)	515 (10/15/2015)	(685 - 515)/(6 - 2)	42.5
396 (5/26/2016)	515 (10/15/2015)	(396 - 515)/(7 - 2)	-23.8
504 (7/12/2016)	515 (10/15/2015)	(504 - 515)/(8 - 2)	-1.83333
660 (1/24/2017)	515 (10/15/2015)	(660 - 515)/(9 - 2)	20.7143
437 (4/4/2017)	515 (10/15/2015)	(437 - 515)/(10 - 2)	-9.75
473 (7/17/2017)	515 (10/15/2015)	(473 - 515)/(11 - 2)	-4.66667
755 (1/6/2016)	939 (11/20/2015)	(755 - 939)/(4 - 3)	-184
663 (2/18/2016)	939 (11/20/2015)	(663 - 939)/(5 - 3)	-138
685 (4/6/2016)	939 (11/20/2015)	(685 - 939)/(6 - 3)	-84.6667
396 (5/26/2016)	939 (11/20/2015)	(396 - 939)/(7 - 3)	-135.75
504 (7/12/2016)	939 (11/20/2015)	(504 - 939)/(8 - 3)	-87
660 (1/24/2017)	939 (11/20/2015)	(660 - 939)/(9 - 3)	-46.5
437 (4/4/2017)	939 (11/20/2015)	(437 - 939)/(10 - 3)	-71.7143
473 (7/17/2017)	939 (11/20/2015)	(473 - 939)/(11 - 3)	-58.25
663 (2/18/2016)	755 (1/6/2016)	(663 - 755)/(5 - 4)	-92
685 (4/6/2016)	755 (1/6/2016)	(685 - 755)/(6 - 4)	-35
396 (5/26/2016)	755 (1/6/2016)	(396 - 755)/(7 - 4)	-119.667
504 (7/12/2016)	755 (1/6/2016)	(504 - 755)/(8 - 4)	-62.75
660 (1/24/2017)	755 (1/6/2016)	(660 - 755)/(9 - 4)	-19
437 (4/4/2017)	755 (1/6/2016)	(437 - 755)/(10 - 4)	-53
473 (7/17/2017)	755 (1/6/2016)	(473 - 755)/(11 - 4)	-40.2857
685 (4/6/2016)	663 (2/18/2016)	(685 - 663)/(6 - 5)	22
396 (5/26/2016)	663 (2/18/2016)	(396 - 663)/(7 - 5)	-133.5
504 (7/12/2016)	663 (2/18/2016)	(504 - 663)/(8 - 5)	-53
660 (1/24/2017)	663 (2/18/2016)	(660 - 663)/(9 - 5)	-0.75
437 (4/4/2017)	663 (2/18/2016)	(437 - 663)/(10 - 5)	-45.2
473 (7/17/2017)	663 (2/18/2016)	(473 - 663)/(11 - 5)	-31.6667
396 (5/26/2016)	685 (4/6/2016)	(396 - 685)/(7 - 6)	-289
504 (7/12/2016)	685 (4/6/2016)	(504 - 685)/(8 - 6)	-90.5
660 (1/24/2017)	685 (4/6/2016)	(660 - 685)/(9 - 6)	-8.33333
437 (4/4/2017)	685 (4/6/2016)	(437 - 685)/(10 - 6)	-62
473 (7/17/2017)	685 (4/6/2016)	(473 - 685)/(11 - 6)	-42.4
504 (7/12/2016)	396 (5/26/2016)	(504 - 396)/(8 - 7)	108
660 (1/24/2017)	396 (5/26/2016)	(660 - 396)/(9 - 7)	132
437 (4/4/2017)	396 (5/26/2016)	(437 - 396)/(10 - 7)	13.6667
473 (7/17/2017)	396 (5/26/2016)	(473 - 396)/(11 - 7)	19.25
660 (1/24/2017)	504 (7/12/2016)	(660 - 504)/(9 - 8)	156
437 (4/4/2017)	504 (7/12/2016)	(437 - 504)/(10 - 8)	-33.5
473 (7/17/2017)	504 (7/12/2016)	(473 - 504)/(11 - 8)	-10.3333
437 (4/4/2017)	660 (1/24/2017)	(437 - 660)/(10 - 9)	-223
473 (7/17/2017)	660 (1/24/2017)	(473 - 660)/(11 - 9)	-93.5

Number of Q values = 55

Ordered Q Values

n	Q
1	-289
2	-223
3	-184
4	-138
5	-135.75
6	-133.5
7	-119.667
8	-93.5
9	-92
10	-90.5
11	-87
12	-84.6667
13	-71.7143
14	-62.75
15	-62
16	-58.25
17	-53
18	-53
19	-46.5
20	-45.2
21	-42.4
22	-40.2857
23	-35
24	-33.5
25	-31.6667
26	-23.8
27	-19
28	-14
29	-10.3333
30	-9.75
31	-8.33333
32	-4.77778
33	-4.66667
34	-1.83333
35	-0.75
36	-0.7
37	3.42857
38	13.6667
39	19.25
40	20.7143
41	22
42	22.5
43	35
44	36
45	41
46	42.5
47	45.75
48	49.3333
49	91.6667
50	108
51	120
52	132
53	156
54	229.5
55	424

Sen's Estimator (Median Q) is -14

Time Period	Observations
8/12/2015	1
10/15/2015	1
11/20/2015	1
1/6/2016	1
2/18/2016	1

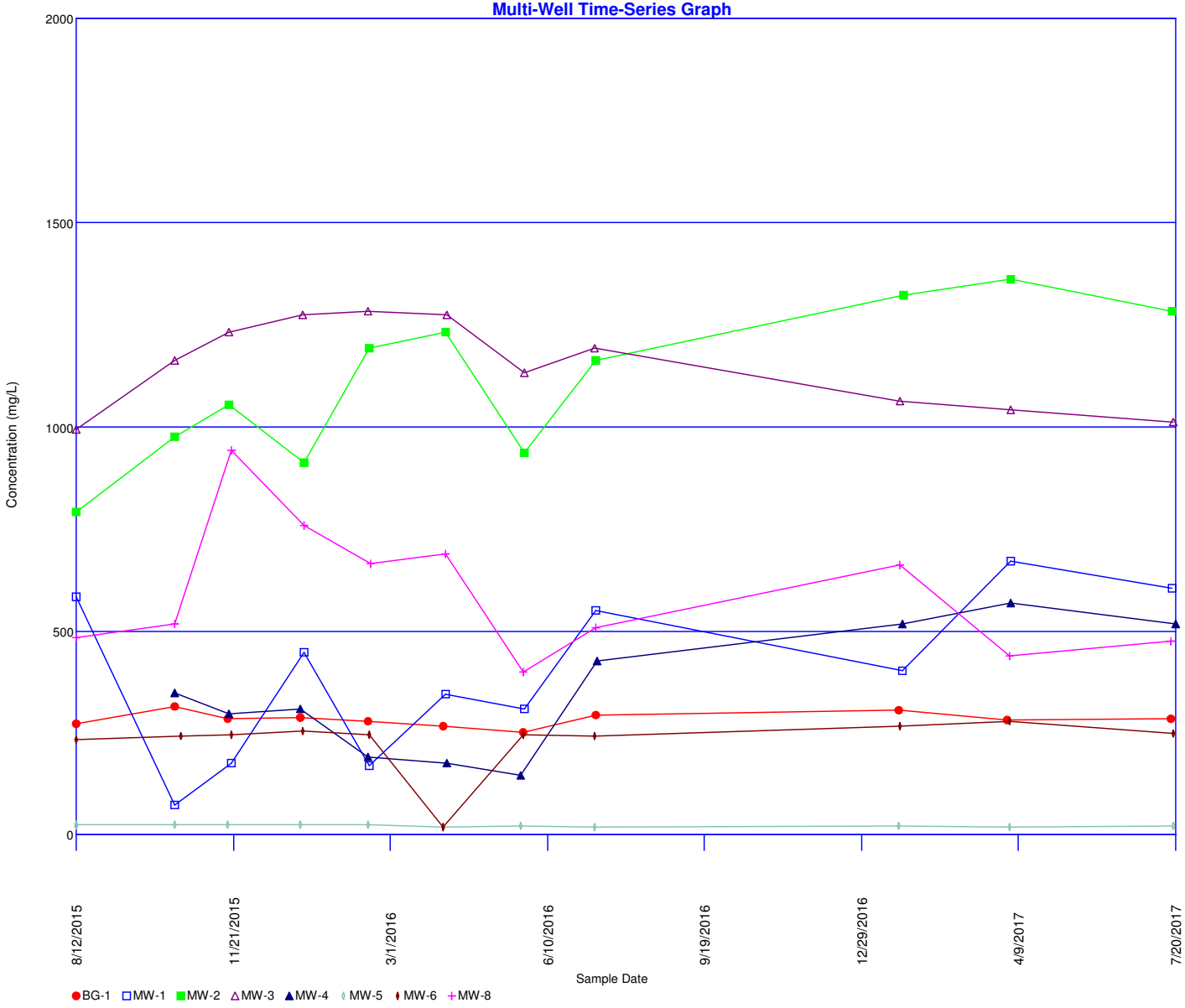
4/6/2016	1
5/26/2016	1
7/12/2016	1
1/24/2017	1
4/4/2017	1
7/17/2017	1

There are 0 time periods with multiple data

A = 0
B = 0
C = 0
D = 0
E = 0
F = 0
a = 2970
b = 8910
c = 220
Group Variance = 165
For 90% confidence interval (two-tailed), Z at (1-0.9)/2 = 1.64485
C = 21.1285
M1 = (55 - 21.1285)/2.0 = 16.9357
M2 = (55 + 21.1285)/2.0 + 1 = 39.0643
Lower limit is -53 = Q(17)
Upper limit is 19.25 = Q(39)
-53 < 0 < 19.25 indicating no trend in data.

Chloride

Multi-Well Time-Series Graph



Concentrations (ug/L)

Parameter: Chromium

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

Total Measurements: 89
Total Non-Detect: 65
Percent Non-Detects: 73.0337%
Total Background Measurements: 11
There is 1 background location

Loc.	Meas.	ND	Date	Conc.	Original
BG-1	11	11 (100%)	8/12/2015	ND<5 U	ND<5 U
			10/15/2015	ND<5 U	ND<5 U
			11/18/2015	ND<5 U	ND<5 U
			1/4/2016	ND<5 U	ND<5 U
			2/16/2016	ND<5 U	ND<5 U
			4/5/2016	ND<5 U	ND<5 U
			5/26/2016	ND<5 U	ND<5 U
			7/12/2016	ND<5 U	ND<5 U
			1/23/2017	ND<5 U	ND<5 U
			4/3/2017	ND<5 U	ND<5 U
			7/17/2017	ND<2.5 U	ND<2.5 U

There are 7 compliance locations

Loc.	Meas.	ND	Date	Conc.	Original
MW-1	11	9 (81.8182%)	8/12/2015	1.1 J	1.1 J
			10/15/2015	ND<5 U	ND<5 U
			11/20/2015	ND<5 U	ND<5 U
			1/6/2016	ND<5 U	ND<5 U
			2/17/2016	ND<5 U	ND<5 U
			4/6/2016	ND<5 U	ND<5 U
			5/27/2016	ND<5 U	ND<5 U
			7/12/2016	ND<5 U	ND<5 U
			1/25/2017	6.6	6.6
			4/5/2017	ND<5 U	ND<5 U
			7/18/2017	ND<2.5 U	ND<2.5 U
MW-2	11	2 (18.1818%)	8/12/2015	6	6
			10/15/2015	13	13
			11/19/2015	7.2	7.2
			1/6/2016	15.8	15.8
			2/17/2016	23.3	23.3
			4/6/2016	5.7	5.7
			5/27/2016	ND<5 U	ND<5 U
			7/12/2016	5.2	5.2
			1/26/2017	29.5	29.5
			4/5/2017	48.8	48.8
			7/18/2017	ND<2.5 U	ND<2.5 U
MW-3	12	8 (66.6667%)	8/12/2015	1.1 J	1.1 J
			8/12/2015	1.2 J	1.2 J
			10/15/2015	ND<5 U	ND<5 U
			11/19/2015	ND<5 U	ND<5 U
			1/5/2016	ND<5 U	ND<5 U
			2/16/2016	ND<5 U	ND<5 U
			4/7/2016	ND<5 U	ND<5 U
			5/27/2016	ND<5 U	ND<5 U
			7/11/2016	ND<5 U	ND<5 U
			1/24/2017	ND<5 U	ND<5 U
			4/5/2017	10.3	10.3
			7/19/2017	9.4	9.4
MW-4	11	10 (90.9091%)	8/12/2015	2.5 J	2.5 J
			10/15/2015	ND<5 U	ND<5 U
			11/19/2015	ND<5 U	ND<5 U
			1/4/2016	ND<5 U	ND<5 U
			2/16/2016	ND<5 U	ND<5 U
			4/7/2016	ND<5 U	ND<5 U

			5/25/2016	ND<5 U	ND<5 U
			7/13/2016	ND<5 U	ND<5 U
			1/25/2017	ND<5 U	ND<5 U
			4/5/2017	ND<5 U	ND<5 U
			7/20/2017	ND<2.5 U	ND<2.5 U
MW-5	11	8 (72.7273%)	8/12/2015	1.8 J	1.8 J
			10/15/2015	10.8	10.8
			11/18/2015	ND<5 U	ND<5 U
			1/4/2016	ND<5 U	ND<5 U
			2/16/2016	ND<5 U	ND<5 U
			4/5/2016	ND<5 U	ND<5 U
			5/25/2016	ND<5 U	ND<5 U
			7/11/2016	ND<5 U	ND<5 U
			1/23/2017	ND<5 U	ND<5 U
			4/4/2017	5.3	5.3
			7/19/2017	ND<2.5 U	ND<2.5 U
MW-6	11	9 (81.8182%)	8/12/2015	0.75 J	0.75 J
			10/19/2015	ND<5 U	ND<5 U
			11/20/2015	ND<5 U	ND<5 U
			1/5/2016	ND<5 U	ND<5 U
			2/17/2016	ND<5 U	ND<5 U
			4/5/2016	ND<5 U	ND<5 U
			5/26/2016	ND<5 U	ND<5 U
			7/11/2016	ND<5 U	ND<5 U
			1/24/2017	ND<5 U	ND<5 U
			4/4/2017	6	6
			7/19/2017	ND<2.5 U	ND<2.5 U
MW-8	11	8 (72.7273%)	8/12/2015	1.7 J	1.7 J
			10/15/2015	33.9	33.9
			11/20/2015	ND<5 U	ND<5 U
			1/6/2016	ND<5 U	ND<5 U
			2/18/2016	ND<5 U	ND<5 U
			4/6/2016	ND<5 U	ND<5 U
			5/26/2016	ND<5 U	ND<5 U
			7/12/2016	ND<5 U	ND<5 U
			1/24/2017	82	82
			4/4/2017	ND<5 U	ND<5 U
			7/17/2017	ND<2.5 U	ND<2.5 U

There are 0 unused locations

Loc.	Meas.	ND	Date	Conc.	Original

Rosner's Test for Outliers

Parameter: Chromium

All Locations

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

Data set mean = 7.15112

10 most extreme of 89 measurements

by order of magnitude difference from the mean

1	1/24/2017	MW-8	82	74.8489
2	4/5/2017	MW-2	48.8	41.6489
3	10/15/2015	MW-8	33.9	26.7489
4	1/26/2017	MW-2	29.5	22.3489
5	2/17/2016	MW-2	23.3	16.1489
6	1/6/2016	MW-2	15.8	8.64888
7	8/12/2015	MW-6	0.75 J	-6.40112
8	8/12/2015	MW-3	1.1 J	-6.05112
9	8/12/2015	MW-1	1.1 J	-6.05112
10	8/12/2015	MW-3	1.2 J	-5.95112

Iteration i = 9

Mean of 80 measurements = 5.0025
Std Dev = 1.74544
x(i+1) = 1.2 from measurement 8/12/2015 from location MW-3
Rosner Statistic R = |1.2 - 5.0025|/1.74544 = 2.17853
Lambda(89, 10, 0.05) = 3.305
2.17853 < 3.305 -- No outliers detected for i = 9

Iteration i = 8

Mean of 81 measurements = 4.95432
Std Dev = 1.78788
x(i+1) = 1.1 from measurement 8/12/2015 from location MW-1
Rosner Statistic R = |1.1 - 4.95432|/1.78788 = 2.15581
Lambda(89, 9, 0.05) = 3.3092
2.15581 < 3.3092 -- No outliers detected for i = 8

Iteration i = 7

Mean of 82 measurements = 4.90732
Std Dev = 1.82708
x(i+1) = 1.1 from measurement 8/12/2015 from location MW-3
Rosner Statistic R = |1.1 - 4.90732|/1.82708 = 2.08383
Lambda(89, 8, 0.05) = 3.3134
2.08383 < 3.3134 -- No outliers detected for i = 7

Iteration i = 6

Mean of 83 measurements = 4.85723
Std Dev = 1.87236
x(i+1) = 0.75 from measurement 8/12/2015 from location MW-6
Rosner Statistic R = |0.75 - 4.85723|/1.87236 = 2.19361
Lambda(89, 7, 0.05) = 3.3176
2.19361 < 3.3176 -- No outliers detected for i = 6

Iteration i = 5

Mean of 84 measurements = 4.9875
Std Dev = 2.21111
x(i+1) = 15.8 from measurement 1/6/2016 from location MW-2
Rosner Statistic R = |15.8 - 4.9875|/2.21111 = 4.89007
Lambda(89, 6, 0.05) = 3.3218
4.89007 > 3.3218 -- Measurement 1/6/2016 for location MW-2 is an outlier

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Iteration i = 4

Mean of 85 measurements = 5.20294
Std Dev = 2.96245
x(i+1) = 23.3 from measurement 2/17/2016 from location MW-2

Rosner Statistic R = |23.3 - 5.20294|/2.96245 = 6.10882
Lambda(89, 5, 0.05) = 3.326
Measurement 2/17/2016 for location MW-2 is an outlier

Iteration i = 3
Mean of 86 measurements = 5.48547
Std Dev = 3.94174
x(i+1) = 29.5 from measurement 1/26/2017 from location MW-2
Rosner Statistic R = |29.5 - 5.48547|/3.94174 = 6.09236
Lambda(89, 4, 0.05) = 3.335
Measurement 1/26/2017 for location MW-2 is an outlier

Iteration i = 2
Mean of 87 measurements = 5.81207
Std Dev = 4.96356
x(i+1) = 33.9 from measurement 10/15/2015 from location MW-8
Rosner Statistic R = |33.9 - 5.81207|/4.96356 = 5.65882
Lambda(89, 3, 0.05) = 3.336
Measurement 10/15/2015 for location MW-8 is an outlier

Iteration i = 1
Mean of 88 measurements = 6.30057
Std Dev = 6.73449
x(i+1) = 48.8 from measurement 4/5/2017 from location MW-2
Rosner Statistic R = |48.8 - 6.30057|/6.73449 = 6.31071
Lambda(89, 2, 0.05) = 3.336
Measurement 4/5/2017 for location MW-2 is an outlier

Iteration i = 0
Mean of 89 measurements = 7.15112
Std Dev = 10.4511
x(i+1) = 82 from measurement 1/24/2017 from location MW-8
Rosner Statistic R = |82 - 7.15112|/10.4511 = 7.16185
Lambda(89, 1, 0.05) = 3.346
Measurement 1/24/2017 for location MW-8 is an outlier

Non-Parametric Prediction Interval

Inter-Well Comparison

Parameter: Chromium

Original Data (Not Transformed)

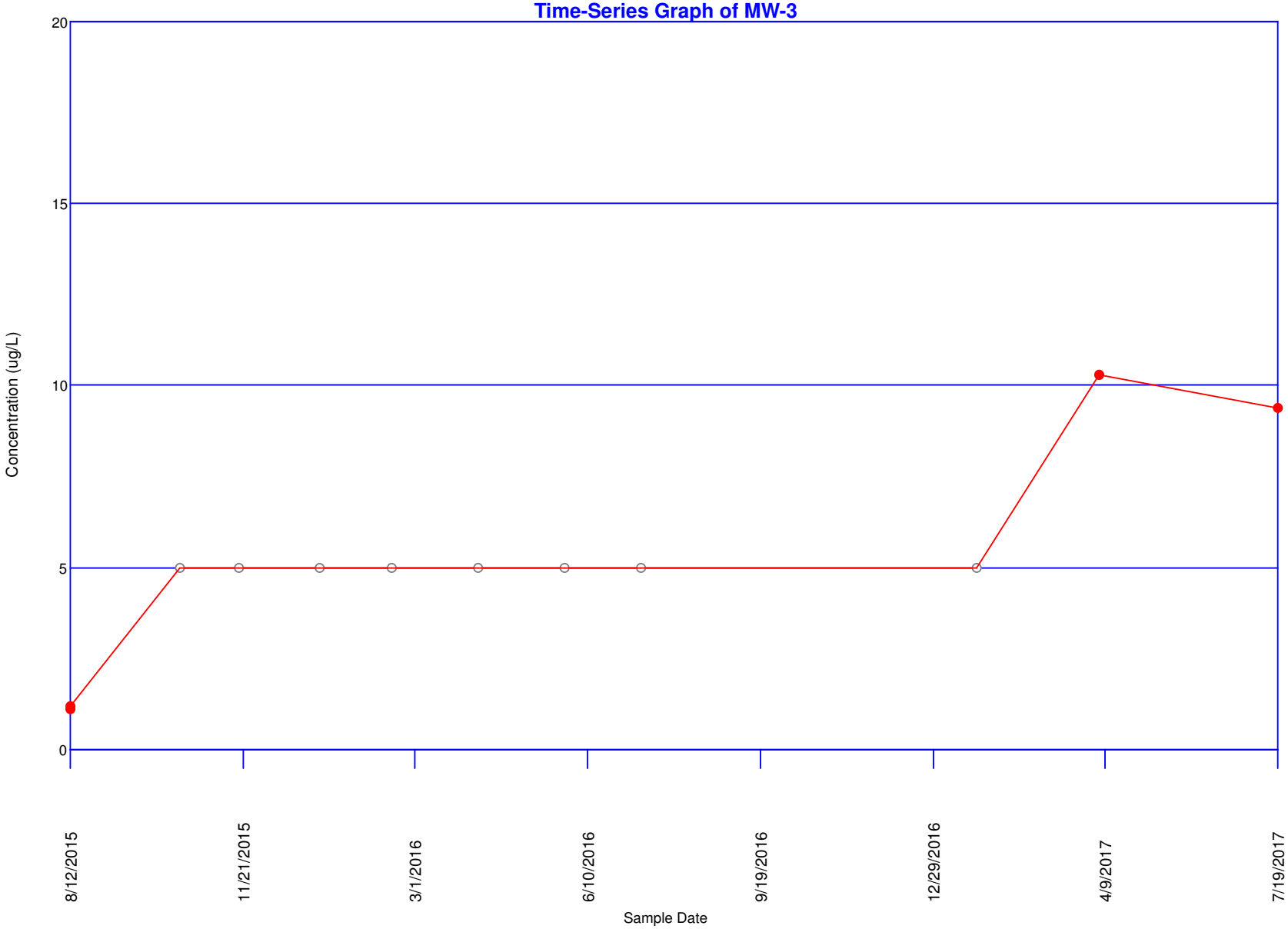
Non-Detects Replaced with Detection Limit

Total Percent Non-Detects = 73.0337%
Number of comparisons = 7
Future Samples (k) = 7
Recent Dates = 1
Background Measurements (n) = 11
Maximum Background Value = 5
Confidence Level = 61.1%
False Positive Rate = 38.9%

Location	Date	Count	Mean	Significant
MW-1	7/18/2017	1	2.5	FALSE
MW-2	7/18/2017	1	2.5	FALSE
MW-3	**7/19/2017**	**1**	**9.4**	**TRUE**
MW-4	7/20/2017	1	2.5	FALSE
MW-5	7/19/2017	1	2.5	FALSE
MW-6	7/19/2017	1	2.5	FALSE
MW-8	7/17/2017	1	2.5	FALSE

Chromium

Time-Series Graph of MW-3



Concentrations (ug/L)

Parameter: Cobalt

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

Total Measurements: 88
Total Non-Detect: 78
Percent Non-Detects: 88.6364%
Total Background Measurements: 11
There is 1 background location

Loc.	Meas.	ND	Date	Conc.	Original
BG-1	11	10 (90.9091%)	8/12/2015	0.91 J	0.91 J
			10/15/2015	ND<5 U	ND<5 U
			11/18/2015	ND<5 U	ND<5 U
			1/4/2016	ND<5 U	ND<5 U
			2/16/2016	ND<5 U	ND<5 U
			4/5/2016	ND<5 U	ND<5 U
			5/26/2016	ND<5 U	ND<5 U
			7/12/2016	ND<5 U	ND<5 U
			1/23/2017	ND<5 U	ND<5 U
			4/3/2017	ND<5 U	ND<5 U
			7/17/2017	ND<2.5 U	ND<2.5 U

There are 7 compliance locations

Loc.	Meas.	ND	Date	Conc.	Original
MW-1	11	10 (90.9091%)	8/12/2015	0.45 J	0.45 J
			10/15/2015	ND<5 U	ND<5 U
			11/20/2015	ND<5 U	ND<5 U
			1/6/2016	ND<5 U	ND<5 U
			2/17/2016	ND<5 U	ND<5 U
			4/6/2016	ND<5 U	ND<5 U
			5/27/2016	ND<5 U	ND<5 U
			7/12/2016	ND<5 U	ND<5 U
			1/25/2017	ND<5 U	ND<5 U
			4/5/2017	ND<5 U	ND<5 U
			7/18/2017	ND<2.5 U	ND<2.5 U
MW-2	11	10 (90.9091%)	8/12/2015	1.9 J	1.9 J
			10/15/2015	ND<5 U	ND<5 U
			11/19/2015	ND<5 U	ND<5 U
			1/6/2016	ND<5 U	ND<5 U
			2/17/2016	ND<5 U	ND<5 U
			4/6/2016	ND<5 U	ND<5 U
			5/27/2016	ND<5 U	ND<5 U
			7/12/2016	ND<5 U	ND<5 U
			1/26/2017	ND<5 U	ND<5 U
			4/5/2017	ND<5 U	ND<5 U
			7/18/2017	ND<2.5 U	ND<2.5 U
MW-3	11	10 (90.9091%)	8/12/2015	0.74 J	0.74 J
			10/15/2015	ND<5 U	ND<5 U
			11/19/2015	ND<5 U	ND<5 U
			1/5/2016	ND<5 U	ND<5 U
			2/16/2016	ND<5 U	ND<5 U
			4/7/2016	ND<5 U	ND<5 U
			5/27/2016	ND<5 U	ND<5 U
			7/11/2016	ND<5 U	ND<5 U
			1/24/2017	ND<5 U	ND<5 U
			4/5/2017	ND<5 U	ND<5 U
			7/19/2017	ND<2.5 U	ND<2.5 U
MW-4	11	9 (81.8182%)	8/12/2015	8.2	8.2
			10/15/2015	ND<5 U	ND<5 U
			11/19/2015	ND<5 U	ND<5 U
			1/4/2016	ND<5 U	ND<5 U
			2/16/2016	ND<5 U	ND<5 U
			4/7/2016	ND<5 U	ND<5 U
			5/25/2016	ND<5 U	ND<5 U

			7/13/2016	ND<5 U	ND<5 U
			1/25/2017	ND<5 U	ND<5 U
			4/5/2017	ND<5 U	ND<5 U
			7/20/2017	5.3	5.3
MW-5	11	9 (81.8182%)	8/12/2015	1.6 J	1.6 J
			10/15/2015	7	7
			11/18/2015	ND<5 U	ND<5 U
			1/4/2016	ND<5 U	ND<5 U
			2/16/2016	ND<5 U	ND<5 U
			4/5/2016	ND<5 U	ND<5 U
			5/25/2016	ND<5 U	ND<5 U
			7/11/2016	ND<5 U	ND<5 U
			1/23/2017	ND<5 U	ND<5 U
			4/4/2017	ND<5 U	ND<5 U
			7/19/2017	ND<2.5 U	ND<2.5 U
MW-6	11	10 (90.9091%)	8/12/2015	2.2 J	2.2 J
			10/19/2015	ND<5 U	ND<5 U
			11/20/2015	ND<5 U	ND<5 U
			1/5/2016	ND<5 U	ND<5 U
			2/17/2016	ND<5 U	ND<5 U
			4/5/2016	ND<5 U	ND<5 U
			5/26/2016	ND<5 U	ND<5 U
			7/11/2016	ND<5 U	ND<5 U
			1/24/2017	ND<5 U	ND<5 U
			4/4/2017	ND<5 U	ND<5 U
			7/19/2017	ND<2.5 U	ND<2.5 U
MW-8	11	10 (90.9091%)	8/12/2015	0.36 J	0.36 J
			10/15/2015	ND<5 U	ND<5 U
			11/20/2015	ND<5 U	ND<5 U
			1/6/2016	ND<5 U	ND<5 U
			2/18/2016	ND<5 U	ND<5 U
			4/6/2016	ND<5 U	ND<5 U
			5/26/2016	ND<5 U	ND<5 U
			7/12/2016	ND<5 U	ND<5 U
			1/24/2017	ND<5 U	ND<5 U
			4/4/2017	ND<5 U	ND<5 U
			7/17/2017	ND<2.5 U	ND<2.5 U

There are 0 unused locations

Loc.	Meas.	ND	Date	Conc.	Original

Rosner's Test for Outliers

Parameter: Cobalt

All Locations

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

Data set mean = 4.55864

10 most extreme of 88 measurements

by order of magnitude difference from the mean

1	8/12/2015	MW-8	0.36 J	-4.19864
2	8/12/2015	MW-1	0.45 J	-4.10864
3	8/12/2015	MW-3	0.74 J	-3.81864
4	8/12/2015	BG-1	0.91 J	-3.64864
5	8/12/2015	MW-4	8.2	3.64136
6	8/12/2015	MW-5	1.6 J	-2.95864
7	8/12/2015	MW-2	1.9 J	-2.65864
8	10/15/2015	MW-5	7	2.44136
9	8/12/2015	MW-6	2.2 J	-2.35864
10	7/19/2017	MW-6	ND<2.5 U	-2.05864

Iteration i = 9

Mean of 79 measurements = 4.78228
Std Dev = 0.716966
x(i+1) = 2.5 from measurement 7/19/2017 from location MW-6
Rosner Statistic R = |2.5 - 4.78228|/0.716966 = 3.18324
Lambda(88, 10, 0.05) = 3.3
3.18324 < 3.3 -- No outliers detected for i = 9

Iteration i = 8

Mean of 80 measurements = 4.75
Std Dev = 0.768691
x(i+1) = 2.2 from measurement 8/12/2015 from location MW-6
Rosner Statistic R = |2.2 - 4.75|/0.768691 = 3.31733
Lambda(88, 9, 0.05) = 3.3044
3.31733 > 3.3044 -- Measurement 8/12/2015 for location MW-6 is an outlier

---

Iteration i = 7

Mean of 81 measurements = 4.77778
Std Dev = 0.803741
x(i+1) = 7 from measurement 10/15/2015 from location MW-5
Rosner Statistic R = |7 - 4.77778|/0.803741 = 2.76485
Lambda(88, 8, 0.05) = 3.3088
Measurement 10/15/2015 for location MW-5 is an outlier

Iteration i = 6

Mean of 82 measurements = 4.74268
Std Dev = 0.859663
x(i+1) = 1.9 from measurement 8/12/2015 from location MW-2
Rosner Statistic R = |1.9 - 4.74268|/0.859663 = 3.30674
Lambda(88, 7, 0.05) = 3.3132
Measurement 8/12/2015 for location MW-2 is an outlier

Iteration i = 5

Mean of 83 measurements = 4.70482
Std Dev = 0.921412
x(i+1) = 1.6 from measurement 8/12/2015 from location MW-5
Rosner Statistic R = |1.6 - 4.70482|/0.921412 = 3.36963
Lambda(88, 6, 0.05) = 3.3176
Measurement 8/12/2015 for location MW-5 is an outlier

Iteration i = 4

Mean of 84 measurements = 4.74643
Std Dev = 0.992071
x(i+1) = 8.2 from measurement 8/12/2015 from location MW-4

Rosner Statistic R = |8.2 - 4.74643|/0.992071 = 3.48118
Lambda(88, 5, 0.05) = 3.322
Measurement 8/12/2015 for location MW-4 is an outlier

Iteration i = 3
Mean of 85 measurements = 4.70129
Std Dev = 1.07035
x(i+1) = 0.91 from measurement 8/12/2015 from location BG-1
Rosner Statistic R = |0.91 - 4.70129|/1.07035 = 3.54212
Lambda(88, 4, 0.05) = 3.33
Measurement 8/12/2015 for location BG-1 is an outlier

Iteration i = 2
Mean of 86 measurements = 4.65523
Std Dev = 1.14657
x(i+1) = 0.74 from measurement 8/12/2015 from location MW-3
Rosner Statistic R = |0.74 - 4.65523|/1.14657 = 3.41473
Lambda(88, 3, 0.05) = 3.332
Measurement 8/12/2015 for location MW-3 is an outlier

Iteration i = 1
Mean of 87 measurements = 4.6069
Std Dev = 1.22581
x(i+1) = 0.45 from measurement 8/12/2015 from location MW-1
Rosner Statistic R = |0.45 - 4.6069|/1.22581 = 3.39115
Lambda(88, 2, 0.05) = 3.332
Measurement 8/12/2015 for location MW-1 is an outlier

Iteration i = 0
Mean of 88 measurements = 4.55864
Std Dev = 1.30011
x(i+1) = 0.36 from measurement 8/12/2015 from location MW-8
Rosner Statistic R = |0.36 - 4.55864|/1.30011 = 3.22944
Lambda(88, 1, 0.05) = 3.342
Measurement 8/12/2015 for location MW-8 is an outlier

Non-Parametric Prediction Interval

Inter-Well Comparison

Parameter: Cobalt

Original Data (Not Transformed)

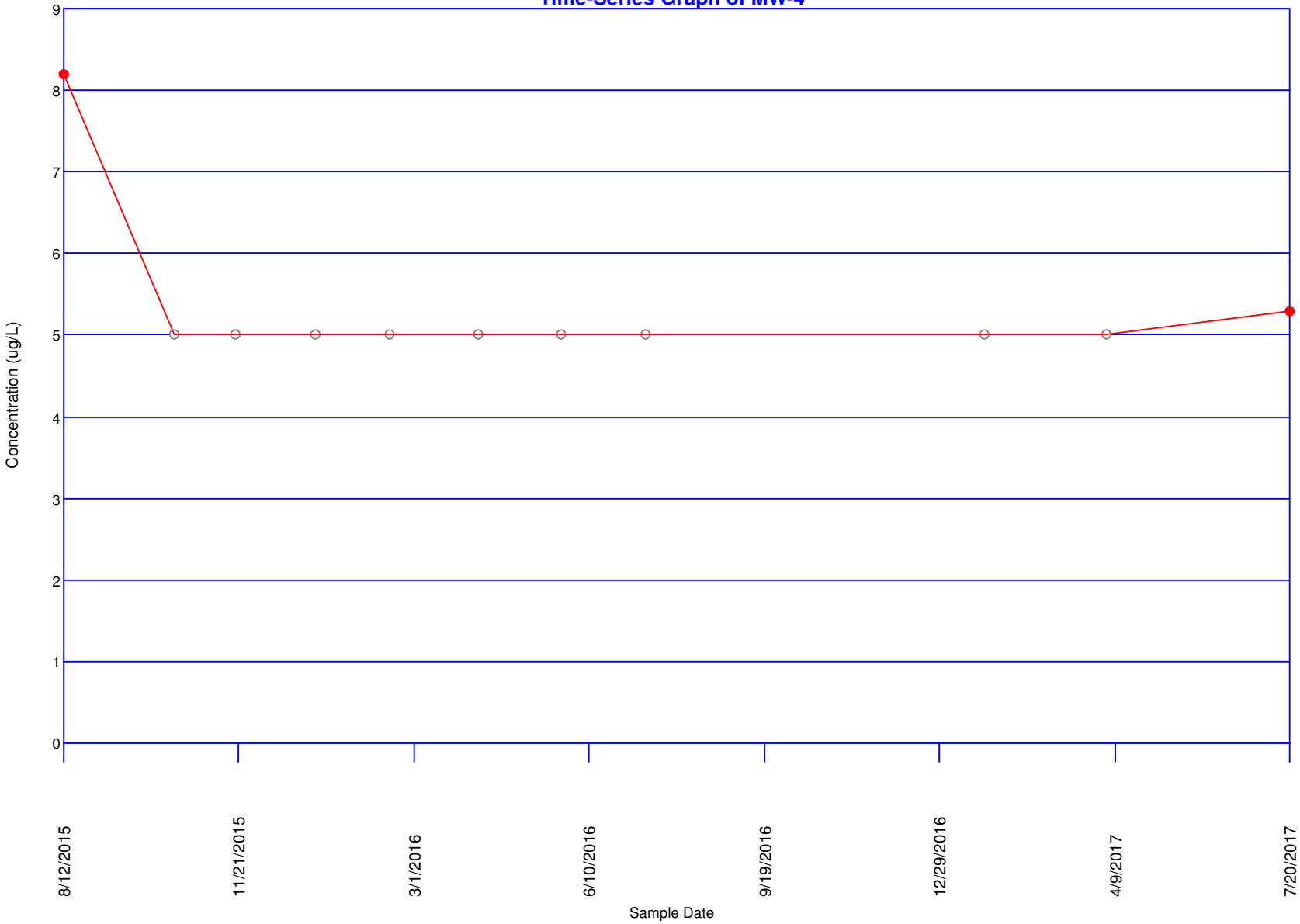
Non-Detects Replaced with Detection Limit

Total Percent Non-Detects = 88.6364%
Number of comparisons = 7
Future Samples (k) = 7
Recent Dates = 1
Background Measurements (n) = 11
Maximum Background Value = 5
Confidence Level = 61.1%
False Positive Rate = 38.9%

Location	Date	Count	Mean	Significant
MW-1	7/18/2017	1	2.5	FALSE
MW-2	7/18/2017	1	2.5	FALSE
MW-3	7/19/2017	1	2.5	FALSE
MW-4	**7/20/2017**	**1**	**5.3**	**TRUE**
MW-5	7/19/2017	1	2.5	FALSE
MW-6	7/19/2017	1	2.5	FALSE
MW-8	7/17/2017	1	2.5	FALSE

Cobalt

Time-Series Graph of MW-4



Concentrations (mg/L)

Parameter: Fluoride

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

Total Measurements: 88
Total Non-Detect: 16
Percent Non-Detects: 18.1818%
Total Background Measurements: 11
There is 1 background location

Loc.	Meas.	ND	Date	Conc.	Original
BG-1	11	0 (0%)	8/12/2015	0.22 J	0.22 J
			10/15/2015	0.1	0.1
			11/18/2015	0.12	0.12
			1/4/2016	0.13	0.13
			2/16/2016	0.13	0.13
			4/5/2016	0.13	0.13
			5/26/2016	0.12	0.12
			7/12/2016	0.11	0.11
			1/23/2017	0.14	0.14
			4/3/2017	0.12	0.12
			7/17/2017	0.11	0.11

There are 7 compliance locations

Loc.	Meas.	ND	Date	Conc.	Original
MW-1	11	1 (9.09091%)	8/12/2015	0.23 J	0.23 J
			10/15/2015	0.16	0.16
			11/20/2015	0.16	0.16
			1/6/2016	0.14	0.14
			2/17/2016	0.16	0.16
			4/6/2016	0.13	0.13
			5/27/2016	0.11	0.11
			7/12/2016	0.12	0.12
			1/25/2017	0.12	0.12
			4/5/2017	ND<0.1 U	ND<0.1 U
			7/18/2017	0.17	0.17
MW-2	11	2 (18.1818%)	8/12/2015	ND<2.5 U	ND<2.5 U
			10/15/2015	0.34	0.34
			11/19/2015	0.3	0.3
			1/6/2016	0.29	0.29
			2/17/2016	0.22	0.22
			4/6/2016	0.22	0.22
			5/27/2016	0.13	0.13
			7/12/2016	0.14	0.14
			1/26/2017	ND<0.1 U	ND<0.1 U
			4/5/2017	0.15	0.15
			7/18/2017	0.4	0.4
MW-3	11	2 (18.1818%)	8/12/2015	ND<2.5 U	ND<2.5 U
			10/15/2015	0.22	0.22
			11/19/2015	0.22	0.22
			1/5/2016	0.26	0.26
			2/16/2016	0.21	0.21
			4/7/2016	0.22	0.22
			5/27/2016	0.21	0.21
			7/11/2016	0.26	0.26
			1/24/2017	ND<0.1 U	ND<0.1 U
			4/5/2017	0.43	0.43
			7/19/2017	0.49	0.49
MW-4	11	0 (0%)	8/12/2015	0.51	0.51
			10/15/2015	0.28	0.28
			11/19/2015	0.34	0.34
			1/4/2016	0.35	0.35
			2/16/2016	0.36	0.36
			4/7/2016	0.42	0.42
			5/25/2016	0.42	0.42

			7/13/2016	0.34	0.34
			1/25/2017	0.21	0.21
			4/5/2017	0.28	0.28
			7/20/2017	0.31	0.31
MW-5	11	0 (0%)	8/12/2015	0.74	0.74
			10/15/2015	0.59	0.59
			11/18/2015	0.59	0.59
			1/4/2016	0.56	0.56
			2/16/2016	0.55	0.55
			4/5/2016	0.52	0.52
			5/25/2016	0.5	0.5
			7/11/2016	0.5	0.5
			1/23/2017	0.52	0.52
			4/4/2017	0.41	0.41
			7/19/2017	0.54	0.54
MW-6	11	0 (0%)	8/12/2015	0.49 J	0.49 J
			10/19/2015	0.45	0.45
			11/20/2015	0.39	0.39
			1/5/2016	0.41	0.41
			2/17/2016	0.34	0.34
			4/5/2016	0.18	0.18
			5/26/2016	0.46	0.46
			7/11/2016	0.31	0.31
			1/24/2017	0.38	0.38
			4/4/2017	0.42	0.42
			7/19/2017	0.37	0.37
MW-8	11	11 (100%)	8/12/2015	ND<0.5 U	ND<0.5 U
			10/15/2015	ND<0.1 U	ND<0.1 U
			11/20/2015	ND<0.1 U	ND<0.1 U
			1/6/2016	ND<0.1 U	ND<0.1 U
			2/18/2016	ND<0.1 U	ND<0.1 U
			4/6/2016	ND<0.1 U	ND<0.1 U
			5/26/2016	ND<0.1 U	ND<0.1 U
			7/12/2016	ND<0.1 U	ND<0.1 U
			1/24/2017	ND<0.1 U	ND<0.1 U
			4/4/2017	ND<0.1 U	ND<0.1 U
			7/17/2017	ND<0.05 U	ND<0.05 U

There are 0 unused locations

Loc.	Meas.	ND	Date	Conc.	Original

Rosner's Test for Outliers

Parameter: Fluoride

All Locations

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

Data set mean = 0.323068

10 most extreme of 88 measurements

by order of magnitude difference from the mean

1	8/12/2015	MW-3	ND<2.5 U	2.17693
2	8/12/2015	MW-2	ND<2.5 U	2.17693
3	8/12/2015	MW-5	0.74	0.416932
4	7/17/2017	MW-8	ND<0.05 U	-0.273068
5	11/18/2015	MW-5	0.59	0.266932
6	10/15/2015	MW-5	0.59	0.266932
7	1/4/2016	MW-5	0.56	0.236932
8	2/16/2016	MW-5	0.55	0.226932
9	2/18/2016	MW-8	ND<0.1 U	-0.223068
10	1/6/2016	MW-8	ND<0.1 U	-0.223068

Iteration i = 9

Mean of 79 measurements = 0.256329
Std Dev = 0.141894
x(i+1) = 0.1 from measurement 1/6/2016 from location MW-8
Rosner Statistic R = |0.1 - 0.256329|/0.141894 = 1.10173
Lambda(88, 10, 0.05) = 3.3
1.10173 < 3.3 -- No outliers detected for i = 9

Iteration i = 8

Mean of 80 measurements = 0.254375
Std Dev = 0.142072
x(i+1) = 0.1 from measurement 2/18/2016 from location MW-8
Rosner Statistic R = |0.1 - 0.254375|/0.142072 = 1.0866
Lambda(88, 9, 0.05) = 3.3044
1.0866 < 3.3044 -- No outliers detected for i = 8

Iteration i = 7

Mean of 81 measurements = 0.258025
Std Dev = 0.144952
x(i+1) = 0.55 from measurement 2/16/2016 from location MW-5
Rosner Statistic R = |0.55 - 0.258025|/0.144952 = 2.01429
Lambda(88, 8, 0.05) = 3.3088
2.01429 < 3.3088 -- No outliers detected for i = 7

Iteration i = 6

Mean of 82 measurements = 0.261707
Std Dev = 0.147864
x(i+1) = 0.56 from measurement 1/4/2016 from location MW-5
Rosner Statistic R = |0.56 - 0.261707|/0.147864 = 2.01735
Lambda(88, 7, 0.05) = 3.3132
2.01735 < 3.3132 -- No outliers detected for i = 6

Iteration i = 5

Mean of 83 measurements = 0.265663
Std Dev = 0.151313
x(i+1) = 0.59 from measurement 10/15/2015 from location MW-5
Rosner Statistic R = |0.59 - 0.265663|/0.151313 = 2.14349
Lambda(88, 6, 0.05) = 3.3176
2.14349 < 3.3176 -- No outliers detected for i = 5

Iteration i = 4

Mean of 84 measurements = 0.269524
Std Dev = 0.154506
x(i+1) = 0.59 from measurement 11/18/2015 from location MW-5

Rosner Statistic R = |0.59 - 0.269524|/0.154506 = 2.0742
Lambda(88, 5, 0.05) = 3.322
2.0742 < 3.322 -- No outliers detected for i = 4

Iteration i = 3

Mean of 85 measurements = 0.266941
Std Dev = 0.155418
x(i+1) = 0.05 from measurement 7/17/2017 from location MW-8
Rosner Statistic R = |0.05 - 0.266941|/0.155418 = 1.39585
Lambda(88, 4, 0.05) = 3.33
1.39585 < 3.33 -- No outliers detected for i = 3

Iteration i = 2

Mean of 86 measurements = 0.272442
Std Dev = 0.162705
x(i+1) = 0.74 from measurement 8/12/2015 from location MW-5
Rosner Statistic R = |0.74 - 0.272442|/0.162705 = 2.87366
Lambda(88, 3, 0.05) = 3.332
2.87366 < 3.332 -- No outliers detected for i = 2

Iteration i = 1

Mean of 87 measurements = 0.298046
Std Dev = 0.288443
x(i+1) = 2.5 from measurement 8/12/2015 from location MW-2
Rosner Statistic R = |2.5 - 0.298046|/0.288443 = 7.63392
Lambda(88, 2, 0.05) = 3.332
7.63392 > 3.332 -- Measurement 8/12/2015 for location MW-2 is an outlier

---

Iteration i = 0

Mean of 88 measurements = 0.323068
Std Dev = 0.370596
x(i+1) = 2.5 from measurement 8/12/2015 from location MW-3
Rosner Statistic R = |2.5 - 0.323068|/0.370596 = 5.87414
Lambda(88, 1, 0.05) = 3.342
Measurement 8/12/2015 for location MW-3 is an outlier

Shapiro-Wilks Test of Normality

Parameter: Fluoride
All Locations
Normality Test of Parameter Concentrations
Natural Logarithm Transformation
Non-Detects Replaced with Detection Limit
K = 5 for 11 measurements

i	x(i)	x(n-i+1)	x(n-1+1)-x(i)	a(n-i+1)	b(i)
1	-2.30259	-1.51413	0.788457	0.5601	0.441615
2	-2.20727	-1.96611	0.241162	0.3315	0.0799452
3	-2.20727	-2.04022	0.167054	0.226	0.0377542
4	-2.12026	-2.04022	0.0800427	0.1429	0.0114381
5	-2.12026	-2.04022	0.0800427	0.0695	0.00556297
6	-2.12026	-2.12026	0		
7	-2.04022	-2.12026	-0.0800427		
8	-2.04022	-2.12026	-0.0800427		
9	-2.04022	-2.20727	-0.167054		
10	-1.96611	-2.20727	-0.241162		
11	-1.51413	-2.30259	-0.788457		

Sum of b values = 0.576315
Sample Standard Deviation = 0.205196
W Statistic = 0.788827

5% Critical value of 0.85 exceeds 0.788827
Evidence of non-normality at 95% level of significance

1% Critical value of 0.792 exceeds 0.788827
Evidence of non-normality at 99% level of significance

1	**Background Statistics for Data Sets with Non-Detects**											
2	**User Selected Options**											
3	Date/Time of Computation			9/18/2017 3:01:39 PM								
4	From File			UPL-Input-July-2017.xls								
5	Full Precision			OFF								
6	Confidence Coefficient			95%								
7	Coverage			95%								
8	Different or Future K Observations			1								
9	Number of Bootstrap Operations			2000								
10												
11	**Floride**											
12												
13	**General Statistics**											
14	Total Number of Observations			11			Number of Distinct Observations				6	
15	Minimum			0.1			First Quartile				0.115	
16	Second Largest			0.14			Median				0.12	
17	Maximum			0.22			Third Quartile				0.13	
18	Mean			0.13			SD				0.0319	
19	Coefficient of Variation			0.246			Skewness				2.566	
20	Mean of logged Data			-2.062			SD of logged Data				0.205	
21												
22	**Critical Values for Background Threshold Values (BTVs)**											
23	Tolerance Factor K (For UTL)			2.815			d2max (for USL)				2.234	
24												
25	**Normal GOF Test**											
26	Shapiro Wilk Test Statistic			0.688			**Shapiro Wilk GOF Test**					
27	5% Shapiro Wilk Critical Value			0.85			Data Not Normal at 5% Significance Level					
28	Lilliefors Test Statistic			0.318			**Lilliefors GOF Test**					
29	5% Lilliefors Critical Value			0.267			Data Not Normal at 5% Significance Level					
30	**Data Not Normal at 5% Significance Level**											
31												
32	**Background Statistics Assuming Normal Distribution**											
33	95% UTL with 95% Coverage			0.22			90% Percentile (z)				0.171	
34	95% UPL (t)			0.19			95% Percentile (z)				0.183	
35	95% USL			0.201			99% Percentile (z)				0.204	
36												
37	**Gamma GOF Test**											
38	A-D Test Statistic			1.059			**Anderson-Darling Gamma GOF Test**					
39	5% A-D Critical Value			0.729			Data Not Gamma Distributed at 5% Significance Level					
40	K-S Test Statistic			0.291			**Kolmogrov-Smirnoff Gamma GOF Test**					
41	5% K-S Critical Value			0.255			Data Not Gamma Distributed at 5% Significance Level					
42	**Data Not Gamma Distributed at 5% Significance Level**											
43												
44	**Gamma Statistics**											
45	k hat (MLE)			23.43			k star (bias corrected MLE)				17.1	
46	Theta hat (MLE)			0.00555			Theta star (bias corrected MLE)				0.0076	
47	nu hat (MLE)			515.5			nu star (bias corrected)				376.2	
48	MLE Mean (bias corrected)			0.13			MLE Sd (bias corrected)				0.0314	
49												
50	**Background Statistics Assuming Gamma Distribution**											
51	95% Wilson Hilferty (WH) Approx. Gamma UPL			0.188			90% Percentile				0.172	
52	95% Hawkins Wixley (HW) Approx. Gamma UPL			0.188			95% Percentile				0.186	
53	95% WH Approx. Gamma UTL with 95% Coverage			0.224			99% Percentile				0.214	
54	95% HW Approx. Gamma UTL with 95% Coverage			0.224								
55	95% WH USL			0.201			95% HW USL				0.201	

	A	B	C	D	E	F	G	H	I	J	K	L
56												
57	**Lognormal GOF Test**											
58	Shapiro Wilk Test Statistic					0.789	**Shapiro Wilk Lognormal GOF Test**					
59	5% Shapiro Wilk Critical Value					0.85	Data Not Lognormal at 5% Significance Level					
60	Lilliefors Test Statistic					0.276	**Lilliefors Lognormal GOF Test**					
61	5% Lilliefors Critical Value					0.267	Data Not Lognormal at 5% Significance Level					
62	**Data Not Lognormal at 5% Significance Level**											
63												
64	**Background Statistics assuming Lognormal Distribution**											
65	95% UTL with 95% Coverage					0.227	90% Percentile (z)					0.166
66	95% UPL (t)					0.188	95% Percentile (z)					0.178
67	95% USL					0.201	99% Percentile (z)					0.205
68												
69	**Nonparametric Distribution Free Background Statistics**											
70	**Data do not follow a Discernible Distribution (0.05)**											
71												
72	**Nonparametric Upper Limits for Background Threshold Values**											
73	Order of Statistic, r					11	95% UTL with 95% Coverage					0.22
74	Approximate f					0.579	Confidence Coefficient (CC) achieved by UTL					0.431
75	95% Percentile Bootstrap UTL with 95% Coverage					0.22	95% BCA Bootstrap UTL with 95% Coverage					0.22
76	95% UPL					0.22	90% Percentile					0.14
77	90% Chebyshev UPL					0.23	95% Percentile					0.18
78	95% Chebyshev UPL					0.275	99% Percentile					0.212
79	95% USL					0.22						
80												
81	Note: The use of USL to estimate a BTV is recommended only when the data set represents a background											
82	data set free of outliers and consists of observations collected from clean unimpacted locations.											
83	The use of USL tends to provide a balance between false positives and false negatives provided the data											
84	represents a background data set and when many onsite observations need to be compared with the BTV.											
85												

Sen's Slope Analysis

Parameter: Fluoride
Location: MW-2
Original Data (Not Transformed)
Non-Detects Replaced with Detection Limit

90% Confidence Level

Xj	Xk	(Xj - Xk)/(j-k)	Q
0.34 (10/15/2015)	ND<2.5 U (8/12/2015)	(0.34 - 2.5)/(2 - 1)	-2.16
0.3 (11/19/2015)	ND<2.5 U (8/12/2015)	(0.3 - 2.5)/(3 - 1)	-1.1
0.29 (1/6/2016)	ND<2.5 U (8/12/2015)	(0.29 - 2.5)/(4 - 1)	-0.736667
0.22 (2/17/2016)	ND<2.5 U (8/12/2015)	(0.22 - 2.5)/(5 - 1)	-0.57
0.22 (4/6/2016)	ND<2.5 U (8/12/2015)	(0.22 - 2.5)/(6 - 1)	-0.456
0.13 (5/27/2016)	ND<2.5 U (8/12/2015)	(0.13 - 2.5)/(7 - 1)	-0.395
0.14 (7/12/2016)	ND<2.5 U (8/12/2015)	(0.14 - 2.5)/(8 - 1)	-0.337143
ND<0.1 U (1/26/2017)	ND<2.5 U (8/12/2015)	(0.1 - 2.5)/(9 - 1)	-0.3
0.15 (4/5/2017)	ND<2.5 U (8/12/2015)	(0.15 - 2.5)/(10 - 1)	-0.261111
0.4 (7/18/2017)	ND<2.5 U (8/12/2015)	(0.4 - 2.5)/(11 - 1)	-0.21
0.3 (11/19/2015)	0.34 (10/15/2015)	(0.3 - 0.34)/(3 - 2)	-0.04
0.29 (1/6/2016)	0.34 (10/15/2015)	(0.29 - 0.34)/(4 - 2)	-0.025
0.22 (2/17/2016)	0.34 (10/15/2015)	(0.22 - 0.34)/(5 - 2)	-0.04
0.22 (4/6/2016)	0.34 (10/15/2015)	(0.22 - 0.34)/(6 - 2)	-0.03
0.13 (5/27/2016)	0.34 (10/15/2015)	(0.13 - 0.34)/(7 - 2)	-0.042
0.14 (7/12/2016)	0.34 (10/15/2015)	(0.14 - 0.34)/(8 - 2)	-0.0333333
ND<0.1 U (1/26/2017)	0.34 (10/15/2015)	(0.1 - 0.34)/(9 - 2)	-0.0342857
0.15 (4/5/2017)	0.34 (10/15/2015)	(0.15 - 0.34)/(10 - 2)	-0.02375
0.4 (7/18/2017)	0.34 (10/15/2015)	(0.4 - 0.34)/(11 - 2)	0.00666667
0.29 (1/6/2016)	0.3 (11/19/2015)	(0.29 - 0.3)/(4 - 3)	-0.01
0.22 (2/17/2016)	0.3 (11/19/2015)	(0.22 - 0.3)/(5 - 3)	-0.04
0.22 (4/6/2016)	0.3 (11/19/2015)	(0.22 - 0.3)/(6 - 3)	-0.0266667
0.13 (5/27/2016)	0.3 (11/19/2015)	(0.13 - 0.3)/(7 - 3)	-0.0425
0.14 (7/12/2016)	0.3 (11/19/2015)	(0.14 - 0.3)/(8 - 3)	-0.032
ND<0.1 U (1/26/2017)	0.3 (11/19/2015)	(0.1 - 0.3)/(9 - 3)	-0.0333333
0.15 (4/5/2017)	0.3 (11/19/2015)	(0.15 - 0.3)/(10 - 3)	-0.0214286
0.4 (7/18/2017)	0.3 (11/19/2015)	(0.4 - 0.3)/(11 - 3)	0.0125
0.22 (2/17/2016)	0.29 (1/6/2016)	(0.22 - 0.29)/(5 - 4)	-0.07
0.22 (4/6/2016)	0.29 (1/6/2016)	(0.22 - 0.29)/(6 - 4)	-0.035
0.13 (5/27/2016)	0.29 (1/6/2016)	(0.13 - 0.29)/(7 - 4)	-0.0533333
0.14 (7/12/2016)	0.29 (1/6/2016)	(0.14 - 0.29)/(8 - 4)	-0.0375
ND<0.1 U (1/26/2017)	0.29 (1/6/2016)	(0.1 - 0.29)/(9 - 4)	-0.038
0.15 (4/5/2017)	0.29 (1/6/2016)	(0.15 - 0.29)/(10 - 4)	-0.0233333
0.4 (7/18/2017)	0.29 (1/6/2016)	(0.4 - 0.29)/(11 - 4)	0.0157143
0.22 (4/6/2016)	0.22 (2/17/2016)	(0.22 - 0.22)/(6 - 5)	0
0.13 (5/27/2016)	0.22 (2/17/2016)	(0.13 - 0.22)/(7 - 5)	-0.045
0.14 (7/12/2016)	0.22 (2/17/2016)	(0.14 - 0.22)/(8 - 5)	-0.0266667
ND<0.1 U (1/26/2017)	0.22 (2/17/2016)	(0.1 - 0.22)/(9 - 5)	-0.03
0.15 (4/5/2017)	0.22 (2/17/2016)	(0.15 - 0.22)/(10 - 5)	-0.014
0.4 (7/18/2017)	0.22 (2/17/2016)	(0.4 - 0.22)/(11 - 5)	0.03
0.13 (5/27/2016)	0.22 (4/6/2016)	(0.13 - 0.22)/(7 - 6)	-0.09
0.14 (7/12/2016)	0.22 (4/6/2016)	(0.14 - 0.22)/(8 - 6)	-0.04
ND<0.1 U (1/26/2017)	0.22 (4/6/2016)	(0.1 - 0.22)/(9 - 6)	-0.04
0.15 (4/5/2017)	0.22 (4/6/2016)	(0.15 - 0.22)/(10 - 6)	-0.0175
0.4 (7/18/2017)	0.22 (4/6/2016)	(0.4 - 0.22)/(11 - 6)	0.036
0.14 (7/12/2016)	0.13 (5/27/2016)	(0.14 - 0.13)/(8 - 7)	0.01
ND<0.1 U (1/26/2017)	0.13 (5/27/2016)	(0.1 - 0.13)/(9 - 7)	-0.015
0.15 (4/5/2017)	0.13 (5/27/2016)	(0.15 - 0.13)/(10 - 7)	0.00666667
0.4 (7/18/2017)	0.13 (5/27/2016)	(0.4 - 0.13)/(11 - 7)	0.0675
ND<0.1 U (1/26/2017)	0.14 (7/12/2016)	(0.1 - 0.14)/(9 - 8)	-0.04
0.15 (4/5/2017)	0.14 (7/12/2016)	(0.15 - 0.14)/(10 - 8)	0.005
0.4 (7/18/2017)	0.14 (7/12/2016)	(0.4 - 0.14)/(11 - 8)	0.0866667
0.15 (4/5/2017)	ND<0.1 U (1/26/2017)	(0.15 - 0.1)/(10 - 9)	0.05
0.4 (7/18/2017)	ND<0.1 U (1/26/2017)	(0.4 - 0.1)/(11 - 9)	0.15

0.4 (7/18/2017)	0.15 (4/5/2017)	(0.4 - 0.15)/(11 - 10)	0.25

Number of Q values = 55

Ordered Q Values

n	Q
1	-2.16
2	-1.1
3	-0.736667
4	-0.57
5	-0.456
6	-0.395
7	-0.337143
8	-0.3
9	-0.261111
10	-0.21
11	-0.09
12	-0.07
13	-0.0533333
14	-0.045
15	-0.0425
16	-0.042
17	-0.04
18	-0.04
19	-0.04
20	-0.04
21	-0.04
22	-0.04
23	-0.038
24	-0.0375
25	-0.035
26	-0.0342857
27	-0.0333333
28	-0.0333333
29	-0.032
30	-0.03
31	-0.03
32	-0.0266667
33	-0.0266667
34	-0.025
35	-0.02375
36	-0.0233333
37	-0.0214286
38	-0.0175
39	-0.015
40	-0.014
41	-0.01
42	0
43	0.005
44	0.00666667
45	0.00666667
46	0.01
47	0.0125
48	0.0157143
49	0.03
50	0.036
51	0.05
52	0.0675
53	0.0866667
54	0.15
55	0.25

Sen's Estimator (Median Q) is -0.0333333

Tied Group	Value	Members
1	0.22	2

Time Period	Observations
8/12/2015	1
10/15/2015	1

11/19/2015	1
1/6/2016	1
2/17/2016	1
4/6/2016	1
5/27/2016	1
7/12/2016	1
1/26/2017	1
4/5/2017	1
7/18/2017	1

There are 0 time periods with multiple data

A = 18
B = 0
C = 0
D = 0
E = 2
F = 0
a = 2970
b = 8910
c = 220
Group Variance = 164
For 90% confidence interval (two-tailed), Z at (1-0.9)/2 = 1.64485
C = 21.0644
M1 = (55 - 21.0644)/2.0 = 16.9678
M2 = (55 + 21.0644)/2.0 + 1 = 39.0322
Lower limit is -0.04 = Q(17)
Upper limit is -0.015 = Q(39)
-0.015 < 0 indicating a downward trend in data.

Sen's Slope Analysis

Parameter: Fluoride
Location: MW-3
Original Data (Not Transformed)
Non-Detects Replaced with Detection Limit

90% Confidence Level

Xj	Xk	(Xj - Xk)/(j-k)	Q
0.22 (10/15/2015)	ND<2.5 U (8/12/2015)	(0.22 - 2.5)/(2 - 1)	-2.28
0.22 (11/19/2015)	ND<2.5 U (8/12/2015)	(0.22 - 2.5)/(3 - 1)	-1.14
0.26 (1/5/2016)	ND<2.5 U (8/12/2015)	(0.26 - 2.5)/(4 - 1)	-0.746667
0.21 (2/16/2016)	ND<2.5 U (8/12/2015)	(0.21 - 2.5)/(5 - 1)	-0.5725
0.22 (4/7/2016)	ND<2.5 U (8/12/2015)	(0.22 - 2.5)/(6 - 1)	-0.456
0.21 (5/27/2016)	ND<2.5 U (8/12/2015)	(0.21 - 2.5)/(7 - 1)	-0.381667
0.26 (7/11/2016)	ND<2.5 U (8/12/2015)	(0.26 - 2.5)/(8 - 1)	-0.32
ND<0.1 U (1/24/2017)	ND<2.5 U (8/12/2015)	(0.1 - 2.5)/(9 - 1)	-0.3
0.43 (4/5/2017)	ND<2.5 U (8/12/2015)	(0.43 - 2.5)/(10 - 1)	-0.23
0.49 (7/19/2017)	ND<2.5 U (8/12/2015)	(0.49 - 2.5)/(11 - 1)	-0.201
0.22 (11/19/2015)	0.22 (10/15/2015)	(0.22 - 0.22)/(3 - 2)	0
0.26 (1/5/2016)	0.22 (10/15/2015)	(0.26 - 0.22)/(4 - 2)	0.02
0.21 (2/16/2016)	0.22 (10/15/2015)	(0.21 - 0.22)/(5 - 2)	-0.00333333
0.22 (4/7/2016)	0.22 (10/15/2015)	(0.22 - 0.22)/(6 - 2)	0
0.21 (5/27/2016)	0.22 (10/15/2015)	(0.21 - 0.22)/(7 - 2)	-0.002
0.26 (7/11/2016)	0.22 (10/15/2015)	(0.26 - 0.22)/(8 - 2)	0.00666667
ND<0.1 U (1/24/2017)	0.22 (10/15/2015)	(0.1 - 0.22)/(9 - 2)	-0.0171429
0.43 (4/5/2017)	0.22 (10/15/2015)	(0.43 - 0.22)/(10 - 2)	0.02625
0.49 (7/19/2017)	0.22 (10/15/2015)	(0.49 - 0.22)/(11 - 2)	0.03
0.26 (1/5/2016)	0.22 (11/19/2015)	(0.26 - 0.22)/(4 - 3)	0.04
0.21 (2/16/2016)	0.22 (11/19/2015)	(0.21 - 0.22)/(5 - 3)	-0.005
0.22 (4/7/2016)	0.22 (11/19/2015)	(0.22 - 0.22)/(6 - 3)	0
0.21 (5/27/2016)	0.22 (11/19/2015)	(0.21 - 0.22)/(7 - 3)	-0.0025
0.26 (7/11/2016)	0.22 (11/19/2015)	(0.26 - 0.22)/(8 - 3)	0.008
ND<0.1 U (1/24/2017)	0.22 (11/19/2015)	(0.1 - 0.22)/(9 - 3)	-0.02
0.43 (4/5/2017)	0.22 (11/19/2015)	(0.43 - 0.22)/(10 - 3)	0.03
0.49 (7/19/2017)	0.22 (11/19/2015)	(0.49 - 0.22)/(11 - 3)	0.03375
0.21 (2/16/2016)	0.26 (1/5/2016)	(0.21 - 0.26)/(5 - 4)	-0.05
0.22 (4/7/2016)	0.26 (1/5/2016)	(0.22 - 0.26)/(6 - 4)	-0.02
0.21 (5/27/2016)	0.26 (1/5/2016)	(0.21 - 0.26)/(7 - 4)	-0.0166667
0.26 (7/11/2016)	0.26 (1/5/2016)	(0.26 - 0.26)/(8 - 4)	0
ND<0.1 U (1/24/2017)	0.26 (1/5/2016)	(0.1 - 0.26)/(9 - 4)	-0.032
0.43 (4/5/2017)	0.26 (1/5/2016)	(0.43 - 0.26)/(10 - 4)	0.0283333
0.49 (7/19/2017)	0.26 (1/5/2016)	(0.49 - 0.26)/(11 - 4)	0.0328571
0.22 (4/7/2016)	0.21 (2/16/2016)	(0.22 - 0.21)/(6 - 5)	0.01
0.21 (5/27/2016)	0.21 (2/16/2016)	(0.21 - 0.21)/(7 - 5)	0
0.26 (7/11/2016)	0.21 (2/16/2016)	(0.26 - 0.21)/(8 - 5)	0.0166667
ND<0.1 U (1/24/2017)	0.21 (2/16/2016)	(0.1 - 0.21)/(9 - 5)	-0.0275
0.43 (4/5/2017)	0.21 (2/16/2016)	(0.43 - 0.21)/(10 - 5)	0.044
0.49 (7/19/2017)	0.21 (2/16/2016)	(0.49 - 0.21)/(11 - 5)	0.0466667
0.21 (5/27/2016)	0.22 (4/7/2016)	(0.21 - 0.22)/(7 - 6)	-0.01
0.26 (7/11/2016)	0.22 (4/7/2016)	(0.26 - 0.22)/(8 - 6)	0.02
ND<0.1 U (1/24/2017)	0.22 (4/7/2016)	(0.1 - 0.22)/(9 - 6)	-0.04
0.43 (4/5/2017)	0.22 (4/7/2016)	(0.43 - 0.22)/(10 - 6)	0.0525
0.49 (7/19/2017)	0.22 (4/7/2016)	(0.49 - 0.22)/(11 - 6)	0.054
0.26 (7/11/2016)	0.21 (5/27/2016)	(0.26 - 0.21)/(8 - 7)	0.05
ND<0.1 U (1/24/2017)	0.21 (5/27/2016)	(0.1 - 0.21)/(9 - 7)	-0.055
0.43 (4/5/2017)	0.21 (5/27/2016)	(0.43 - 0.21)/(10 - 7)	0.0733333
0.49 (7/19/2017)	0.21 (5/27/2016)	(0.49 - 0.21)/(11 - 7)	0.07
ND<0.1 U (1/24/2017)	0.26 (7/11/2016)	(0.1 - 0.26)/(9 - 8)	-0.16
0.43 (4/5/2017)	0.26 (7/11/2016)	(0.43 - 0.26)/(10 - 8)	0.085
0.49 (7/19/2017)	0.26 (7/11/2016)	(0.49 - 0.26)/(11 - 8)	0.0766667
0.43 (4/5/2017)	ND<0.1 U (1/24/2017)	(0.43 - 0.1)/(10 - 9)	0.33
0.49 (7/19/2017)	ND<0.1 U (1/24/2017)	(0.49 - 0.1)/(11 - 9)	0.195

0.49 (7/19/2017)	0.43 (4/5/2017)	(0.49 - 0.43)/(11 - 10)	0.06

Number of Q values = 55

Ordered Q Values

n	Q
1	-2.28
2	-1.14
3	-0.746667
4	-0.5725
5	-0.456
6	-0.381667
7	-0.32
8	-0.3
9	-0.23
10	-0.201
11	-0.16
12	-0.055
13	-0.05
14	-0.04
15	-0.032
16	-0.0275
17	-0.02
18	-0.02
19	-0.0171429
20	-0.0166667
21	-0.01
22	-0.005
23	-0.00333333
24	-0.0025
25	-0.002
26	0
27	0
28	0
29	0
30	0
31	0.00666667
32	0.008
33	0.01
34	0.0166667
35	0.02
36	0.02
37	0.02625
38	0.0283333
39	0.03
40	0.03
41	0.0328571
42	0.03375
43	0.04
44	0.044
45	0.0466667
46	0.05
47	0.0525
48	0.054
49	0.06
50	0.07
51	0.0733333
52	0.0766667
53	0.085
54	0.195
55	0.33

Sen's Estimator (Median Q) is 0

Tied Group	Value	Members
1	0.22	3
2	0.26	2
3	0.21	2

Time Period	Observations

8/12/2015	1
10/15/2015	1
11/19/2015	1
1/5/2016	1
2/16/2016	1
4/7/2016	1
5/27/2016	1
7/11/2016	1
1/24/2017	1
4/5/2017	1
7/19/2017	1

There are 0 time periods with multiple data

A = 102
B = 0
C = 6
D = 0
E = 10
F = 0
a = 2970
b = 8910
c = 220
Group Variance = 159.333
For 90% confidence interval (two-tailed), Z at (1-0.9)/2 = 1.64485
C = 20.7625
M1 = (55 - 20.7625)/2.0 = 17.1187
M2 = (55 + 20.7625)/2.0 + 1 = 38.8813
Lower limit is -0.02 = Q(17)
Upper limit is 0.03 = Q(39)
-0.02 < 0 < 0.03 indicating no trend in data.

Sen's Slope Analysis

Parameter: Fluoride
Location: MW-4
Original Data (Not Transformed)
Non-Detects Replaced with Detection Limit

90% Confidence Level

Xj	Xk	(Xj - Xk)/(j-k)	Q
0.28 (10/15/2015)	0.51 (8/12/2015)	(0.28 - 0.51)/(2 - 1)	-0.23
0.34 (11/19/2015)	0.51 (8/12/2015)	(0.34 - 0.51)/(3 - 1)	-0.085
0.35 (1/4/2016)	0.51 (8/12/2015)	(0.35 - 0.51)/(4 - 1)	-0.0533333
0.36 (2/16/2016)	0.51 (8/12/2015)	(0.36 - 0.51)/(5 - 1)	-0.0375
0.42 (4/7/2016)	0.51 (8/12/2015)	(0.42 - 0.51)/(6 - 1)	-0.018
0.42 (5/25/2016)	0.51 (8/12/2015)	(0.42 - 0.51)/(7 - 1)	-0.015
0.34 (7/13/2016)	0.51 (8/12/2015)	(0.34 - 0.51)/(8 - 1)	-0.0242857
0.21 (1/25/2017)	0.51 (8/12/2015)	(0.21 - 0.51)/(9 - 1)	-0.0375
0.28 (4/5/2017)	0.51 (8/12/2015)	(0.28 - 0.51)/(10 - 1)	-0.0255556
0.31 (7/20/2017)	0.51 (8/12/2015)	(0.31 - 0.51)/(11 - 1)	-0.02
0.34 (11/19/2015)	0.28 (10/15/2015)	(0.34 - 0.28)/(3 - 2)	0.06
0.35 (1/4/2016)	0.28 (10/15/2015)	(0.35 - 0.28)/(4 - 2)	0.035
0.36 (2/16/2016)	0.28 (10/15/2015)	(0.36 - 0.28)/(5 - 2)	0.0266667
0.42 (4/7/2016)	0.28 (10/15/2015)	(0.42 - 0.28)/(6 - 2)	0.035
0.42 (5/25/2016)	0.28 (10/15/2015)	(0.42 - 0.28)/(7 - 2)	0.028
0.34 (7/13/2016)	0.28 (10/15/2015)	(0.34 - 0.28)/(8 - 2)	0.01
0.21 (1/25/2017)	0.28 (10/15/2015)	(0.21 - 0.28)/(9 - 2)	-0.01
0.28 (4/5/2017)	0.28 (10/15/2015)	(0.28 - 0.28)/(10 - 2)	0
0.31 (7/20/2017)	0.28 (10/15/2015)	(0.31 - 0.28)/(11 - 2)	0.00333333
0.35 (1/4/2016)	0.34 (11/19/2015)	(0.35 - 0.34)/(4 - 3)	0.01
0.36 (2/16/2016)	0.34 (11/19/2015)	(0.36 - 0.34)/(5 - 3)	0.01
0.42 (4/7/2016)	0.34 (11/19/2015)	(0.42 - 0.34)/(6 - 3)	0.0266667
0.42 (5/25/2016)	0.34 (11/19/2015)	(0.42 - 0.34)/(7 - 3)	0.02
0.34 (7/13/2016)	0.34 (11/19/2015)	(0.34 - 0.34)/(8 - 3)	0
0.21 (1/25/2017)	0.34 (11/19/2015)	(0.21 - 0.34)/(9 - 3)	-0.0216667
0.28 (4/5/2017)	0.34 (11/19/2015)	(0.28 - 0.34)/(10 - 3)	-0.00857143
0.31 (7/20/2017)	0.34 (11/19/2015)	(0.31 - 0.34)/(11 - 3)	-0.00375
0.36 (2/16/2016)	0.35 (1/4/2016)	(0.36 - 0.35)/(5 - 4)	0.01
0.42 (4/7/2016)	0.35 (1/4/2016)	(0.42 - 0.35)/(6 - 4)	0.035
0.42 (5/25/2016)	0.35 (1/4/2016)	(0.42 - 0.35)/(7 - 4)	0.0233333
0.34 (7/13/2016)	0.35 (1/4/2016)	(0.34 - 0.35)/(8 - 4)	-0.0025
0.21 (1/25/2017)	0.35 (1/4/2016)	(0.21 - 0.35)/(9 - 4)	-0.028
0.28 (4/5/2017)	0.35 (1/4/2016)	(0.28 - 0.35)/(10 - 4)	-0.0116667
0.31 (7/20/2017)	0.35 (1/4/2016)	(0.31 - 0.35)/(11 - 4)	-0.00571429
0.42 (4/7/2016)	0.36 (2/16/2016)	(0.42 - 0.36)/(6 - 5)	0.06
0.42 (5/25/2016)	0.36 (2/16/2016)	(0.42 - 0.36)/(7 - 5)	0.03
0.34 (7/13/2016)	0.36 (2/16/2016)	(0.34 - 0.36)/(8 - 5)	-0.00666667
0.21 (1/25/2017)	0.36 (2/16/2016)	(0.21 - 0.36)/(9 - 5)	-0.0375
0.28 (4/5/2017)	0.36 (2/16/2016)	(0.28 - 0.36)/(10 - 5)	-0.016
0.31 (7/20/2017)	0.36 (2/16/2016)	(0.31 - 0.36)/(11 - 5)	-0.00833333
0.42 (5/25/2016)	0.42 (4/7/2016)	(0.42 - 0.42)/(7 - 6)	0
0.34 (7/13/2016)	0.42 (4/7/2016)	(0.34 - 0.42)/(8 - 6)	-0.04
0.21 (1/25/2017)	0.42 (4/7/2016)	(0.21 - 0.42)/(9 - 6)	-0.07
0.28 (4/5/2017)	0.42 (4/7/2016)	(0.28 - 0.42)/(10 - 6)	-0.035
0.31 (7/20/2017)	0.42 (4/7/2016)	(0.31 - 0.42)/(11 - 6)	-0.022
0.34 (7/13/2016)	0.42 (5/25/2016)	(0.34 - 0.42)/(8 - 7)	-0.08
0.21 (1/25/2017)	0.42 (5/25/2016)	(0.21 - 0.42)/(9 - 7)	-0.105
0.28 (4/5/2017)	0.42 (5/25/2016)	(0.28 - 0.42)/(10 - 7)	-0.0466667
0.31 (7/20/2017)	0.42 (5/25/2016)	(0.31 - 0.42)/(11 - 7)	-0.0275
0.21 (1/25/2017)	0.34 (7/13/2016)	(0.21 - 0.34)/(9 - 8)	-0.13
0.28 (4/5/2017)	0.34 (7/13/2016)	(0.28 - 0.34)/(10 - 8)	-0.03
0.31 (7/20/2017)	0.34 (7/13/2016)	(0.31 - 0.34)/(11 - 8)	-0.01
0.28 (4/5/2017)	0.21 (1/25/2017)	(0.28 - 0.21)/(10 - 9)	0.07
0.31 (7/20/2017)	0.21 (1/25/2017)	(0.31 - 0.21)/(11 - 9)	0.05

0.31 (7/20/2017)	0.28 (4/5/2017)	(0.31 - 0.28)/(11 - 10)	0.03

Number of Q values = 55

Ordered Q Values

n	Q
1	-0.23
2	-0.13
3	-0.105
4	-0.085
5	-0.08
6	-0.07
7	-0.0533333
8	-0.0466667
9	-0.04
10	-0.0375
11	-0.0375
12	-0.0375
13	-0.035
14	-0.03
15	-0.028
16	-0.0275
17	-0.0255556
18	-0.0242857
19	-0.022
20	-0.0216667
21	-0.02
22	-0.018
23	-0.016
24	-0.015
25	-0.0116667
26	-0.01
27	-0.01
28	-0.00857143
29	-0.00833333
30	-0.00666667
31	-0.00571429
32	-0.00375
33	-0.0025
34	0
35	0
36	0
37	0.00333333
38	0.01
39	0.01
40	0.01
41	0.01
42	0.02
43	0.0233333
44	0.0266667
45	0.0266667
46	0.028
47	0.03
48	0.03
49	0.035
50	0.035
51	0.035
52	0.05
53	0.06
54	0.06
55	0.07

Sen's Estimator (Median Q) is -0.00857143

Tied Group	Value	Members
1	0.28	2
2	0.34	2
3	0.42	2

Time Period	Observations

8/12/2015	1
10/15/2015	1
11/19/2015	1
1/4/2016	1
2/16/2016	1
4/7/2016	1
5/25/2016	1
7/13/2016	1
1/25/2017	1
4/5/2017	1
7/20/2017	1

There are 0 time periods with multiple data

A = 54
B = 0
C = 0
D = 0
E = 6
F = 0
a = 2970
b = 8910
c = 220
Group Variance = 162
For 90% confidence interval (two-tailed), Z at (1-0.9)/2 = 1.64485
C = 20.9356
M1 = (55 - 20.9356)/2.0 = 17.0322
M2 = (55 + 20.9356)/2.0 + 1 = 38.9678
Lower limit is -0.0255556 = Q(17)
Upper limit is 0.01 = Q(39)
-0.0255556 < 0 < 0.01 indicating no trend in data.

Sen's Slope Analysis

Parameter: Fluoride
Location: MW-5
Original Data (Not Transformed)
Non-Detects Replaced with Detection Limit

90% Confidence Level

Xj	Xk	(Xj - Xk)/(j-k)	Q
0.59 (10/15/2015)	0.74 (8/12/2015)	(0.59 - 0.74)/(2 - 1)	-0.15
0.59 (11/18/2015)	0.74 (8/12/2015)	(0.59 - 0.74)/(3 - 1)	-0.075
0.56 (1/4/2016)	0.74 (8/12/2015)	(0.56 - 0.74)/(4 - 1)	-0.06
0.55 (2/16/2016)	0.74 (8/12/2015)	(0.55 - 0.74)/(5 - 1)	-0.0475
0.52 (4/5/2016)	0.74 (8/12/2015)	(0.52 - 0.74)/(6 - 1)	-0.044
0.5 (5/25/2016)	0.74 (8/12/2015)	(0.5 - 0.74)/(7 - 1)	-0.04
0.5 (7/11/2016)	0.74 (8/12/2015)	(0.5 - 0.74)/(8 - 1)	-0.0342857
0.52 (1/23/2017)	0.74 (8/12/2015)	(0.52 - 0.74)/(9 - 1)	-0.0275
0.41 (4/4/2017)	0.74 (8/12/2015)	(0.41 - 0.74)/(10 - 1)	-0.0366667
0.54 (7/19/2017)	0.74 (8/12/2015)	(0.54 - 0.74)/(11 - 1)	-0.02
0.59 (11/18/2015)	0.59 (10/15/2015)	(0.59 - 0.59)/(3 - 2)	0
0.56 (1/4/2016)	0.59 (10/15/2015)	(0.56 - 0.59)/(4 - 2)	-0.015
0.55 (2/16/2016)	0.59 (10/15/2015)	(0.55 - 0.59)/(5 - 2)	-0.0133333
0.52 (4/5/2016)	0.59 (10/15/2015)	(0.52 - 0.59)/(6 - 2)	-0.0175
0.5 (5/25/2016)	0.59 (10/15/2015)	(0.5 - 0.59)/(7 - 2)	-0.018
0.5 (7/11/2016)	0.59 (10/15/2015)	(0.5 - 0.59)/(8 - 2)	-0.015
0.52 (1/23/2017)	0.59 (10/15/2015)	(0.52 - 0.59)/(9 - 2)	-0.01
0.41 (4/4/2017)	0.59 (10/15/2015)	(0.41 - 0.59)/(10 - 2)	-0.0225
0.54 (7/19/2017)	0.59 (10/15/2015)	(0.54 - 0.59)/(11 - 2)	-0.00555556
0.56 (1/4/2016)	0.59 (11/18/2015)	(0.56 - 0.59)/(4 - 3)	-0.03
0.55 (2/16/2016)	0.59 (11/18/2015)	(0.55 - 0.59)/(5 - 3)	-0.02
0.52 (4/5/2016)	0.59 (11/18/2015)	(0.52 - 0.59)/(6 - 3)	-0.0233333
0.5 (5/25/2016)	0.59 (11/18/2015)	(0.5 - 0.59)/(7 - 3)	-0.0225
0.5 (7/11/2016)	0.59 (11/18/2015)	(0.5 - 0.59)/(8 - 3)	-0.018
0.52 (1/23/2017)	0.59 (11/18/2015)	(0.52 - 0.59)/(9 - 3)	-0.0116667
0.41 (4/4/2017)	0.59 (11/18/2015)	(0.41 - 0.59)/(10 - 3)	-0.0257143
0.54 (7/19/2017)	0.59 (11/18/2015)	(0.54 - 0.59)/(11 - 3)	-0.00625
0.55 (2/16/2016)	0.56 (1/4/2016)	(0.55 - 0.56)/(5 - 4)	-0.01
0.52 (4/5/2016)	0.56 (1/4/2016)	(0.52 - 0.56)/(6 - 4)	-0.02
0.5 (5/25/2016)	0.56 (1/4/2016)	(0.5 - 0.56)/(7 - 4)	-0.02
0.5 (7/11/2016)	0.56 (1/4/2016)	(0.5 - 0.56)/(8 - 4)	-0.015
0.52 (1/23/2017)	0.56 (1/4/2016)	(0.52 - 0.56)/(9 - 4)	-0.008
0.41 (4/4/2017)	0.56 (1/4/2016)	(0.41 - 0.56)/(10 - 4)	-0.025
0.54 (7/19/2017)	0.56 (1/4/2016)	(0.54 - 0.56)/(11 - 4)	-0.00285714
0.52 (4/5/2016)	0.55 (2/16/2016)	(0.52 - 0.55)/(6 - 5)	-0.03
0.5 (5/25/2016)	0.55 (2/16/2016)	(0.5 - 0.55)/(7 - 5)	-0.025
0.5 (7/11/2016)	0.55 (2/16/2016)	(0.5 - 0.55)/(8 - 5)	-0.0166667
0.52 (1/23/2017)	0.55 (2/16/2016)	(0.52 - 0.55)/(9 - 5)	-0.0075
0.41 (4/4/2017)	0.55 (2/16/2016)	(0.41 - 0.55)/(10 - 5)	-0.028
0.54 (7/19/2017)	0.55 (2/16/2016)	(0.54 - 0.55)/(11 - 5)	-0.00166667
0.5 (5/25/2016)	0.52 (4/5/2016)	(0.5 - 0.52)/(7 - 6)	-0.02
0.5 (7/11/2016)	0.52 (4/5/2016)	(0.5 - 0.52)/(8 - 6)	-0.01
0.52 (1/23/2017)	0.52 (4/5/2016)	(0.52 - 0.52)/(9 - 6)	0
0.41 (4/4/2017)	0.52 (4/5/2016)	(0.41 - 0.52)/(10 - 6)	-0.0275
0.54 (7/19/2017)	0.52 (4/5/2016)	(0.54 - 0.52)/(11 - 6)	0.004
0.5 (7/11/2016)	0.5 (5/25/2016)	(0.5 - 0.5)/(8 - 7)	0
0.52 (1/23/2017)	0.5 (5/25/2016)	(0.52 - 0.5)/(9 - 7)	0.01
0.41 (4/4/2017)	0.5 (5/25/2016)	(0.41 - 0.5)/(10 - 7)	-0.03
0.54 (7/19/2017)	0.5 (5/25/2016)	(0.54 - 0.5)/(11 - 7)	0.01
0.52 (1/23/2017)	0.5 (7/11/2016)	(0.52 - 0.5)/(9 - 8)	0.02
0.41 (4/4/2017)	0.5 (7/11/2016)	(0.41 - 0.5)/(10 - 8)	-0.045
0.54 (7/19/2017)	0.5 (7/11/2016)	(0.54 - 0.5)/(11 - 8)	0.0133333
0.41 (4/4/2017)	0.52 (1/23/2017)	(0.41 - 0.52)/(10 - 9)	-0.11
0.54 (7/19/2017)	0.52 (1/23/2017)	(0.54 - 0.52)/(11 - 9)	0.01

0.54 (7/19/2017)	0.41 (4/4/2017)	(0.54 - 0.41)/(11 - 10)	0.13

Number of Q values = 55

Ordered Q Values

n	Q
1	-0.15
2	-0.11
3	-0.075
4	-0.06
5	-0.0475
6	-0.045
7	-0.044
8	-0.04
9	-0.0366667
10	-0.0342857
11	-0.03
12	-0.03
13	-0.03
14	-0.028
15	-0.0275
16	-0.0275
17	-0.0257143
18	-0.025
19	-0.025
20	-0.0233333
21	-0.0225
22	-0.0225
23	-0.02
24	-0.02
25	-0.02
26	-0.02
27	-0.02
28	-0.018
29	-0.018
30	-0.0175
31	-0.0166667
32	-0.015
33	-0.015
34	-0.015
35	-0.0133333
36	-0.0116667
37	-0.01
38	-0.01
39	-0.01
40	-0.008
41	-0.0075
42	-0.00625
43	-0.00555556
44	-0.00285714
45	-0.00166667
46	0
47	0
48	0
49	0.004
50	0.01
51	0.01
52	0.01
53	0.0133333
54	0.02
55	0.13

Sen's Estimator (Median Q) is -0.018

Tied Group	Value	Members
1	0.59	2
2	0.52	2
3	0.5	2

Time Period	Observations

8/12/2015	1
10/15/2015	1
11/18/2015	1
1/4/2016	1
2/16/2016	1
4/5/2016	1
5/25/2016	1
7/11/2016	1
1/23/2017	1
4/4/2017	1
7/19/2017	1

There are 0 time periods with multiple data

A = 54
B = 0
C = 0
D = 0
E = 6
F = 0
a = 2970
b = 8910
c = 220
Group Variance = 162
For 90% confidence interval (two-tailed), Z at (1-0.9)/2 = 1.64485
C = 20.9356
M1 = (55 - 20.9356)/2.0 = 17.0322
M2 = (55 + 20.9356)/2.0 + 1 = 38.9678
Lower limit is -0.0257143 = Q(17)
Upper limit is -0.01 = Q(39)
-0.01 < 0 indicating a downward trend in data.

Sen's Slope Analysis

Parameter: Fluoride
Location: MW-6
Original Data (Not Transformed)
Non-Detects Replaced with Detection Limit

90% Confidence Level

Xj	Xk	(Xj - Xk)/(j-k)	Q
0.45 (10/19/2015)	0.49 J (8/12/2015)	(0.45 - 0.49)/(2 - 1)	-0.04
0.39 (11/20/2015)	0.49 J (8/12/2015)	(0.39 - 0.49)/(3 - 1)	-0.05
0.41 (1/5/2016)	0.49 J (8/12/2015)	(0.41 - 0.49)/(4 - 1)	-0.0266667
0.34 (2/17/2016)	0.49 J (8/12/2015)	(0.34 - 0.49)/(5 - 1)	-0.0375
0.18 (4/5/2016)	0.49 J (8/12/2015)	(0.18 - 0.49)/(6 - 1)	-0.062
0.46 (5/26/2016)	0.49 J (8/12/2015)	(0.46 - 0.49)/(7 - 1)	-0.005
0.31 (7/11/2016)	0.49 J (8/12/2015)	(0.31 - 0.49)/(8 - 1)	-0.0257143
0.38 (1/24/2017)	0.49 J (8/12/2015)	(0.38 - 0.49)/(9 - 1)	-0.01375
0.42 (4/4/2017)	0.49 J (8/12/2015)	(0.42 - 0.49)/(10 - 1)	-0.00777778
0.37 (7/19/2017)	0.49 J (8/12/2015)	(0.37 - 0.49)/(11 - 1)	-0.012
0.39 (11/20/2015)	0.45 (10/19/2015)	(0.39 - 0.45)/(3 - 2)	-0.06
0.41 (1/5/2016)	0.45 (10/19/2015)	(0.41 - 0.45)/(4 - 2)	-0.02
0.34 (2/17/2016)	0.45 (10/19/2015)	(0.34 - 0.45)/(5 - 2)	-0.0366667
0.18 (4/5/2016)	0.45 (10/19/2015)	(0.18 - 0.45)/(6 - 2)	-0.0675
0.46 (5/26/2016)	0.45 (10/19/2015)	(0.46 - 0.45)/(7 - 2)	0.002
0.31 (7/11/2016)	0.45 (10/19/2015)	(0.31 - 0.45)/(8 - 2)	-0.0233333
0.38 (1/24/2017)	0.45 (10/19/2015)	(0.38 - 0.45)/(9 - 2)	-0.01
0.42 (4/4/2017)	0.45 (10/19/2015)	(0.42 - 0.45)/(10 - 2)	-0.00375
0.37 (7/19/2017)	0.45 (10/19/2015)	(0.37 - 0.45)/(11 - 2)	-0.00888889
0.41 (1/5/2016)	0.39 (11/20/2015)	(0.41 - 0.39)/(4 - 3)	0.02
0.34 (2/17/2016)	0.39 (11/20/2015)	(0.34 - 0.39)/(5 - 3)	-0.025
0.18 (4/5/2016)	0.39 (11/20/2015)	(0.18 - 0.39)/(6 - 3)	-0.07
0.46 (5/26/2016)	0.39 (11/20/2015)	(0.46 - 0.39)/(7 - 3)	0.0175
0.31 (7/11/2016)	0.39 (11/20/2015)	(0.31 - 0.39)/(8 - 3)	-0.016
0.38 (1/24/2017)	0.39 (11/20/2015)	(0.38 - 0.39)/(9 - 3)	-0.00166667
0.42 (4/4/2017)	0.39 (11/20/2015)	(0.42 - 0.39)/(10 - 3)	0.00428571
0.37 (7/19/2017)	0.39 (11/20/2015)	(0.37 - 0.39)/(11 - 3)	-0.0025
0.34 (2/17/2016)	0.41 (1/5/2016)	(0.34 - 0.41)/(5 - 4)	-0.07
0.18 (4/5/2016)	0.41 (1/5/2016)	(0.18 - 0.41)/(6 - 4)	-0.115
0.46 (5/26/2016)	0.41 (1/5/2016)	(0.46 - 0.41)/(7 - 4)	0.0166667
0.31 (7/11/2016)	0.41 (1/5/2016)	(0.31 - 0.41)/(8 - 4)	-0.025
0.38 (1/24/2017)	0.41 (1/5/2016)	(0.38 - 0.41)/(9 - 4)	-0.006
0.42 (4/4/2017)	0.41 (1/5/2016)	(0.42 - 0.41)/(10 - 4)	0.00166667
0.37 (7/19/2017)	0.41 (1/5/2016)	(0.37 - 0.41)/(11 - 4)	-0.00571429
0.18 (4/5/2016)	0.34 (2/17/2016)	(0.18 - 0.34)/(6 - 5)	-0.16
0.46 (5/26/2016)	0.34 (2/17/2016)	(0.46 - 0.34)/(7 - 5)	0.06
0.31 (7/11/2016)	0.34 (2/17/2016)	(0.31 - 0.34)/(8 - 5)	-0.01
0.38 (1/24/2017)	0.34 (2/17/2016)	(0.38 - 0.34)/(9 - 5)	0.01
0.42 (4/4/2017)	0.34 (2/17/2016)	(0.42 - 0.34)/(10 - 5)	0.016
0.37 (7/19/2017)	0.34 (2/17/2016)	(0.37 - 0.34)/(11 - 5)	0.005
0.46 (5/26/2016)	0.18 (4/5/2016)	(0.46 - 0.18)/(7 - 6)	0.28
0.31 (7/11/2016)	0.18 (4/5/2016)	(0.31 - 0.18)/(8 - 6)	0.065
0.38 (1/24/2017)	0.18 (4/5/2016)	(0.38 - 0.18)/(9 - 6)	0.0666667
0.42 (4/4/2017)	0.18 (4/5/2016)	(0.42 - 0.18)/(10 - 6)	0.06
0.37 (7/19/2017)	0.18 (4/5/2016)	(0.37 - 0.18)/(11 - 6)	0.038
0.31 (7/11/2016)	0.46 (5/26/2016)	(0.31 - 0.46)/(8 - 7)	-0.15
0.38 (1/24/2017)	0.46 (5/26/2016)	(0.38 - 0.46)/(9 - 7)	-0.04
0.42 (4/4/2017)	0.46 (5/26/2016)	(0.42 - 0.46)/(10 - 7)	-0.0133333
0.37 (7/19/2017)	0.46 (5/26/2016)	(0.37 - 0.46)/(11 - 7)	-0.0225
0.38 (1/24/2017)	0.31 (7/11/2016)	(0.38 - 0.31)/(9 - 8)	0.07
0.42 (4/4/2017)	0.31 (7/11/2016)	(0.42 - 0.31)/(10 - 8)	0.055
0.37 (7/19/2017)	0.31 (7/11/2016)	(0.37 - 0.31)/(11 - 8)	0.02
0.42 (4/4/2017)	0.38 (1/24/2017)	(0.42 - 0.38)/(10 - 9)	0.04
0.37 (7/19/2017)	0.38 (1/24/2017)	(0.37 - 0.38)/(11 - 9)	-0.005

0.37 (7/19/2017)	0.42 (4/4/2017)	(0.37 - 0.42)/(11 - 10)	-0.05

Number of Q values = 55

Ordered Q Values

n	Q
1	-0.16
2	-0.15
3	-0.115
4	-0.07
5	-0.07
6	-0.0675
7	-0.062
8	-0.06
9	-0.05
10	-0.05
11	-0.04
12	-0.04
13	-0.0375
14	-0.0366667
15	-0.0266667
16	-0.0257143
17	-0.025
18	-0.025
19	-0.0233333
20	-0.0225
21	-0.02
22	-0.016
23	-0.01375
24	-0.0133333
25	-0.012
26	-0.01
27	-0.01
28	-0.00888889
29	-0.00777778
30	-0.006
31	-0.00571429
32	-0.005
33	-0.005
34	-0.00375
35	-0.0025
36	-0.00166667
37	0.00166667
38	0.002
39	0.00428571
40	0.005
41	0.01
42	0.016
43	0.0166667
44	0.0175
45	0.02
46	0.02
47	0.038
48	0.04
49	0.055
50	0.06
51	0.06
52	0.065
53	0.0666667
54	0.07
55	0.28

Sen's Estimator (Median Q) is -0.00888889

Time Period	Observations
8/12/2015	1
10/19/2015	1
11/20/2015	1
1/5/2016	1
2/17/2016	1

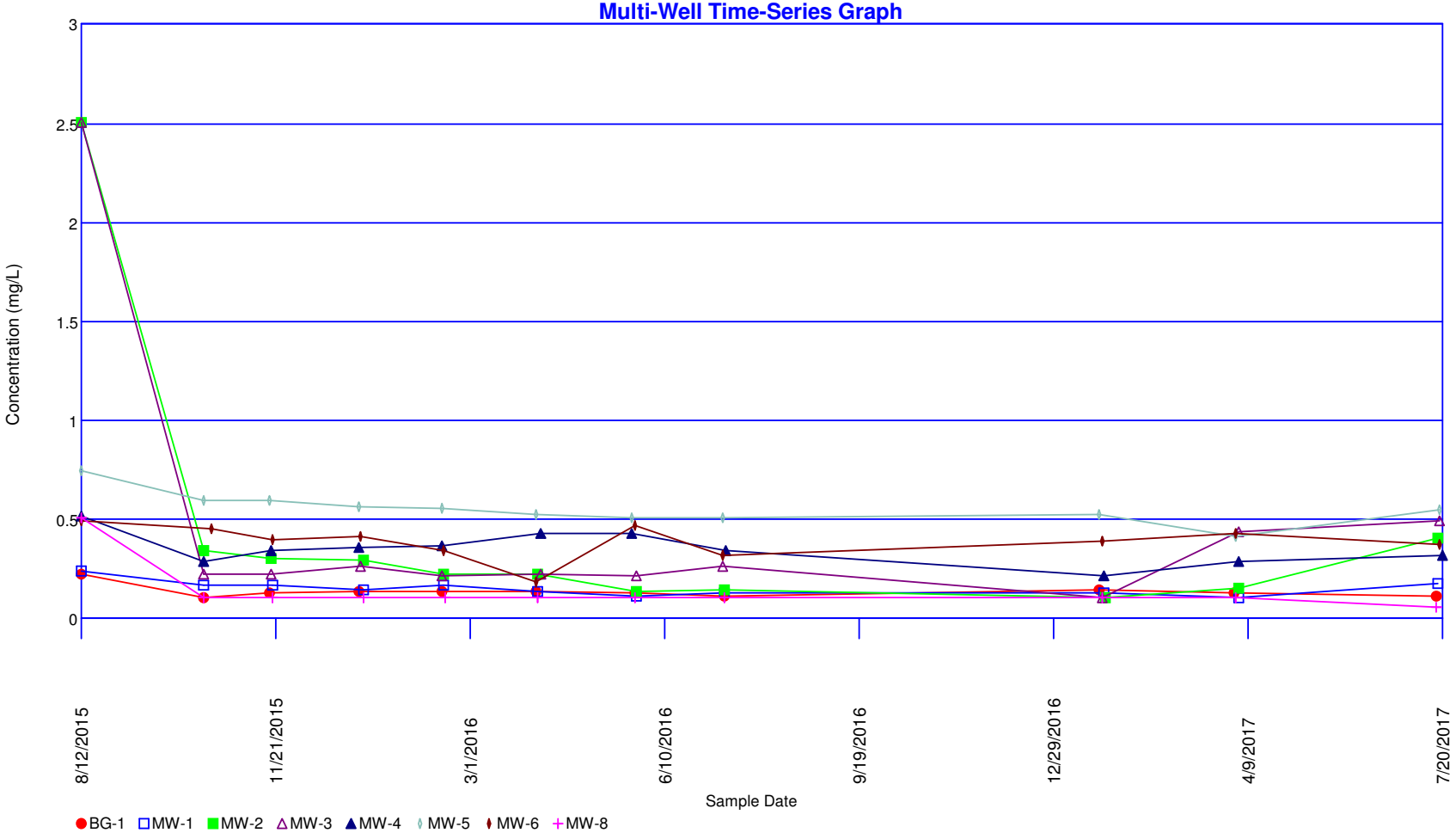
4/5/2016	1
5/26/2016	1
7/11/2016	1
1/24/2017	1
4/4/2017	1
7/19/2017	1

There are 0 time periods with multiple data

A = 0
B = 0
C = 0
D = 0
E = 0
F = 0
a = 2970
b = 8910
c = 220
Group Variance = 165
For 90% confidence interval (two-tailed), Z at (1-0.9)/2 = 1.64485
C = 21.1285
M1 = (55 - 21.1285)/2.0 = 16.9357
M2 = (55 + 21.1285)/2.0 + 1 = 39.0643
Lower limit is -0.025 = Q(17)
Upper limit is 0.00428571 = Q(39)
-0.025 < 0 < 0.00428571 indicating no trend in data.

Fluoride

Multi-Well Time-Series Graph



Concentrations (ug/L)

Parameter: Lithium

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

Total Measurements: 80
Total Non-Detect: 1
Percent Non-Detects: 1.25%
Total Background Measurements: 10
There is 1 background location

Loc.	Meas.	ND	Date	Conc.	Original
BG-1	10	0 (0%)	10/15/2015	14.9	14.9
			11/18/2015	12.1	12.1
			1/4/2016	15	15
			2/16/2016	17.1	17.1
			4/5/2016	36.8	36.8
			5/26/2016	23.5	23.5
			7/12/2016	23.8	23.8
			1/23/2017	24.5	24.5
			4/3/2017	25.7	25.7
			7/17/2017	19.8	19.8

There are 7 compliance locations

Loc.	Meas.	ND	Date	Conc.	Original
MW-1	10	0 (0%)	10/15/2015	20.9	20.9
			11/20/2015	23.7	23.7
			1/6/2016	30.1	30.1
			2/17/2016	19.2	19.2
			4/6/2016	28.4	28.4
			5/27/2016	27.5	27.5
			7/12/2016	32.8	32.8
			1/25/2017	31.2	31.2
			4/5/2017	33	33
			7/18/2017	36.1	36.1
MW-2	10	0 (0%)	10/15/2015	34	34
			11/19/2015	53.1	53.1
			1/6/2016	144	144
			2/17/2016	88.4	88.4
			4/6/2016	117	117
			5/27/2016	350	350
			7/12/2016	356	356
			1/26/2017	195	195
			4/5/2017	165	165
			7/18/2017	154	154
MW-3	10	0 (0%)	10/15/2015	70.4	70.4
			11/19/2015	128	128
			1/5/2016	65.4	65.4
			2/16/2016	75.5	75.5
			4/7/2016	217	217
			5/27/2016	102	102
			7/11/2016	73.2	73.2
			1/24/2017	103	103
			4/5/2017	129	129
			7/19/2017	97.1	97.1
MW-4	10	1 (10%)	10/15/2015	20.1	20.1
			11/19/2015	20	20
			1/4/2016	23.2	23.2
			2/16/2016	22.8	22.8
			4/7/2016	18.3	18.3
			5/25/2016	15.8	15.8
			7/13/2016	ND<0.5 U	ND<0.5 U
			1/25/2017	28.3	28.3
			4/5/2017	28.3	28.3
			7/20/2017	27.7	27.7

MW-5	10	0 (0%)	10/15/2015	7.5	7.5
			11/18/2015	7.4	7.4
			1/4/2016	6.4	6.4
			2/16/2016	6.3	6.3
			4/5/2016	9.7	9.7
			5/25/2016	8.9	8.9
			7/11/2016	9.3	9.3
			1/23/2017	9.4	9.4
			4/4/2017	8.6	8.6
			7/19/2017	9.3	9.3
MW-6	10	0 (0%)	10/19/2015	43.1	43.1
			11/20/2015	60.5	60.5
			1/5/2016	55.8	55.8
			2/17/2016	37.1	37.1
			4/5/2016	41.2	41.2
			5/26/2016	30.6	30.6
			7/11/2016	31.7	31.7
			1/24/2017	48.5	48.5
			4/4/2017	48.9	48.9
			7/19/2017	45.3	45.3
MW-8	10	0 (0%)	10/15/2015	27.4	27.4
			11/20/2015	50.1	50.1
			1/6/2016	39.6	39.6
			2/18/2016	33.4	33.4
			4/6/2016	37.6	37.6
			5/26/2016	29.7	29.7
			7/12/2016	31.2	31.2
			1/24/2017	38.3	38.3
			4/4/2017	25.3	25.3
			7/17/2017	27.7	27.7

There are 0 unused locations

Loc.	Meas.	ND	Date	Conc.	Original

Rosner's Test for Outliers

Parameter: Lithium

All Locations

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

Data set mean = 53.55

10 most extreme of 80 measurements

by order of magnitude difference from the mean

1	7/12/2016	MW-2	356	302.45
2	5/27/2016	MW-2	350	296.45
3	4/7/2016	MW-3	217	163.45
4	1/26/2017	MW-2	195	141.45
5	4/5/2017	MW-2	165	111.45
6	7/18/2017	MW-2	154	100.45
7	1/6/2016	MW-2	144	90.45
8	4/5/2017	MW-3	129	75.45
9	11/19/2015	MW-3	128	74.45
10	4/6/2016	MW-2	117	63.45

Iteration i = 9

Mean of 71 measurements = 34.4507
Std Dev = 24.8657
x(i+1) = 117 from measurement 4/6/2016 from location MW-2
Rosner Statistic R = |117 - 34.4507|/24.8657 = 3.3198
Lambda(80, 10, 0.05) = 3.26
3.3198 > 3.26 -- Measurement 4/6/2016 for location MW-2 is an outlier

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Iteration i = 8

Mean of 72 measurements = 35.75
Std Dev = 27.0397
x(i+1) = 128 from measurement 11/19/2015 from location MW-3
Rosner Statistic R = |128 - 35.75|/27.0397 = 3.41165
Lambda(80, 9, 0.05) = 3.266
Measurement 11/19/2015 for location MW-3 is an outlier

Iteration i = 7

Mean of 73 measurements = 37.0274
Std Dev = 28.9846
x(i+1) = 129 from measurement 4/5/2017 from location MW-3
Rosner Statistic R = |129 - 37.0274|/28.9846 = 3.17315
Lambda(80, 8, 0.05) = 3.272
Measurement 4/5/2017 for location MW-3 is an outlier

Iteration i = 6

Mean of 74 measurements = 38.473
Std Dev = 31.3566
x(i+1) = 144 from measurement 1/6/2016 from location MW-2
Rosner Statistic R = |144 - 38.473|/31.3566 = 3.36539
Lambda(80, 7, 0.05) = 3.278
Measurement 1/6/2016 for location MW-2 is an outlier

Iteration i = 5

Mean of 75 measurements = 40.0133
Std Dev = 33.8807
x(i+1) = 154 from measurement 7/18/2017 from location MW-2
Rosner Statistic R = |154 - 40.0133|/33.8807 = 3.36435
Lambda(80, 6, 0.05) = 3.284
Measurement 7/18/2017 for location MW-2 is an outlier

Iteration i = 4

Mean of 76 measurements = 41.6579
Std Dev = 36.5807
x(i+1) = 165 from measurement 4/5/2017 from location MW-2

Rosner Statistic R = |165 - 41.6579|/36.5807 = 3.37178
Lambda(80, 5, 0.05) = 3.29
Measurement 4/5/2017 for location MW-2 is an outlier

Iteration i = 3
Mean of 77 measurements = 43.6494
Std Dev = 40.3226
x(i+1) = 195 from measurement 1/26/2017 from location MW-2
Rosner Statistic R = |195 - 43.6494|/40.3226 = 3.75349
Lambda(80, 4, 0.05) = 3.29
Measurement 1/26/2017 for location MW-2 is an outlier

Iteration i = 2
Mean of 78 measurements = 45.8718
Std Dev = 44.6101
x(i+1) = 217 from measurement 4/7/2016 from location MW-3
Rosner Statistic R = |217 - 45.8718|/44.6101 = 3.83609
Lambda(80, 3, 0.05) = 3.3
Measurement 4/7/2016 for location MW-3 is an outlier

Iteration i = 1
Mean of 79 measurements = 49.7215
Std Dev = 55.9942
x(i+1) = 350 from measurement 5/27/2016 from location MW-2
Rosner Statistic R = |350 - 49.7215|/55.9942 = 5.36267
Lambda(80, 2, 0.05) = 3.3
Measurement 5/27/2016 for location MW-2 is an outlier

Iteration i = 0
Mean of 80 measurements = 53.55
Std Dev = 65.3318
x(i+1) = 356 from measurement 7/12/2016 from location MW-2
Rosner Statistic R = |356 - 53.55|/65.3318 = 4.62944
Lambda(80, 1, 0.05) = 3.31
Measurement 7/12/2016 for location MW-2 is an outlier

Shapiro-Wilks Test of Normality

Parameter: Lithium
All Locations
Normality Test of Parameter Concentrations
Original Data (Not Transformed)
Non-Detects Replaced with Detection Limit
K = 5 for 10 measurements

i	x(i)	x(n-i+1)	x(n-1+1)-x(i)	a(n-i+1)	b(i)
1	12.1	36.8	24.7	0.5739	14.1753
2	14.9	25.7	10.8	0.3291	3.55428
3	15	24.5	9.5	0.2141	2.03395
4	17.1	23.8	6.7	0.1224	0.82008
5	19.8	23.5	3.7	0.0399	0.14763
6	23.5	19.8	-3.7		
7	23.8	17.1	-6.7		
8	24.5	15	-9.5		
9	25.7	14.9	-10.8		
10	36.8	12.1	-24.7		

Sum of b values = 20.7313
Sample Standard Deviation = 7.19657
W Statistic = 0.922057

5% Critical value of 0.842 is less than 0.922057
Data is normally distributed at 95% level of significance

1% Critical value of 0.781 is less than 0.922057
Data is normally distributed at 99% level of significance

Parametric Prediction Interval Analysis

Inter-Well Comparison

Parameter: Lithium

Original Data (Not Transformed)

Non-Detects Replaced with 1/2 DL

Inter-Well Unified Guid. Formula 95% One-Sided Comparison

Background Samples = 10
Background Mean = 21.32
Background Std Dev = 7.19657

Number of comparisons = 7
Future Samples (k) = 7
Actual confidence level is 1.0 - (0.05/7) = 99.2857 %
t is Percentile of Student's T-Test (0.95/7) = 0.992857
Degrees of Freedom = 10 (background observations) - 1
t(0.992857, 10) = 3.06624

Well MW-1

Date	Samples	Mean	Interval	Significant
7/18/2017	1	36.1	[0, 44.4635]	FALSE

Well MW-2

Date	Samples	Mean	Interval	Significant
7/18/2017	**1**	**154**	**[0, 44.4635]**	**TRUE**

Well MW-3

Date	Samples	Mean	Interval	Significant
7/19/2017	**1**	**97.1**	**[0, 44.4635]**	**TRUE**

Well MW-4

Date	Samples	Mean	Interval	Significant
7/20/2017	1	27.7	[0, 44.4635]	FALSE

Well MW-5

Date	Samples	Mean	Interval	Significant
7/19/2017	1	9.3	[0, 44.4635]	FALSE

Well MW-6

Date	Samples	Mean	Interval	Significant
7/19/2017	**1**	**45.3**	**[0, 44.4635]**	**TRUE**

Well MW-8

Date	Samples	Mean	Interval	Significant
7/17/2017	1	27.7	[0, 44.4635]	FALSE

Sen's Slope Analysis

Parameter: Lithium

Location: MW-2

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

90% Confidence Level

Xj	Xk	(Xj - Xk)/(j-k)	Q
53.1 (11/19/2015)	34 (10/15/2015)	(53.1 - 34)/(2 - 1)	19.1
144 (1/6/2016)	34 (10/15/2015)	(144 - 34)/(3 - 1)	55
88.4 (2/17/2016)	34 (10/15/2015)	(88.4 - 34)/(4 - 1)	18.1333
117 (4/6/2016)	34 (10/15/2015)	(117 - 34)/(5 - 1)	20.75
350 (5/27/2016)	34 (10/15/2015)	(350 - 34)/(6 - 1)	63.2
356 (7/12/2016)	34 (10/15/2015)	(356 - 34)/(7 - 1)	53.6667
195 (1/26/2017)	34 (10/15/2015)	(195 - 34)/(8 - 1)	23
165 (4/5/2017)	34 (10/15/2015)	(165 - 34)/(9 - 1)	16.375
154 (7/18/2017)	34 (10/15/2015)	(154 - 34)/(10 - 1)	13.3333
144 (1/6/2016)	53.1 (11/19/2015)	(144 - 53.1)/(3 - 2)	90.9
88.4 (2/17/2016)	53.1 (11/19/2015)	(88.4 - 53.1)/(4 - 2)	17.65
117 (4/6/2016)	53.1 (11/19/2015)	(117 - 53.1)/(5 - 2)	21.3
350 (5/27/2016)	53.1 (11/19/2015)	(350 - 53.1)/(6 - 2)	74.225
356 (7/12/2016)	53.1 (11/19/2015)	(356 - 53.1)/(7 - 2)	60.58
195 (1/26/2017)	53.1 (11/19/2015)	(195 - 53.1)/(8 - 2)	23.65
165 (4/5/2017)	53.1 (11/19/2015)	(165 - 53.1)/(9 - 2)	15.9857
154 (7/18/2017)	53.1 (11/19/2015)	(154 - 53.1)/(10 - 2)	12.6125
88.4 (2/17/2016)	144 (1/6/2016)	(88.4 - 144)/(4 - 3)	-55.6
117 (4/6/2016)	144 (1/6/2016)	(117 - 144)/(5 - 3)	-13.5
350 (5/27/2016)	144 (1/6/2016)	(350 - 144)/(6 - 3)	68.6667
356 (7/12/2016)	144 (1/6/2016)	(356 - 144)/(7 - 3)	53
195 (1/26/2017)	144 (1/6/2016)	(195 - 144)/(8 - 3)	10.2
165 (4/5/2017)	144 (1/6/2016)	(165 - 144)/(9 - 3)	3.5
154 (7/18/2017)	144 (1/6/2016)	(154 - 144)/(10 - 3)	1.42857
117 (4/6/2016)	88.4 (2/17/2016)	(117 - 88.4)/(5 - 4)	28.6
350 (5/27/2016)	88.4 (2/17/2016)	(350 - 88.4)/(6 - 4)	130.8
356 (7/12/2016)	88.4 (2/17/2016)	(356 - 88.4)/(7 - 4)	89.2
195 (1/26/2017)	88.4 (2/17/2016)	(195 - 88.4)/(8 - 4)	26.65
165 (4/5/2017)	88.4 (2/17/2016)	(165 - 88.4)/(9 - 4)	15.32
154 (7/18/2017)	88.4 (2/17/2016)	(154 - 88.4)/(10 - 4)	10.9333
350 (5/27/2016)	117 (4/6/2016)	(350 - 117)/(6 - 5)	233
356 (7/12/2016)	117 (4/6/2016)	(356 - 117)/(7 - 5)	119.5
195 (1/26/2017)	117 (4/6/2016)	(195 - 117)/(8 - 5)	26
165 (4/5/2017)	117 (4/6/2016)	(165 - 117)/(9 - 5)	12
154 (7/18/2017)	117 (4/6/2016)	(154 - 117)/(10 - 5)	7.4
356 (7/12/2016)	350 (5/27/2016)	(356 - 350)/(7 - 6)	6
195 (1/26/2017)	350 (5/27/2016)	(195 - 350)/(8 - 6)	-77.5
165 (4/5/2017)	350 (5/27/2016)	(165 - 350)/(9 - 6)	-61.6667
154 (7/18/2017)	350 (5/27/2016)	(154 - 350)/(10 - 6)	-49
195 (1/26/2017)	356 (7/12/2016)	(195 - 356)/(8 - 7)	-161
165 (4/5/2017)	356 (7/12/2016)	(165 - 356)/(9 - 7)	-95.5
154 (7/18/2017)	356 (7/12/2016)	(154 - 356)/(10 - 7)	-67.3333
165 (4/5/2017)	195 (1/26/2017)	(165 - 195)/(9 - 8)	-30
154 (7/18/2017)	195 (1/26/2017)	(154 - 195)/(10 - 8)	-20.5
154 (7/18/2017)	165 (4/5/2017)	(154 - 165)/(10 - 9)	-11

Number of Q values = 45

Ordered Q Values

n	Q
1	-161
2	-95.5
3	-77.5

4	-67.3333
5	-61.6667
6	-55.6
7	-49
8	-30
9	-20.5
10	-13.5
11	-11
12	1.42857
13	3.5
14	6
15	7.4
16	10.2
17	10.9333
18	12
19	12.6125
20	13.3333
21	15.32
22	15.9857
23	16.375
24	17.65
25	18.1333
26	19.1
27	20.75
28	21.3
29	23
30	23.65
31	26
32	26.65
33	28.6
34	53
35	53.6667
36	55
37	60.58
38	63.2
39	68.6667
40	74.225
41	89.2
42	90.9
43	119.5
44	130.8
45	233

Sen's Estimator (Median Q) is 16.375

Time Period	Observations
10/15/2015	1
11/19/2015	1
1/6/2016	1
2/17/2016	1
4/6/2016	1
5/27/2016	1
7/12/2016	1
1/26/2017	1
4/5/2017	1
7/18/2017	1

There are 0 time periods with multiple data

A = 0
B = 0
C = 0
D = 0
E = 0
F = 0
a = 2250
b = 6480
c = 180
Group Variance = 125
For 90% confidence interval (two-tailed), Z at (1-0.9)/2 = 1.64485
C = 18.39
M1 = (45 - 18.39)/2.0 = 13.305
M2 = (45 + 18.39)/2.0 + 1 = 32.695

Lower limit is 3.5 = Q(13)
Upper limit is 28.6 = Q(33)
3.5 > 0 indicating an upward trend in data.

Sen's Slope Analysis

Parameter: Lithium

Location: MW-3

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

90% Confidence Level

Xj	Xk	(Xj - Xk)/(j-k)	Q
128 (11/19/2015)	70.4 (10/15/2015)	(128 - 70.4)/(2 - 1)	57.6
65.4 (1/5/2016)	70.4 (10/15/2015)	(65.4 - 70.4)/(3 - 1)	-2.5
75.5 (2/16/2016)	70.4 (10/15/2015)	(75.5 - 70.4)/(4 - 1)	1.7
217 (4/7/2016)	70.4 (10/15/2015)	(217 - 70.4)/(5 - 1)	36.65
102 (5/27/2016)	70.4 (10/15/2015)	(102 - 70.4)/(6 - 1)	6.32
73.2 (7/11/2016)	70.4 (10/15/2015)	(73.2 - 70.4)/(7 - 1)	0.466667
103 (1/24/2017)	70.4 (10/15/2015)	(103 - 70.4)/(8 - 1)	4.65714
129 (4/5/2017)	70.4 (10/15/2015)	(129 - 70.4)/(9 - 1)	7.325
97.1 (7/19/2017)	70.4 (10/15/2015)	(97.1 - 70.4)/(10 - 1)	2.96667
65.4 (1/5/2016)	128 (11/19/2015)	(65.4 - 128)/(3 - 2)	-62.6
75.5 (2/16/2016)	128 (11/19/2015)	(75.5 - 128)/(4 - 2)	-26.25
217 (4/7/2016)	128 (11/19/2015)	(217 - 128)/(5 - 2)	29.6667
102 (5/27/2016)	128 (11/19/2015)	(102 - 128)/(6 - 2)	-6.5
73.2 (7/11/2016)	128 (11/19/2015)	(73.2 - 128)/(7 - 2)	-10.96
103 (1/24/2017)	128 (11/19/2015)	(103 - 128)/(8 - 2)	-4.16667
129 (4/5/2017)	128 (11/19/2015)	(129 - 128)/(9 - 2)	0.142857
97.1 (7/19/2017)	128 (11/19/2015)	(97.1 - 128)/(10 - 2)	-3.8625
75.5 (2/16/2016)	65.4 (1/5/2016)	(75.5 - 65.4)/(4 - 3)	10.1
217 (4/7/2016)	65.4 (1/5/2016)	(217 - 65.4)/(5 - 3)	75.8
102 (5/27/2016)	65.4 (1/5/2016)	(102 - 65.4)/(6 - 3)	12.2
73.2 (7/11/2016)	65.4 (1/5/2016)	(73.2 - 65.4)/(7 - 3)	1.95
103 (1/24/2017)	65.4 (1/5/2016)	(103 - 65.4)/(8 - 3)	7.52
129 (4/5/2017)	65.4 (1/5/2016)	(129 - 65.4)/(9 - 3)	10.6
97.1 (7/19/2017)	65.4 (1/5/2016)	(97.1 - 65.4)/(10 - 3)	4.52857
217 (4/7/2016)	75.5 (2/16/2016)	(217 - 75.5)/(5 - 4)	141.5
102 (5/27/2016)	75.5 (2/16/2016)	(102 - 75.5)/(6 - 4)	13.25
73.2 (7/11/2016)	75.5 (2/16/2016)	(73.2 - 75.5)/(7 - 4)	-0.766667
103 (1/24/2017)	75.5 (2/16/2016)	(103 - 75.5)/(8 - 4)	6.875
129 (4/5/2017)	75.5 (2/16/2016)	(129 - 75.5)/(9 - 4)	10.7
97.1 (7/19/2017)	75.5 (2/16/2016)	(97.1 - 75.5)/(10 - 4)	3.6
102 (5/27/2016)	217 (4/7/2016)	(102 - 217)/(6 - 5)	-115
73.2 (7/11/2016)	217 (4/7/2016)	(73.2 - 217)/(7 - 5)	-71.9
103 (1/24/2017)	217 (4/7/2016)	(103 - 217)/(8 - 5)	-38
129 (4/5/2017)	217 (4/7/2016)	(129 - 217)/(9 - 5)	-22
97.1 (7/19/2017)	217 (4/7/2016)	(97.1 - 217)/(10 - 5)	-23.98
73.2 (7/11/2016)	102 (5/27/2016)	(73.2 - 102)/(7 - 6)	-28.8
103 (1/24/2017)	102 (5/27/2016)	(103 - 102)/(8 - 6)	0.5
129 (4/5/2017)	102 (5/27/2016)	(129 - 102)/(9 - 6)	9
97.1 (7/19/2017)	102 (5/27/2016)	(97.1 - 102)/(10 - 6)	-1.225
103 (1/24/2017)	73.2 (7/11/2016)	(103 - 73.2)/(8 - 7)	29.8
129 (4/5/2017)	73.2 (7/11/2016)	(129 - 73.2)/(9 - 7)	27.9
97.1 (7/19/2017)	73.2 (7/11/2016)	(97.1 - 73.2)/(10 - 7)	7.96667
129 (4/5/2017)	103 (1/24/2017)	(129 - 103)/(9 - 8)	26
97.1 (7/19/2017)	103 (1/24/2017)	(97.1 - 103)/(10 - 8)	-2.95
97.1 (7/19/2017)	129 (4/5/2017)	(97.1 - 129)/(10 - 9)	-31.9

Number of Q values = 45

Ordered Q Values

n	Q
1	-115
2	-71.9
3	-62.6

4	-38
5	-31.9
6	-28.8
7	-26.25
8	-23.98
9	-22
10	-10.96
11	-6.5
12	-4.16667
13	-3.8625
14	-2.95
15	-2.5
16	-1.225
17	-0.766667
18	0.142857
19	0.466667
20	0.5
21	1.7
22	1.95
23	2.96667
24	3.6
25	4.52857
26	4.65714
27	6.32
28	6.875
29	7.325
30	7.52
31	7.96667
32	9
33	10.1
34	10.6
35	10.7
36	12.2
37	13.25
38	26
39	27.9
40	29.6667
41	29.8
42	36.65
43	57.6
44	75.8
45	141.5

Sen's Estimator (Median Q) is 2.96667

Time Period	Observations
10/15/2015	1
11/19/2015	1
1/5/2016	1
2/16/2016	1
4/7/2016	1
5/27/2016	1
7/11/2016	1
1/24/2017	1
4/5/2017	1
7/19/2017	1

There are 0 time periods with multiple data

A = 0
B = 0
C = 0
D = 0
E = 0
F = 0
a = 2250
b = 6480
c = 180
Group Variance = 125
For 90% confidence interval (two-tailed), Z at (1-0.9)/2 = 1.64485
C = 18.39
M1 = (45 - 18.39)/2.0 = 13.305
M2 = (45 + 18.39)/2.0 + 1 = 32.695

Lower limit is -3.8625 = Q(13)
Upper limit is 10.1 = Q(33)
-3.8625 < 0 < 10.1 indicating no trend in data.

Sen's Slope Analysis

Parameter: Lithium
Location: MW-6
Original Data (Not Transformed)
Non-Detects Replaced with Detection Limit

90% Confidence Level

Xj	Xk	(Xj - Xk)/(j-k)	Q
60.5 (11/20/2015)	43.1 (10/19/2015)	(60.5 - 43.1)/(2 - 1)	17.4
55.8 (1/5/2016)	43.1 (10/19/2015)	(55.8 - 43.1)/(3 - 1)	6.35
37.1 (2/17/2016)	43.1 (10/19/2015)	(37.1 - 43.1)/(4 - 1)	-2
41.2 (4/5/2016)	43.1 (10/19/2015)	(41.2 - 43.1)/(5 - 1)	-0.475
30.6 (5/26/2016)	43.1 (10/19/2015)	(30.6 - 43.1)/(6 - 1)	-2.5
31.7 (7/11/2016)	43.1 (10/19/2015)	(31.7 - 43.1)/(7 - 1)	-1.9
48.5 (1/24/2017)	43.1 (10/19/2015)	(48.5 - 43.1)/(8 - 1)	0.771429
48.9 (4/4/2017)	43.1 (10/19/2015)	(48.9 - 43.1)/(9 - 1)	0.725
45.3 (7/19/2017)	43.1 (10/19/2015)	(45.3 - 43.1)/(10 - 1)	0.244444
55.8 (1/5/2016)	60.5 (11/20/2015)	(55.8 - 60.5)/(3 - 2)	-4.7
37.1 (2/17/2016)	60.5 (11/20/2015)	(37.1 - 60.5)/(4 - 2)	-11.7
41.2 (4/5/2016)	60.5 (11/20/2015)	(41.2 - 60.5)/(5 - 2)	-6.43333
30.6 (5/26/2016)	60.5 (11/20/2015)	(30.6 - 60.5)/(6 - 2)	-7.475
31.7 (7/11/2016)	60.5 (11/20/2015)	(31.7 - 60.5)/(7 - 2)	-5.76
48.5 (1/24/2017)	60.5 (11/20/2015)	(48.5 - 60.5)/(8 - 2)	-2
48.9 (4/4/2017)	60.5 (11/20/2015)	(48.9 - 60.5)/(9 - 2)	-1.65714
45.3 (7/19/2017)	60.5 (11/20/2015)	(45.3 - 60.5)/(10 - 2)	-1.9
37.1 (2/17/2016)	55.8 (1/5/2016)	(37.1 - 55.8)/(4 - 3)	-18.7
41.2 (4/5/2016)	55.8 (1/5/2016)	(41.2 - 55.8)/(5 - 3)	-7.3
30.6 (5/26/2016)	55.8 (1/5/2016)	(30.6 - 55.8)/(6 - 3)	-8.4
31.7 (7/11/2016)	55.8 (1/5/2016)	(31.7 - 55.8)/(7 - 3)	-6.025
48.5 (1/24/2017)	55.8 (1/5/2016)	(48.5 - 55.8)/(8 - 3)	-1.46
48.9 (4/4/2017)	55.8 (1/5/2016)	(48.9 - 55.8)/(9 - 3)	-1.15
45.3 (7/19/2017)	55.8 (1/5/2016)	(45.3 - 55.8)/(10 - 3)	-1.5
41.2 (4/5/2016)	37.1 (2/17/2016)	(41.2 - 37.1)/(5 - 4)	4.1
30.6 (5/26/2016)	37.1 (2/17/2016)	(30.6 - 37.1)/(6 - 4)	-3.25
31.7 (7/11/2016)	37.1 (2/17/2016)	(31.7 - 37.1)/(7 - 4)	-1.8
48.5 (1/24/2017)	37.1 (2/17/2016)	(48.5 - 37.1)/(8 - 4)	2.85
48.9 (4/4/2017)	37.1 (2/17/2016)	(48.9 - 37.1)/(9 - 4)	2.36
45.3 (7/19/2017)	37.1 (2/17/2016)	(45.3 - 37.1)/(10 - 4)	1.36667
30.6 (5/26/2016)	41.2 (4/5/2016)	(30.6 - 41.2)/(6 - 5)	-10.6
31.7 (7/11/2016)	41.2 (4/5/2016)	(31.7 - 41.2)/(7 - 5)	-4.75
48.5 (1/24/2017)	41.2 (4/5/2016)	(48.5 - 41.2)/(8 - 5)	2.43333
48.9 (4/4/2017)	41.2 (4/5/2016)	(48.9 - 41.2)/(9 - 5)	1.925
45.3 (7/19/2017)	41.2 (4/5/2016)	(45.3 - 41.2)/(10 - 5)	0.82
31.7 (7/11/2016)	30.6 (5/26/2016)	(31.7 - 30.6)/(7 - 6)	1.1
48.5 (1/24/2017)	30.6 (5/26/2016)	(48.5 - 30.6)/(8 - 6)	8.95
48.9 (4/4/2017)	30.6 (5/26/2016)	(48.9 - 30.6)/(9 - 6)	6.1
45.3 (7/19/2017)	30.6 (5/26/2016)	(45.3 - 30.6)/(10 - 6)	3.675
48.5 (1/24/2017)	31.7 (7/11/2016)	(48.5 - 31.7)/(8 - 7)	16.8
48.9 (4/4/2017)	31.7 (7/11/2016)	(48.9 - 31.7)/(9 - 7)	8.6
45.3 (7/19/2017)	31.7 (7/11/2016)	(45.3 - 31.7)/(10 - 7)	4.53333
48.9 (4/4/2017)	48.5 (1/24/2017)	(48.9 - 48.5)/(9 - 8)	0.4
45.3 (7/19/2017)	48.5 (1/24/2017)	(45.3 - 48.5)/(10 - 8)	-1.6
45.3 (7/19/2017)	48.9 (4/4/2017)	(45.3 - 48.9)/(10 - 9)	-3.6

Number of Q values = 45

Ordered Q Values

n	Q
1	-18.7
2	-11.7
3	-10.6

4	-8.4
5	-7.475
6	-7.3
7	-6.43333
8	-6.025
9	-5.76
10	-4.75
11	-4.7
12	-3.6
13	-3.25
14	-2.5
15	-2
16	-2
17	-1.9
18	-1.9
19	-1.8
20	-1.65714
21	-1.6
22	-1.5
23	-1.46
24	-1.15
25	-0.475
26	0.244444
27	0.4
28	0.725
29	0.771429
30	0.82
31	1.1
32	1.36667
33	1.925
34	2.36
35	2.43333
36	2.85
37	3.675
38	4.1
39	4.53333
40	6.1
41	6.35
42	8.6
43	8.95
44	16.8
45	17.4

Sen's Estimator (Median Q) is -1.46

Time Period	Observations
10/19/2015	1
11/20/2015	1
1/5/2016	1
2/17/2016	1
4/5/2016	1
5/26/2016	1
7/11/2016	1
1/24/2017	1
4/4/2017	1
7/19/2017	1

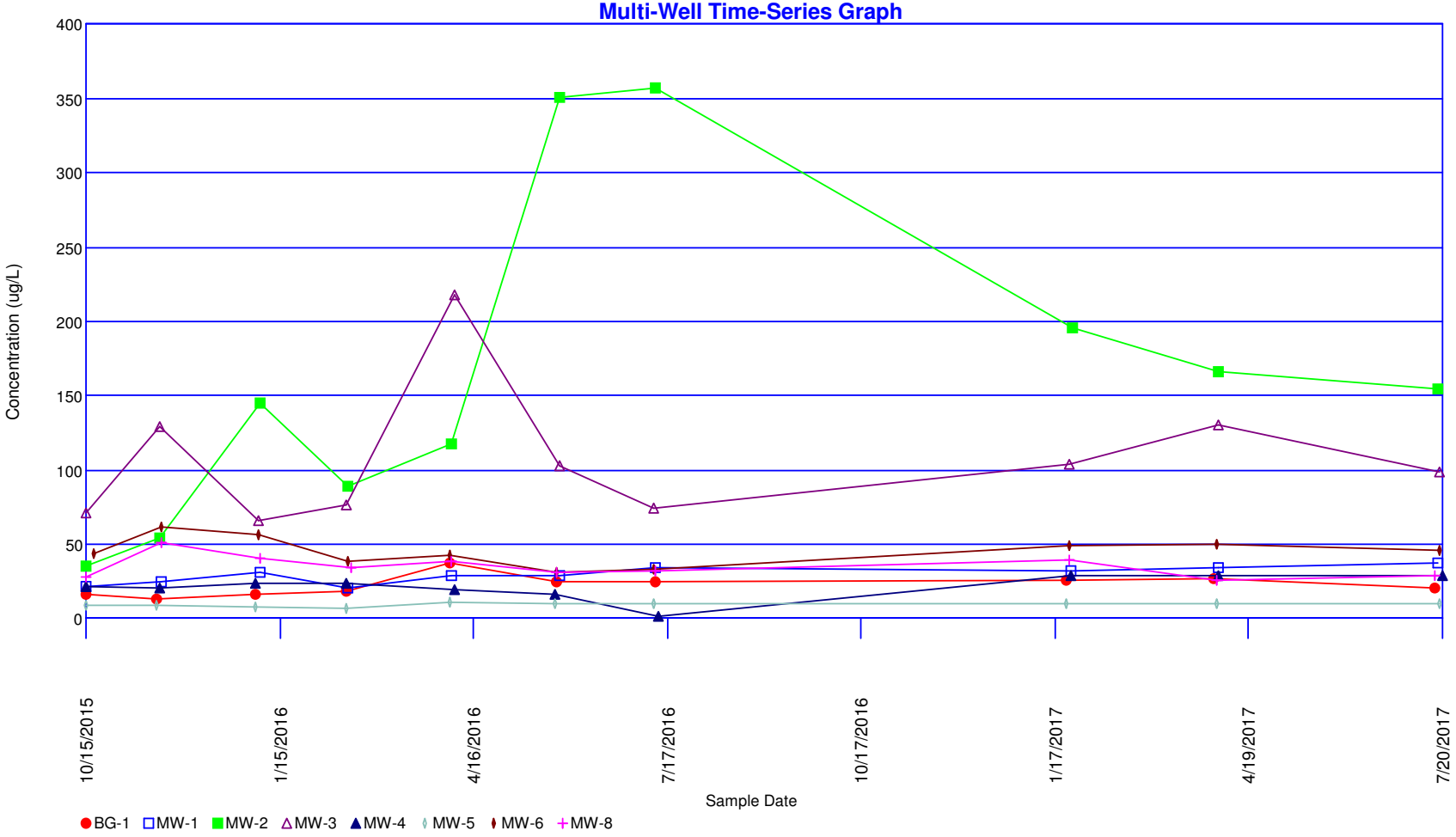
There are 0 time periods with multiple data

A = 0
B = 0
C = 0
D = 0
E = 0
F = 0
a = 2250
b = 6480
c = 180
Group Variance = 125
For 90% confidence interval (two-tailed), Z at (1-0.9)/2 = 1.64485
C = 18.39
M1 = (45 - 18.39)/2.0 = 13.305
M2 = (45 + 18.39)/2.0 + 1 = 32.695

Lower limit is -3.25 = Q(13)
Upper limit is 1.925 = Q(33)
-3.25 < 0 < 1.925 indicating no trend in data.

Lithium

Multi-Well Time-Series Graph



Concentrations (ug/L)

Parameter: Molybdenum

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

Total Measurements: 88
Total Non-Detect: 57
Percent Non-Detects: 64.7727%
Total Background Measurements: 11
There is 1 background location

Loc.	Meas.	ND	Date	Conc.	Original
BG-1	11	9 (81.8182%)	8/12/2015	0.55 J	0.55 J
			10/15/2015	ND<5 U	ND<5 U
			11/18/2015	ND<5 U	ND<5 U
			1/4/2016	ND<5 U	ND<5 U
			2/16/2016	6.8	6.8
			4/5/2016	ND<5 U	ND<5 U
			5/26/2016	ND<5 U	ND<5 U
			7/12/2016	ND<5 U	ND<5 U
			1/23/2017	ND<5 U	ND<5 U
			4/3/2017	ND<5 U	ND<5 U
			7/17/2017	ND<2.5 U	ND<2.5 U

There are 7 compliance locations

Loc.	Meas.	ND	Date	Conc.	Original
MW-1	11	10 (90.9091%)	8/12/2015	1.3 J	1.3 J
			10/15/2015	ND<5 U	ND<5 U
			11/20/2015	ND<5 U	ND<5 U
			1/6/2016	ND<5 U	ND<5 U
			2/17/2016	ND<5 U	ND<5 U
			4/6/2016	ND<5 U	ND<5 U
			5/27/2016	ND<5 U	ND<5 U
			7/12/2016	ND<5 U	ND<5 U
			1/25/2017	ND<5 U	ND<5 U
			4/5/2017	ND<5 U	ND<5 U
			7/18/2017	ND<2.5 U	ND<2.5 U
MW-2	11	0 (0%)	8/12/2015	11	11
			10/15/2015	20.6	20.6
			11/19/2015	21.1	21.1
			1/6/2016	18.1	18.1
			2/17/2016	19.1	19.1
			4/6/2016	9.5	9.5
			5/27/2016	10.1	10.1
			7/12/2016	10.8	10.8
			1/26/2017	13.1	13.1
			4/5/2017	9.8	9.8
			7/18/2017	9.3	9.3
MW-3	11	0 (0%)	8/12/2015	21	21
			10/15/2015	10.5	10.5
			11/19/2015	10.4	10.4
			1/5/2016	10.9	10.9
			2/16/2016	13.8	13.8
			4/7/2016	8.6	8.6
			5/27/2016	10.2	10.2
			7/11/2016	12	12
			1/24/2017	7.2	7.2
			4/5/2017	8.1	8.1
			7/19/2017	6.1	6.1
MW-4	11	9 (81.8182%)	8/12/2015	1.6 J	1.6 J
			10/15/2015	ND<5 U	ND<5 U
			11/19/2015	ND<5 U	ND<5 U
			1/4/2016	ND<5 U	ND<5 U
			2/16/2016	ND<5 U	ND<5 U
			4/7/2016	ND<5 U	ND<5 U
			5/25/2016	ND<5 U	ND<5 U

			7/13/2016	ND<5 U	ND<5 U
			1/25/2017	8.9	8.9
			4/5/2017	ND<5 U	ND<5 U
			7/20/2017	ND<2.5 U	ND<2.5 U
MW-5	11	10 (90.9091%)	8/12/2015	1.6 J	1.6 J
			10/15/2015	ND<5 U	ND<5 U
			11/18/2015	ND<5 U	ND<5 U
			1/4/2016	ND<5 U	ND<5 U
			2/16/2016	ND<5 U	ND<5 U
			4/5/2016	ND<5 U	ND<5 U
			5/25/2016	ND<5 U	ND<5 U
			7/11/2016	ND<5 U	ND<5 U
			1/23/2017	ND<5 U	ND<5 U
			4/4/2017	ND<5 U	ND<5 U
			7/19/2017	ND<2.5 U	ND<2.5 U
MW-6	11	9 (81.8182%)	8/12/2015	1.4 J	1.4 J
			10/19/2015	ND<5 U	ND<5 U
			11/20/2015	ND<5 U	ND<5 U
			1/5/2016	5.4	5.4
			2/17/2016	ND<5 U	ND<5 U
			4/5/2016	ND<5 U	ND<5 U
			5/26/2016	ND<5 U	ND<5 U
			7/11/2016	ND<5 U	ND<5 U
			1/24/2017	ND<5 U	ND<5 U
			4/4/2017	ND<5 U	ND<5 U
			7/19/2017	ND<2.5 U	ND<2.5 U
MW-8	11	10 (90.9091%)	8/12/2015	ND<10 U	ND<10 U
			10/15/2015	ND<5 U	ND<5 U
			11/20/2015	ND<5 U	ND<5 U
			1/6/2016	ND<5 U	ND<5 U
			2/18/2016	5.6	5.6
			4/6/2016	ND<5 U	ND<5 U
			5/26/2016	ND<5 U	ND<5 U
			7/12/2016	ND<5 U	ND<5 U
			1/24/2017	ND<5 U	ND<5 U
			4/4/2017	ND<5 U	ND<5 U
			7/17/2017	ND<2.5 U	ND<2.5 U

There are 0 unused locations

Loc.	Meas.	ND	Date	Conc.	Original

Rosner's Test for Outliers

Parameter: Molybdenum

All Locations

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

Data set mean = 6.58466

10 most extreme of 88 measurements

by order of magnitude difference from the mean

1	11/19/2015	MW-2	21.1	14.5153
2	8/12/2015	MW-3	21	14.4153
3	10/15/2015	MW-2	20.6	14.0153
4	2/17/2016	MW-2	19.1	12.5153
5	1/6/2016	MW-2	18.1	11.5153
6	2/16/2016	MW-3	13.8	7.21534
7	1/26/2017	MW-2	13.1	6.51534
8	8/12/2015	BG-1	0.55 J	-6.03466
9	7/11/2016	MW-3	12	5.41534
10	8/12/2015	MW-1	1.3 J	-5.28466

Iteration i = 9

Mean of 79 measurements = 5.57089
Std Dev = 2.30051
x(i+1) = 1.3 from measurement 8/12/2015 from location MW-1
Rosner Statistic R = |1.3 - 5.57089|/2.30051 = 1.8565
Lambda(88, 10, 0.05) = 3.3
1.8565 < 3.3 -- No outliers detected for i = 9

Iteration i = 8

Mean of 80 measurements = 5.65125
Std Dev = 2.39625
x(i+1) = 12 from measurement 7/11/2016 from location MW-3
Rosner Statistic R = |12 - 5.65125|/2.39625 = 2.64945
Lambda(88, 9, 0.05) = 3.3044
2.64945 < 3.3044 -- No outliers detected for i = 8

Iteration i = 7

Mean of 81 measurements = 5.58827
Std Dev = 2.44776
x(i+1) = 0.55 from measurement 8/12/2015 from location BG-1
Rosner Statistic R = |0.55 - 5.58827|/2.44776 = 2.05832
Lambda(88, 8, 0.05) = 3.3088
2.05832 < 3.3088 -- No outliers detected for i = 7

Iteration i = 6

Mean of 82 measurements = 5.67988
Std Dev = 2.57015
x(i+1) = 13.1 from measurement 1/26/2017 from location MW-2
Rosner Statistic R = |13.1 - 5.67988|/2.57015 = 2.88704
Lambda(88, 7, 0.05) = 3.3132
2.88704 < 3.3132 -- No outliers detected for i = 6

Iteration i = 5

Mean of 83 measurements = 5.77771
Std Dev = 2.70546
x(i+1) = 13.8 from measurement 2/16/2016 from location MW-3
Rosner Statistic R = |13.8 - 5.77771|/2.70546 = 2.96522
Lambda(88, 6, 0.05) = 3.3176
2.96522 < 3.3176 -- No outliers detected for i = 5

Iteration i = 4

Mean of 84 measurements = 5.9244
Std Dev = 3.00648
x(i+1) = 18.1 from measurement 1/6/2016 from location MW-2

Rosner Statistic R = |18.1 - 5.9244|/3.00648 = 4.04978
Lambda(88, 5, 0.05) = 3.322
4.04978 > 3.322 -- Measurement 1/6/2016 for location MW-2 is an outlier

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Iteration i = 3

Mean of 85 measurements = 6.07941
Std Dev = 3.31265
x(i+1) = 19.1 from measurement 2/17/2016 from location MW-2
Rosner Statistic R = |19.1 - 6.07941|/3.31265 = 3.93057
Lambda(88, 4, 0.05) = 3.33
Measurement 2/17/2016 for location MW-2 is an outlier

Iteration i = 2

Mean of 86 measurements = 6.24826
Std Dev = 3.6464
x(i+1) = 20.6 from measurement 10/15/2015 from location MW-2
Rosner Statistic R = |20.6 - 6.24826|/3.6464 = 3.93586
Lambda(88, 3, 0.05) = 3.332
Measurement 10/15/2015 for location MW-2 is an outlier

Iteration i = 1

Mean of 87 measurements = 6.41782
Std Dev = 3.95512
x(i+1) = 21 from measurement 8/12/2015 from location MW-3
Rosner Statistic R = |21 - 6.41782|/3.95512 = 3.68691
Lambda(88, 2, 0.05) = 3.332
Measurement 8/12/2015 for location MW-3 is an outlier

Iteration i = 0

Mean of 88 measurements = 6.58466
Std Dev = 4.23235
x(i+1) = 21.1 from measurement 11/19/2015 from location MW-2
Rosner Statistic R = |21.1 - 6.58466|/4.23235 = 3.42962
Lambda(88, 1, 0.05) = 3.342
Measurement 11/19/2015 for location MW-2 is an outlier

Shapiro-Wilks Test of Normality

Parameter: Molybdenum
All Locations
Normality Test of Parameter Concentrations
Natural Logarithm Transformation
Non-Detects Replaced with Detection Limit
K = 5 for 11 measurements

i	x(i)	x(n-i+1)	x(n-1+1)-x(i)	a(n-i+1)	b(i)
1	-0.597837	1.91692	2.51476	0.5601	1.40852
2	0.916291	1.60944	0.693147	0.3315	0.229778
3	1.60944	1.60944	0	0.226	0
4	1.60944	1.60944	0	0.1429	0
5	1.60944	1.60944	0	0.0695	0
6	1.60944	1.60944	0		
7	1.60944	1.60944	0		
8	1.60944	1.60944	0		
9	1.60944	1.60944	0		
10	1.60944	0.916291	-0.693147		
11	1.91692	-0.597837	-2.51476		

Sum of b values = 1.6383
Sample Standard Deviation = 0.695403
W Statistic = 0.555023

5% Critical value of 0.85 exceeds 0.555023
Evidence of non-normality at 95% level of significance

1% Critical value of 0.792 exceeds 0.555023
Evidence of non-normality at 99% level of significance

1				**Background Statistics for Data Sets with Non-Detects**								
2	**User Selected Options**											
3	Date/Time of Computation			9/18/2017 3:02:12 PM								
4	From File			UPL-Input-July-2017.xls								
5	Full Precision			OFF								
6	Confidence Coefficient			95%								
7	Coverage			95%								
8	Different or Future K Observations			1								
9	Number of Bootstrap Operations			2000								
10												
11	**Molybdenum**											
12												
13	**General Statistics**											
14	Total Number of Observations			11			Number of Missing Observations			0		
15	Number of Distinct Observations			4								
16	Number of Detects			2			Number of Non-Detects			9		
17	Number of Distinct Detects			2			Number of Distinct Non-Detects			2		
18	Minimum Detect			0.55			Minimum Non-Detect			2.5		
19	Maximum Detect			6.8			Maximum Non-Detect			5		
20	Variance Detected			19.53			Percent Non-Detects			81.82%		
21	Mean Detected			3.675			SD Detected			4.419		
22	Mean of Detected Logged Data			0.66			SD of Detected Logged Data			1.778		
23												
24	**Warning: Data set has only 2 Detected Values.**											
25	**This is not enough to compute meaningful or reliable statistics and estimates.**											
26												
27												
28	**Critical Values for Background Threshold Values (BTVs)**											
29	Tolerance Factor K (For UTL)			2.815			d2max (for USL)			2.234		
30												
31	**Normal GOF Test on Detects Only**											
32	**Not Enough Data to Perform GOF Test**											
33												
34	**Kaplan Meier (KM) Background Statistics Assuming Normal Distribution**											
35	Mean			1.118			SD			1.797		
36	95% UTL95% Coverage			6.176			95% KM UPL (t)			4.52		
37	90% KM Percentile (z)			3.421			95% KM Percentile (z)			4.074		
38	99% KM Percentile (z)			5.298			95% KM USL			5.132		
39												
40	**DL/2 Substitution Background Statistics Assuming Normal Distribution**											
41	Mean			2.6			SD			1.541		
42	95% UTL95% Coverage			6.938			95% UPL (t)			5.517		
43	90% Percentile (z)			4.575			95% Percentile (z)			5.135		
44	99% Percentile (z)			6.185			95% USL			6.042		
45	**DL/2 is not a recommended method. DL/2 provided for comparisons and historical reasons**											
46												
47	**Gamma GOF Tests on Detected Observations Only**											
48	**Not Enough Data to Perform GOF Test**											
49												
50	**Gamma Statistics on Detected Data Only**											
51	k hat (MLE)			0.909			k star (bias corrected MLE)			N/A		
52	Theta hat (MLE)			4.041			Theta star (bias corrected MLE)			N/A		
53	nu hat (MLE)			3.638			nu star (bias corrected)			N/A		
54	MLE Mean (bias corrected)			N/A								
55	MLE Sd (bias corrected)			N/A			95% Percentile of Chisquare (2k)			N/A		

	A	B	C	D	E	F	G	H	I	J	K	L
56												
57	**The following statistics are computed using gamma distribution and KM estimates**											
58	**Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods**											
59					k hat (KM)	0.387				nu hat (KM)		8.521
60					WH	HW					WH	HW
61	95% Approx. Gamma UTL with 95% Coverage				5.708	5.618	95% Approx. Gamma UPL				3.39	3.223
62	95% Gamma USL				4.154	3.994						
63												
64	**Lognormal GOF Test on Detected Observations Only**											
65	**Not Enough Data to Perform GOF Test**											
66												
67	**Background Lognormal ROS Statistics Assuming Lognormal Distribution Using Imputed Non-Detects**											
68	Mean in Original Scale					1.284	Mean in Log Scale					-0.402
69	SD in Original Scale					1.923	SD in Log Scale					1.137
70	95% UTL95% Coverage					16.4	95% BCA UTL95% Coverage					6.8
71	95% Bootstrap (%) UTL95% Coverage					6.8	95% UPL (t)					5.752
72	90% Percentile (z)					2.871	95% Percentile (z)					4.339
73	99% Percentile (z)					9.413	95% USL					8.474
74												
75	**Background DL/2 Statistics Assuming Lognormal Distribution**											
76	Mean in Original Scale					2.6	Mean in Log Scale					0.807
77	SD in Original Scale					1.541	SD in Log Scale					0.603
78	95% UTL95% Coverage					12.25	95% UPL (t)					7.022
79	90% Percentile (z)					4.855	95% Percentile (z)					6.045
80	99% Percentile (z)					9.12	95% USL					8.626
81	**DL/2 is not a Recommended Method. DL/2 provided for comparisons and historical reasons.**											
82												
83	**Nonparametric Distribution Free Background Statistics**											
84	**Data do not follow a Discernible Distribution (0.05)**											
85												
86	**Nonparametric Upper Limits for BTVs(no distinction made between detects and nondetects)**											
87	Order of Statistic, r					11	95% UTL with95% Coverage					6.8
88	Approximate f					0.579	Confidence Coefficient (CC) achieved by UTL					0.431
89	95% UPL					6.8	95% USL					6.8
90	95% KM Chebyshev UPL					9.298						
91												
92	Note: The use of USL to estimate a BTV is recommended only when the data set represents a background											
93	data set free of outliers and consists of observations collected from clean unimpacted locations.											
94	The use of USL tends to provide a balance between false positives and false negatives provided the data											
95	represents a background data set and when many onsite observations need to be compared with the BTV.											
96												

Sen's Slope Analysis

Parameter: Molybdenum
Location: MW-2
Original Data (Not Transformed)
Non-Detects Replaced with Detection Limit

90% Confidence Level

Xj	Xk	(Xj - Xk)/(j-k)	Q
20.6 (10/15/2015)	11 (8/12/2015)	(20.6 - 11)/(2 - 1)	9.6
21.1 (11/19/2015)	11 (8/12/2015)	(21.1 - 11)/(3 - 1)	5.05
18.1 (1/6/2016)	11 (8/12/2015)	(18.1 - 11)/(4 - 1)	2.36667
19.1 (2/17/2016)	11 (8/12/2015)	(19.1 - 11)/(5 - 1)	2.025
9.5 (4/6/2016)	11 (8/12/2015)	(9.5 - 11)/(6 - 1)	-0.3
10.1 (5/27/2016)	11 (8/12/2015)	(10.1 - 11)/(7 - 1)	-0.15
10.8 (7/12/2016)	11 (8/12/2015)	(10.8 - 11)/(8 - 1)	-0.0285714
13.1 (1/26/2017)	11 (8/12/2015)	(13.1 - 11)/(9 - 1)	0.2625
9.8 (4/5/2017)	11 (8/12/2015)	(9.8 - 11)/(10 - 1)	-0.133333
9.3 (7/18/2017)	11 (8/12/2015)	(9.3 - 11)/(11 - 1)	-0.17
21.1 (11/19/2015)	20.6 (10/15/2015)	(21.1 - 20.6)/(3 - 2)	0.5
18.1 (1/6/2016)	20.6 (10/15/2015)	(18.1 - 20.6)/(4 - 2)	-1.25
19.1 (2/17/2016)	20.6 (10/15/2015)	(19.1 - 20.6)/(5 - 2)	-0.5
9.5 (4/6/2016)	20.6 (10/15/2015)	(9.5 - 20.6)/(6 - 2)	-2.775
10.1 (5/27/2016)	20.6 (10/15/2015)	(10.1 - 20.6)/(7 - 2)	-2.1
10.8 (7/12/2016)	20.6 (10/15/2015)	(10.8 - 20.6)/(8 - 2)	-1.63333
13.1 (1/26/2017)	20.6 (10/15/2015)	(13.1 - 20.6)/(9 - 2)	-1.07143
9.8 (4/5/2017)	20.6 (10/15/2015)	(9.8 - 20.6)/(10 - 2)	-1.35
9.3 (7/18/2017)	20.6 (10/15/2015)	(9.3 - 20.6)/(11 - 2)	-1.25556
18.1 (1/6/2016)	21.1 (11/19/2015)	(18.1 - 21.1)/(4 - 3)	-3
19.1 (2/17/2016)	21.1 (11/19/2015)	(19.1 - 21.1)/(5 - 3)	-1
9.5 (4/6/2016)	21.1 (11/19/2015)	(9.5 - 21.1)/(6 - 3)	-3.86667
10.1 (5/27/2016)	21.1 (11/19/2015)	(10.1 - 21.1)/(7 - 3)	-2.75
10.8 (7/12/2016)	21.1 (11/19/2015)	(10.8 - 21.1)/(8 - 3)	-2.06
13.1 (1/26/2017)	21.1 (11/19/2015)	(13.1 - 21.1)/(9 - 3)	-1.33333
9.8 (4/5/2017)	21.1 (11/19/2015)	(9.8 - 21.1)/(10 - 3)	-1.61429
9.3 (7/18/2017)	21.1 (11/19/2015)	(9.3 - 21.1)/(11 - 3)	-1.475
19.1 (2/17/2016)	18.1 (1/6/2016)	(19.1 - 18.1)/(5 - 4)	1
9.5 (4/6/2016)	18.1 (1/6/2016)	(9.5 - 18.1)/(6 - 4)	-4.3
10.1 (5/27/2016)	18.1 (1/6/2016)	(10.1 - 18.1)/(7 - 4)	-2.66667
10.8 (7/12/2016)	18.1 (1/6/2016)	(10.8 - 18.1)/(8 - 4)	-1.825
13.1 (1/26/2017)	18.1 (1/6/2016)	(13.1 - 18.1)/(9 - 4)	-1
9.8 (4/5/2017)	18.1 (1/6/2016)	(9.8 - 18.1)/(10 - 4)	-1.38333
9.3 (7/18/2017)	18.1 (1/6/2016)	(9.3 - 18.1)/(11 - 4)	-1.25714
9.5 (4/6/2016)	19.1 (2/17/2016)	(9.5 - 19.1)/(6 - 5)	-9.6
10.1 (5/27/2016)	19.1 (2/17/2016)	(10.1 - 19.1)/(7 - 5)	-4.5
10.8 (7/12/2016)	19.1 (2/17/2016)	(10.8 - 19.1)/(8 - 5)	-2.76667
13.1 (1/26/2017)	19.1 (2/17/2016)	(13.1 - 19.1)/(9 - 5)	-1.5
9.8 (4/5/2017)	19.1 (2/17/2016)	(9.8 - 19.1)/(10 - 5)	-1.86
9.3 (7/18/2017)	19.1 (2/17/2016)	(9.3 - 19.1)/(11 - 5)	-1.63333
10.1 (5/27/2016)	9.5 (4/6/2016)	(10.1 - 9.5)/(7 - 6)	0.6
10.8 (7/12/2016)	9.5 (4/6/2016)	(10.8 - 9.5)/(8 - 6)	0.65
13.1 (1/26/2017)	9.5 (4/6/2016)	(13.1 - 9.5)/(9 - 6)	1.2
9.8 (4/5/2017)	9.5 (4/6/2016)	(9.8 - 9.5)/(10 - 6)	0.075
9.3 (7/18/2017)	9.5 (4/6/2016)	(9.3 - 9.5)/(11 - 6)	-0.04
10.8 (7/12/2016)	10.1 (5/27/2016)	(10.8 - 10.1)/(8 - 7)	0.7
13.1 (1/26/2017)	10.1 (5/27/2016)	(13.1 - 10.1)/(9 - 7)	1.5
9.8 (4/5/2017)	10.1 (5/27/2016)	(9.8 - 10.1)/(10 - 7)	-0.1
9.3 (7/18/2017)	10.1 (5/27/2016)	(9.3 - 10.1)/(11 - 7)	-0.2
13.1 (1/26/2017)	10.8 (7/12/2016)	(13.1 - 10.8)/(9 - 8)	2.3
9.8 (4/5/2017)	10.8 (7/12/2016)	(9.8 - 10.8)/(10 - 8)	-0.5
9.3 (7/18/2017)	10.8 (7/12/2016)	(9.3 - 10.8)/(11 - 8)	-0.5
9.8 (4/5/2017)	13.1 (1/26/2017)	(9.8 - 13.1)/(10 - 9)	-3.3
9.3 (7/18/2017)	13.1 (1/26/2017)	(9.3 - 13.1)/(11 - 9)	-1.9

9.3 (7/18/2017)	9.8 (4/5/2017)	(9.3 - 9.8)/(11 - 10)	-0.5

Number of Q values = 55

Ordered Q Values

n	Q
1	-9.6
2	-4.5
3	-4.3
4	-3.86667
5	-3.3
6	-3
7	-2.775
8	-2.76667
9	-2.75
10	-2.66667
11	-2.1
12	-2.06
13	-1.9
14	-1.86
15	-1.825
16	-1.63333
17	-1.63333
18	-1.61429
19	-1.5
20	-1.475
21	-1.38333
22	-1.35
23	-1.33333
24	-1.25714
25	-1.25556
26	-1.25
27	-1.07143
28	-1
29	-1
30	-0.5
31	-0.5
32	-0.5
33	-0.5
34	-0.3
35	-0.2
36	-0.17
37	-0.15
38	-0.133333
39	-0.1
40	-0.04
41	-0.0285714
42	0.075
43	0.2625
44	0.5
45	0.6
46	0.65
47	0.7
48	1
49	1.2
50	1.5
51	2.025
52	2.3
53	2.36667
54	5.05
55	9.6

Sen's Estimator (Median Q) is -1

Time Period	Observations
8/12/2015	1
10/15/2015	1
11/19/2015	1
1/6/2016	1
2/17/2016	1

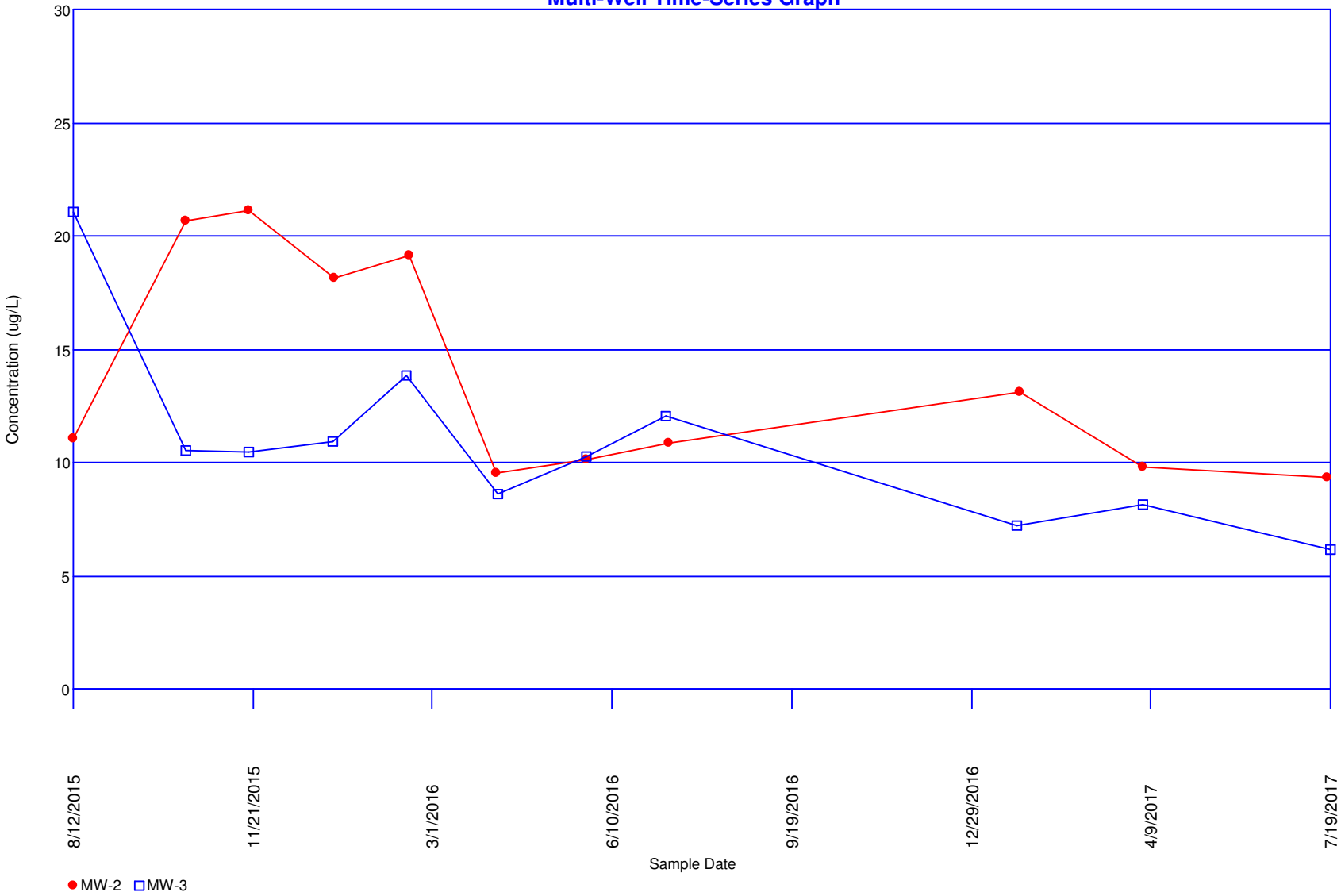
4/6/2016	1
5/27/2016	1
7/12/2016	1
1/26/2017	1
4/5/2017	1
7/18/2017	1

There are 0 time periods with multiple data

A = 0
B = 0
C = 0
D = 0
E = 0
F = 0
a = 2970
b = 8910
c = 220
Group Variance = 165
For 90% confidence interval (two-tailed), Z at (1-0.9)/2 = 1.64485
C = 21.1285
M1 = (55 - 21.1285)/2.0 = 16.9357
M2 = (55 + 21.1285)/2.0 + 1 = 39.0643
Lower limit is -1.63333 = Q(17)
Upper limit is -0.1 = Q(39)
-0.1 < 0 indicating a downward trend in data.

Molybdenum

Multi-Well Time-Series Graph



Concentrations (ug/L)

Parameter: Nickel

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

Total Measurements: 88
Total Non-Detect: 69
Percent Non-Detects: 78.4091%
Total Background Measurements: 11
There is 1 background location

Loc.	Meas.	ND	Date	Conc.	Original
BG-1	11	10 (90.9091%)	8/12/2015	1.3 J	1.3 J
			10/15/2015	ND<5 U	ND<5 U
			11/18/2015	ND<5 U	ND<5 U
			1/4/2016	ND<5 U	ND<5 U
			2/16/2016	ND<5 U	ND<5 U
			4/5/2016	ND<5 U	ND<5 U
			5/26/2016	ND<5 U	ND<5 U
			7/12/2016	ND<5 U	ND<5 U
			1/23/2017	ND<5 U	ND<5 U
			4/3/2017	ND<5 U	ND<5 U
			7/17/2017	ND<2.5 U	ND<2.5 U

There are 7 compliance locations

Loc.	Meas.	ND	Date	Conc.	Original
MW-1	11	10 (90.9091%)	8/12/2015	3.1 J	3.1 J
			10/15/2015	ND<5 U	ND<5 U
			11/20/2015	ND<5 U	ND<5 U
			1/6/2016	ND<5 U	ND<5 U
			2/17/2016	ND<5 U	ND<5 U
			4/6/2016	ND<5 U	ND<5 U
			5/27/2016	ND<5 U	ND<5 U
			7/12/2016	ND<5 U	ND<5 U
			1/25/2017	ND<5 U	ND<5 U
			4/5/2017	ND<5 U	ND<5 U
			7/18/2017	ND<2.5 U	ND<2.5 U
MW-2	11	5 (45.4545%)	8/12/2015	6.1	6.1
			10/15/2015	7.8	7.8
			11/19/2015	ND<5 U	ND<5 U
			1/6/2016	8.7	8.7
			2/17/2016	13.5	13.5
			4/6/2016	ND<5 U	ND<5 U
			5/27/2016	ND<5 U	ND<5 U
			7/12/2016	ND<5 U	ND<5 U
			1/26/2017	15.2	15.2
			4/5/2017	23	23
			7/18/2017	ND<2.5 U	ND<2.5 U
MW-3	11	9 (81.8182%)	8/12/2015	3.7 J	3.7 J
			10/15/2015	ND<5 U	ND<5 U
			11/19/2015	ND<5 U	ND<5 U
			1/5/2016	ND<5 U	ND<5 U
			2/16/2016	ND<5 U	ND<5 U
			4/7/2016	ND<5 U	ND<5 U
			5/27/2016	ND<5 U	ND<5 U
			7/11/2016	ND<5 U	ND<5 U
			1/24/2017	ND<5 U	ND<5 U
			4/5/2017	5.5	5.5
			7/19/2017	ND<2.5 U	ND<2.5 U
MW-4	11	8 (72.7273%)	8/12/2015	8.4	8.4
			10/15/2015	ND<5 U	ND<5 U
			11/19/2015	ND<5 U	ND<5 U
			1/4/2016	ND<5 U	ND<5 U
			2/16/2016	ND<5 U	ND<5 U
			4/7/2016	ND<5 U	ND<5 U
			5/25/2016	ND<5 U	ND<5 U

			7/13/2016	ND<5 U	ND<5 U
			1/25/2017	ND<5 U	ND<5 U
			4/5/2017	6.2	6.2
			7/20/2017	5.2	5.2
MW-5	11	9 (81.8182%)	8/12/2015	3 J	3 J
			10/15/2015	12.6	12.6
			11/18/2015	ND<5 U	ND<5 U
			1/4/2016	ND<5 U	ND<5 U
			2/16/2016	ND<5 U	ND<5 U
			4/5/2016	ND<5 U	ND<5 U
			5/25/2016	ND<5 U	ND<5 U
			7/11/2016	ND<5 U	ND<5 U
			1/23/2017	ND<5 U	ND<5 U
			4/4/2017	ND<5 U	ND<5 U
			7/19/2017	ND<2.5 U	ND<2.5 U
MW-6	11	10 (90.9091%)	8/12/2015	2.8 J	2.8 J
			10/19/2015	ND<5 U	ND<5 U
			11/20/2015	ND<5 U	ND<5 U
			1/5/2016	ND<5 U	ND<5 U
			2/17/2016	ND<5 U	ND<5 U
			4/5/2016	ND<5 U	ND<5 U
			5/26/2016	ND<5 U	ND<5 U
			7/11/2016	ND<5 U	ND<5 U
			1/24/2017	ND<5 U	ND<5 U
			4/4/2017	ND<5 U	ND<5 U
			7/19/2017	ND<2.5 U	ND<2.5 U
MW-8	11	8 (72.7273%)	8/12/2015	2.4 J	2.4 J
			10/15/2015	18.2	18.2
			11/20/2015	ND<5 U	ND<5 U
			1/6/2016	ND<5 U	ND<5 U
			2/18/2016	ND<5 U	ND<5 U
			4/6/2016	ND<5 U	ND<5 U
			5/26/2016	ND<5 U	ND<5 U
			7/12/2016	ND<5 U	ND<5 U
			1/24/2017	42.1	42.1
			4/4/2017	ND<5 U	ND<5 U
			7/17/2017	ND<2.5 U	ND<2.5 U

There are 0 unused locations

Loc.	Meas.	ND	Date	Conc.	Original

Rosner's Test for Outliers

Parameter: Nickel

All Locations

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

Data set mean = 5.86705

10 most extreme of 88 measurements

by order of magnitude difference from the mean

1	1/24/2017	MW-8	42.1	36.233
2	4/5/2017	MW-2	23	17.133
3	10/15/2015	MW-8	18.2	12.333
4	1/26/2017	MW-2	15.2	9.33295
5	2/17/2016	MW-2	13.5	7.63295
6	10/15/2015	MW-5	12.6	6.73295
7	8/12/2015	BG-1	1.3 J	-4.56705
8	8/12/2015	MW-8	2.4 J	-3.46705
9	7/19/2017	MW-6	ND<2.5 U	-3.36705
10	7/19/2017	MW-5	ND<2.5 U	-3.36705

Iteration i = 9

Mean of 79 measurements = 4.87975
Std Dev = 1.05325
x(i+1) = 2.5 from measurement 7/19/2017 from location MW-5
Rosner Statistic R = |2.5 - 4.87975|/1.05325 = 2.25944
Lambda(88, 10, 0.05) = 3.3
2.25944 < 3.3 -- No outliers detected for i = 9

Iteration i = 8

Mean of 80 measurements = 4.85
Std Dev = 1.07985
x(i+1) = 2.5 from measurement 7/19/2017 from location MW-6
Rosner Statistic R = |2.5 - 4.85|/1.07985 = 2.17623
Lambda(88, 9, 0.05) = 3.3044
2.17623 < 3.3044 -- No outliers detected for i = 8

Iteration i = 7

Mean of 81 measurements = 4.81975
Std Dev = 1.10707
x(i+1) = 2.4 from measurement 8/12/2015 from location MW-8
Rosner Statistic R = |2.4 - 4.81975|/1.10707 = 2.18573
Lambda(88, 8, 0.05) = 3.3088
2.18573 < 3.3088 -- No outliers detected for i = 7

Iteration i = 6

Mean of 82 measurements = 4.77683
Std Dev = 1.16686
x(i+1) = 1.3 from measurement 8/12/2015 from location BG-1
Rosner Statistic R = |1.3 - 4.77683|/1.16686 = 2.97965
Lambda(88, 7, 0.05) = 3.3132
2.97965 < 3.3132 -- No outliers detected for i = 6

Iteration i = 5

Mean of 83 measurements = 4.87108
Std Dev = 1.44303
x(i+1) = 12.6 from measurement 10/15/2015 from location MW-5
Rosner Statistic R = |12.6 - 4.87108|/1.44303 = 5.35605
Lambda(88, 6, 0.05) = 3.3176
5.35605 > 3.3176 -- Measurement 10/15/2015 for location MW-5 is an outlier

---

Iteration i = 4

Mean of 84 measurements = 4.97381
Std Dev = 1.7157
x(i+1) = 13.5 from measurement 2/17/2016 from location MW-2

Rosner Statistic R = |13.5 - 4.97381|/1.7157 = 4.9695
Lambda(88, 5, 0.05) = 3.322
Measurement 2/17/2016 for location MW-2 is an outlier

Iteration i = 3
Mean of 85 measurements = 5.09412
Std Dev = 2.03443
x(i+1) = 15.2 from measurement 1/26/2017 from location MW-2
Rosner Statistic R = |15.2 - 5.09412|/2.03443 = 4.96743
Lambda(88, 4, 0.05) = 3.33
Measurement 1/26/2017 for location MW-2 is an outlier

Iteration i = 2
Mean of 86 measurements = 5.24651
Std Dev = 2.46728
x(i+1) = 18.2 from measurement 10/15/2015 from location MW-8
Rosner Statistic R = |18.2 - 5.24651|/2.46728 = 5.25011
Lambda(88, 3, 0.05) = 3.332
Measurement 10/15/2015 for location MW-8 is an outlier

Iteration i = 1
Mean of 87 measurements = 5.45057
Std Dev = 3.10476
x(i+1) = 23 from measurement 4/5/2017 from location MW-2
Rosner Statistic R = |23 - 5.45057|/3.10476 = 5.65243
Lambda(88, 2, 0.05) = 3.332
Measurement 4/5/2017 for location MW-2 is an outlier

Iteration i = 0
Mean of 88 measurements = 5.86705
Std Dev = 4.97917
x(i+1) = 42.1 from measurement 1/24/2017 from location MW-8
Rosner Statistic R = |42.1 - 5.86705|/4.97917 = 7.27691
Lambda(88, 1, 0.05) = 3.342
Measurement 1/24/2017 for location MW-8 is an outlier

Non-Parametric Prediction Interval

Inter-Well Comparison

Parameter: Nickel

Original Data (Not Transformed)

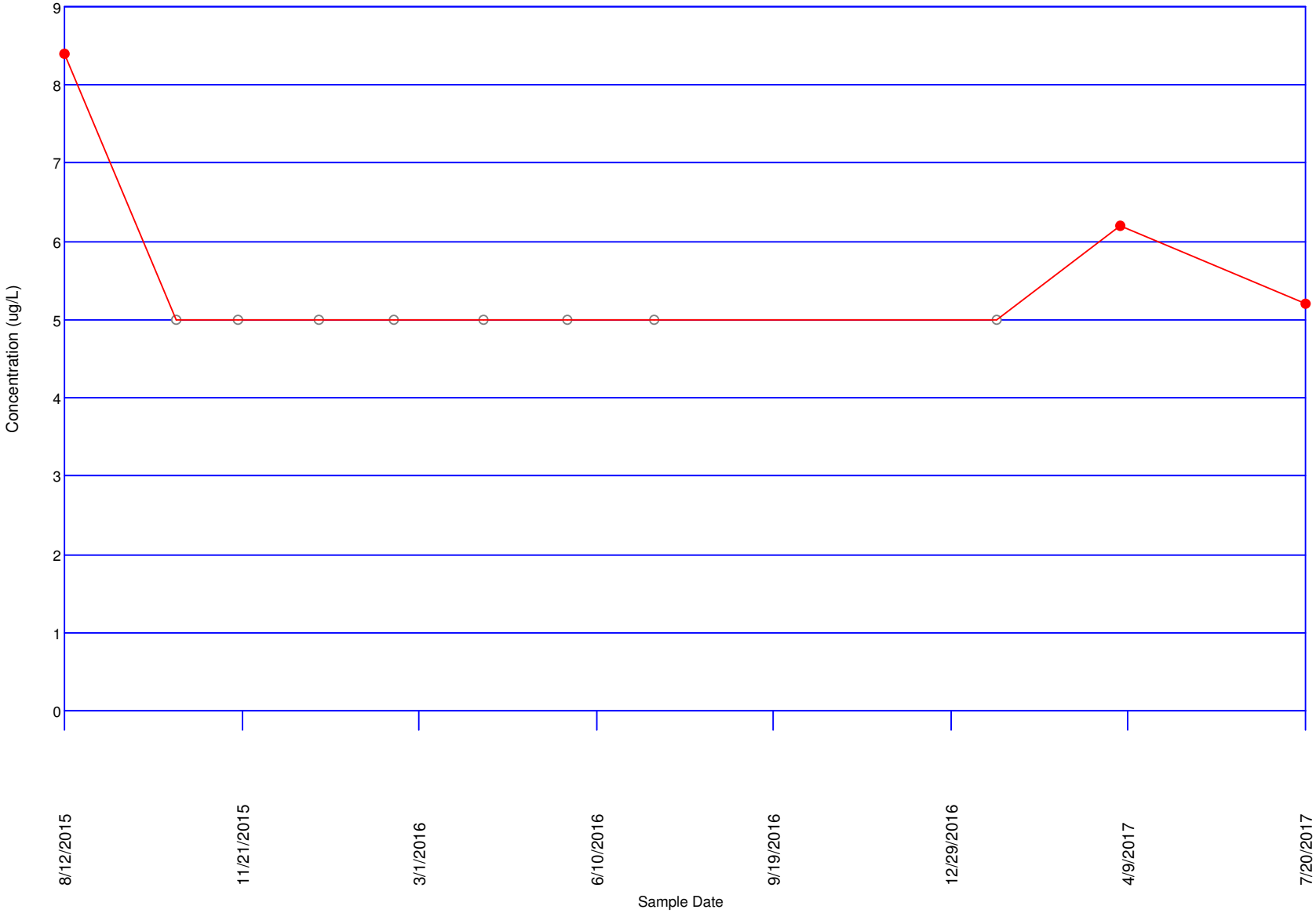
Non-Detects Replaced with Detection Limit

Total Percent Non-Detects = 78.4091%
Number of comparisons = 7
Future Samples (k) = 7
Recent Dates = 1
Background Measurements (n) = 11
Maximum Background Value = 5
Confidence Level = 61.1%
False Positive Rate = 38.9%

Location	Date	Count	Mean	Significant
MW-1	7/18/2017	1	2.5	FALSE
MW-2	7/18/2017	1	2.5	FALSE
MW-3	7/19/2017	1	2.5	FALSE
MW-4	**7/20/2017**	**1**	**5.2**	**TRUE**
MW-5	7/19/2017	1	2.5	FALSE
MW-6	7/19/2017	1	2.5	FALSE
MW-8	7/17/2017	1	2.5	FALSE

Nickel

Time-Series Graph of MW-4



Concentrations (pCi/L)

Parameter: Radium-226

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

Total Measurements: 88
Total Non-Detect: 12
Percent Non-Detects: 13.6364%
Total Background Measurements: 11
There is 1 background location

Loc.	Meas.	ND	Date	Conc.	Original
BG-1	11	2 (18.1818%)	8/12/2015	0.802	0.802
			10/15/2015	0.362	0.362
			11/18/2015	0.8	0.8
			1/4/2016	ND<0.206	ND<0.206
			2/16/2016	0.553	0.553
			4/5/2016	0.407	0.407
			5/26/2016	0.654	0.654
			7/12/2016	0.777	0.777
			1/23/2017	0.532	0.532
			4/3/2017	ND<0	ND<0
			7/17/2017	0.151	0.151

There are 7 compliance locations

Loc.	Meas.	ND	Date	Conc.	Original
MW-1	11	1 (9.09091%)	8/12/2015	0.709	0.709
			10/15/2015	0.387	0.387
			11/20/2015	0.414	0.414
			1/6/2016	0.209	0.209
			2/17/2016	0.276	0.276
			4/6/2016	0.141	0.141
			5/27/2016	0.254	0.254
			7/12/2016	0.448	0.448
			1/25/2017	ND<0.188	ND<0.188
			4/5/2017	0.253	0.253
			7/18/2017	0.601	0.601
MW-2	11	0 (0%)	8/12/2015	1.33	1.33
			10/15/2015	0.681	0.681
			11/20/2015	0.985	0.985
			1/6/2016	0.716	0.716
			2/17/2016	1.22	1.22
			4/6/2016	1.94	1.94
			5/27/2016	0.69	0.69
			7/12/2016	0.58	0.58
			1/26/2017	1.02	1.02
			4/5/2017	1.27	1.27
			7/18/2017	0.74	0.74
MW-3	11	0 (0%)	8/12/2015	0.99	0.99
			10/15/2015	1.59	1.59
			11/19/2015	0.816	0.816
			1/5/2016	0.213	0.213
			2/16/2016	1.18	1.18
			4/7/2016	0.605	0.605
			5/27/2016	1.24	1.24
			7/11/2016	0.308	0.308
			1/24/2017	1.25	1.25
			4/5/2017	0.43	0.43
			7/19/2017	1.19	1.19
MW-4	11	1 (9.09091%)	8/12/2015	0.814	0.814
			10/15/2015	0.281	0.281
			11/19/2015	0.406	0.406
			1/4/2016	ND<0.12	ND<0.12
			2/16/2016	0.0693	0.0693
			4/7/2016	0.444	0.444
			5/25/2016	0.295	0.295

			7/11/2016	0.185	0.185
			1/25/2017	0.224	0.224
			4/5/2017	0.784	0.784
			7/20/2017	0.684	0.684
MW-5	11	5 (45.4545%)	8/12/2015	0.564	0.564
			10/15/2015	0.708	0.708
			11/18/2015	0.592	0.592
			1/4/2016	ND<0.066	ND<0.066
			2/16/2016	ND<0.142	ND<0.142
			4/5/2016	ND<0	ND<0
			5/25/2016	0.0766	0.0766
			7/11/2016	ND<0.092	ND<0.092
			1/23/2017	0.0732	0.0732
			4/4/2017	ND<0.07	ND<0.07
			7/19/2017	0.12	0.12
MW-6	11	2 (18.1818%)	8/12/2015	0.806	0.806
			10/19/2015	0.172	0.172
			11/20/2015	0.0638	0.0638
			1/5/2016	0.91	0.91
			2/17/2016	0.0812	0.0812
			4/5/2016	ND<0.068	ND<0.068
			5/26/2016	ND<0.075	ND<0.075
			7/11/2016	0.393	0.393
			1/24/2017	0.126	0.126
			4/4/2017	0.444	0.444
			7/19/2017	0.227	0.227
MW-8	11	1 (9.09091%)	8/12/2015	0.92	0.92
			10/15/2015	0.0774	0.0774
			11/20/2015	1.16	1.16
			1/6/2016	ND<0	ND<0
			2/18/2016	0.116	0.116
			4/6/2016	0.73	0.73
			5/26/2016	0.719	0.719
			7/12/2016	0.616	0.616
			1/24/2017	0.0618	0.0618
			4/4/2017	0.449	0.449
			7/17/2017	1.05	1.05

There are 0 unused locations

Loc.	Meas.	ND	Date	Conc.	Original

	A	B	C	D	E
1	ROS Adjustment of data below Detection Limit using ROS Method				
2	Radium -226				
3	Well	Date	Ra-226	D_Ra-226	NROS_Ra-226
4	BG-1	8/12/2015	0.802	1	0.802
5	BG-1	10/15/2015	0.362	1	0.362
6	BG-1	11/18/2015	0.8	1	0.8
7	BG-1	1/4/2016	-0.206	0	-0.290069571
8	BG-1	2/16/2016	0.553	1	0.553
9	BG-1	4/5/2016	0.407	1	0.407
10	BG-1	5/25/2016	0.654	1	0.654
11	BG-1	7/11/2016	0.777	1	0.777
12	BG-1	1/23/2017	0.532	1	0.532
13	BG-1	4/4/2017	0	0	-0.460561408
14	BG-1	7/17/2017	0.151	1	0.151

Rosner's Test for Outliers

Parameter: Radium-226

All Locations

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

Data set mean = 0.553367

10 most extreme of 88 measurements

by order of magnitude difference from the mean

1	4/6/2016	MW-2	1.94	1.38663
2	10/15/2015	MW-3	1.59	1.03663
3	8/12/2015	MW-2	1.33	0.776633
4	4/5/2017	MW-2	1.27	0.716633
5	1/24/2017	MW-3	1.25	0.696633
6	5/27/2016	MW-3	1.24	0.686633
7	2/17/2016	MW-2	1.22	0.666633
8	7/19/2017	MW-3	1.19	0.636633
9	2/16/2016	MW-3	1.18	0.626633
10	11/20/2015	MW-8	1.16	0.606633

Iteration i = 9

Mean of 79 measurements = 0.461852
Std Dev = 0.282805
x(i+1) = 1.16 from measurement 11/20/2015 from location MW-8
Rosner Statistic R = |1.16 - 0.461852|/0.282805 = 2.46865
Lambda(88, 10, 0.05) = 3.3
2.46865 < 3.3 -- No outliers detected for i = 9

Iteration i = 8

Mean of 80 measurements = 0.470829
Std Dev = 0.292255
x(i+1) = 1.18 from measurement 2/16/2016 from location MW-3
Rosner Statistic R = |1.18 - 0.470829|/0.292255 = 2.42655
Lambda(88, 9, 0.05) = 3.3044
2.42655 < 3.3044 -- No outliers detected for i = 8

Iteration i = 7

Mean of 81 measurements = 0.479707
Std Dev = 0.301216
x(i+1) = 1.19 from measurement 7/19/2017 from location MW-3
Rosner Statistic R = |1.19 - 0.479707|/0.301216 = 2.35809
Lambda(88, 8, 0.05) = 3.3088
2.35809 < 3.3088 -- No outliers detected for i = 7

Iteration i = 6

Mean of 82 measurements = 0.488735
Std Dev = 0.310313
x(i+1) = 1.22 from measurement 2/17/2016 from location MW-2
Rosner Statistic R = |1.22 - 0.488735|/0.310313 = 2.35654
Lambda(88, 7, 0.05) = 3.3132
2.35654 < 3.3132 -- No outliers detected for i = 6

Iteration i = 5

Mean of 83 measurements = 0.497787
Std Dev = 0.319249
x(i+1) = 1.24 from measurement 5/27/2016 from location MW-3
Rosner Statistic R = |1.24 - 0.497787|/0.319249 = 2.32487
Lambda(88, 6, 0.05) = 3.3176
2.32487 < 3.3176 -- No outliers detected for i = 5

Iteration i = 4

Mean of 84 measurements = 0.506742
Std Dev = 0.327762
x(i+1) = 1.25 from measurement 1/24/2017 from location MW-3

Rosner Statistic R = |1.25 - 0.506742|/0.327762 = 2.26768
Lambda(88, 5, 0.05) = 3.322
2.26768 < 3.322 -- No outliers detected for i = 4

Iteration i = 3
Mean of 85 measurements = 0.515721
Std Dev = 0.336159
x(i+1) = 1.27 from measurement 4/5/2017 from location MW-2
Rosner Statistic R = |1.27 - 0.515721|/0.336159 = 2.24382
Lambda(88, 4, 0.05) = 3.33
2.24382 < 3.33 -- No outliers detected for i = 3

Iteration i = 2
Mean of 86 measurements = 0.52519
Std Dev = 0.345518
x(i+1) = 1.33 from measurement 8/12/2015 from location MW-2
Rosner Statistic R = |1.33 - 0.52519|/0.345518 = 2.32928
Lambda(88, 3, 0.05) = 3.332
2.32928 < 3.332 -- No outliers detected for i = 2

Iteration i = 1
Mean of 87 measurements = 0.537429
Std Dev = 0.361977
x(i+1) = 1.59 from measurement 10/15/2015 from location MW-3
Rosner Statistic R = |1.59 - 0.537429|/0.361977 = 2.90784
Lambda(88, 2, 0.05) = 3.332
2.90784 < 3.332 -- No outliers detected for i = 1

Iteration i = 0
Mean of 88 measurements = 0.553367
Std Dev = 0.389712
x(i+1) = 1.94 from measurement 4/6/2016 from location MW-2
Rosner Statistic R = |1.94 - 0.553367|/0.389712 = 3.55809
Lambda(88, 1, 0.05) = 3.342
3.55809 > 3.342 -- Measurement 4/6/2016 for location MW-2 is an outlier

Shapiro-Wilks Test of Normality

Parameter: Radium-226

All Locations

Normality Test of Parameter Concentrations

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

K = 5 for 11 measurements

i	x(i)	x(n-i+1)	x(n-1+1)-x(i)	a(n-i+1)	b(i)
1	0.151	0.802	0.651	0.5601	0.364625
2	0.29	0.8	0.51	0.3315	0.169065
3	0.362	0.777	0.415	0.226	0.09379
4	0.407	0.654	0.247	0.1429	0.0352963
5	0.46	0.553	0.093	0.0695	0.0064635
6	0.532	0.532	0		
7	0.553	0.46	-0.093		
8	0.654	0.407	-0.247		
9	0.777	0.362	-0.415		
10	0.8	0.29	-0.51		
11	0.802	0.151	-0.651		

Sum of b values = 0.66924

Sample Standard Deviation = 0.217517

W Statistic = 0.946625

5% Critical value of 0.85 is less than 0.946625

Data is normally distributed at 95% level of significance

1% Critical value of 0.792 is less than 0.946625

Data is normally distributed at 99% level of significance

Parametric Prediction Interval Analysis

Inter-Well Comparison

Parameter: Radium-226

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

Inter-Well Unified Guid. Formula 95% One-Sided Comparison

Background Samples = 11
Background Mean = 0.526182
Background Std Dev = 0.217517

Number of comparisons = 7
Future Samples (k) = 7
Actual confidence level is 1.0 - (0.05/7) = 99.2857 %
t is Percentile of Student's T-Test (0.95/7) = 0.992857
Degrees of Freedom = 11 (background observations) - 1
t(0.992857, 11) = 2.99548

Well MW-1

Date	Samples	Mean	Interval	Significant
7/18/2017	1	0.601	[0, 1.20672]	FALSE

Well MW-4

Date	Samples	Mean	Interval	Significant
7/20/2017	1	0.684	[0, 1.20672]	FALSE

Well MW-5

Date	Samples	Mean	Interval	Significant
7/19/2017	1	0.12	[0, 1.20672]	FALSE

Well MW-6

Date	Samples	Mean	Interval	Significant
7/19/2017	1	0.227	[0, 1.20672]	FALSE

Well MW-8

Date	Samples	Mean	Interval	Significant
7/17/2017	1	1.05	[0, 1.20672]	FALSE

Well MW-3

Date	Samples	Mean	Interval	Significant
7/19/2017	1	1.19	[0, 1.20672]	FALSE

Well MW-2

Date	Samples	Mean	Interval	Significant
7/18/2017	1	0.74	[0, 1.20672]	FALSE

Concentrations (pCi/L)

Parameter: Radium-228

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

Total Measurements: 88
Total Non-Detect: 9
Percent Non-Detects: 10.2273%
Total Background Measurements: 11
There is 1 background location

Loc.	Meas.	ND	Date	Conc.	Original
BG-1	11	1 (9.09091%)	8/12/2015	ND<0.496 U	ND<0.496 U
			10/15/2015	0.723	0.723
			11/18/2015	1.29	1.29
			1/4/2016	0.808	0.808
			2/16/2016	0.256	0.256
			4/5/2016	0.828	0.828
			5/26/2016	0.0108	0.0108
			7/12/2016	0.163	0.163
			1/23/2017	0.442	0.442
			4/3/2017	0.271	0.271
			7/17/2017	0.132	0.132

There are 7 compliance locations

Loc.	Meas.	ND	Date	Conc.	Original
MW-1	11	2 (18.1818%)	8/12/2015	ND<0.538 U	ND<0.538 U
			10/15/2015	0.0801	0.0801
			11/20/2015	0.511	0.511
			1/6/2016	0.455	0.455
			2/17/2016	0.47	0.47
			4/6/2016	0.402	0.402
			5/27/2016	ND<0.0467	ND<0.0467
			7/12/2016	0.833	0.833
			1/25/2017	0.237	0.237
			4/5/2017	0.495	0.495
			7/18/2017	0.508	0.508
MW-2	11	1 (9.09091%)	8/12/2015	ND<1.39 U	ND<1.39 U
			10/15/2015	1.56	1.56
			11/19/2015	1.75	1.75
			1/6/2016	1.69	1.69
			2/17/2016	1.15	1.15
			4/6/2016	1.08	1.08
			5/27/2016	0.433	0.433
			7/12/2016	0.98	0.98
			1/26/2017	0.979	0.979
			4/5/2017	1.17	1.17
			7/18/2017	1.54	1.54
MW-3	11	0 (0%)	8/12/2015	2.03	2.03
			10/15/2015	1.34	1.34
			11/19/2015	1.95	1.95
			1/5/2016	0.209	0.209
			2/16/2016	1.78	1.78
			4/7/2016	1.22	1.22
			5/27/2016	1.75	1.75
			7/11/2016	0.801	0.801
			1/24/2017	0.387	0.387
			4/5/2017	0.427	0.427
			7/19/2017	2.27	2.27
MW-4	11	1 (9.09091%)	8/12/2015	ND<1.52 U	ND<1.52 U
			10/15/2015	0.023	0.023
			11/19/2015	0.174	0.174
			1/4/2016	0.481	0.481
			2/16/2016	0.171	0.171
			4/7/2016	0.019	0.019
			5/25/2016	0.584	0.584

			7/11/2016	0.455	0.455
			1/25/2017	0.243	0.243
			4/5/2017	1.14	1.14
			7/20/2017	0.819	0.819
MW-5	11	2 (18.1818%)	8/12/2015	ND<0.52 U	ND<0.52 U
			10/15/2015	0.331	0.331
			11/18/2015	0.359	0.359
			1/4/2016	0.425	0.425
			2/16/2016	0.154	0.154
			4/5/2016	0.951	0.951
			5/25/2016	ND<0.0121	ND<0.0121
			7/11/2016	0.568	0.568
			1/23/2017	1.08	1.08
			4/4/2017	0.196	0.196
			7/19/2017	0.369	0.369
MW-6	11	1 (9.09091%)	8/12/2015	ND<1.26 U	ND<1.26 U
			10/19/2015	0.395	0.395
			11/20/2015	0.791	0.791
			1/5/2016	0.555	0.555
			2/17/2016	0.249	0.249
			4/5/2016	0.912	0.912
			5/26/2016	0.148	0.148
			7/11/2016	0.907	0.907
			1/24/2017	0.416	0.416
			4/4/2017	0.47	0.47
			7/19/2017	0.68	0.68
MW-8	11	1 (9.09091%)	8/12/2015	ND<0.931 U	ND<0.931 U
			10/15/2015	0.809	0.809
			11/20/2015	0.702	0.702
			1/6/2016	0.864	0.864
			2/18/2016	1.11	1.11
			4/6/2016	0.937	0.937
			5/26/2016	0.521	0.521
			7/12/2016	0.548	0.548
			1/24/2017	0.392	0.392
			4/4/2017	1.08	1.08
			7/17/2017	0.594	0.594

There are 0 unused locations

Loc.	Meas.	ND	Date	Conc.	Original

Rosner's Test for Outliers

Parameter: Radium-228

All Locations

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

Data set mean = 0.724394

10 most extreme of 88 measurements

by order of magnitude difference from the mean

1	7/19/2017	MW-3	2.27	1.54561
2	8/12/2015	MW-3	2.03	1.30561
3	11/19/2015	MW-3	1.95	1.22561
4	2/16/2016	MW-3	1.78	1.05561
5	11/19/2015	MW-2	1.75	1.02561
6	5/27/2016	MW-3	1.75	1.02561
7	1/6/2016	MW-2	1.69	0.965606
8	10/15/2015	MW-2	1.56	0.835606
9	7/18/2017	MW-2	1.54	0.815606
10	8/12/2015	MW-4	ND<1.52 U	0.795606

Iteration i = 9

Mean of 79 measurements = 0.600338
Std Dev = 0.377668
x(i+1) = 1.52 from measurement 8/12/2015 from location MW-4
Rosner Statistic R = |1.52 - 0.600338|/0.377668 = 2.43511
Lambda(88, 10, 0.05) = 3.3
2.43511 < 3.3 -- No outliers detected for i = 9

Iteration i = 8

Mean of 80 measurements = 0.612084
Std Dev = 0.389698
x(i+1) = 1.54 from measurement 7/18/2017 from location MW-2
Rosner Statistic R = |1.54 - 0.612084|/0.389698 = 2.38112
Lambda(88, 9, 0.05) = 3.3044
2.38112 < 3.3044 -- No outliers detected for i = 8

Iteration i = 7

Mean of 81 measurements = 0.623786
Std Dev = 0.401322
x(i+1) = 1.56 from measurement 10/15/2015 from location MW-2
Rosner Statistic R = |1.56 - 0.623786|/0.401322 = 2.33282
Lambda(88, 8, 0.05) = 3.3088
2.33282 < 3.3088 -- No outliers detected for i = 7

Iteration i = 6

Mean of 82 measurements = 0.636789
Std Dev = 0.415854
x(i+1) = 1.69 from measurement 1/6/2016 from location MW-2
Rosner Statistic R = |1.69 - 0.636789|/0.415854 = 2.53265
Lambda(88, 7, 0.05) = 3.3132
2.53265 < 3.3132 -- No outliers detected for i = 6

Iteration i = 5

Mean of 83 measurements = 0.650201
Std Dev = 0.430994
x(i+1) = 1.75 from measurement 5/27/2016 from location MW-3
Rosner Statistic R = |1.75 - 0.650201|/0.430994 = 2.55177
Lambda(88, 6, 0.05) = 3.3176
2.55177 < 3.3176 -- No outliers detected for i = 5

Iteration i = 4

Mean of 84 measurements = 0.663294
Std Dev = 0.444879
x(i+1) = 1.75 from measurement 11/19/2015 from location MW-2

Rosner Statistic R = |1.75 - 0.663294|/0.444879 = 2.4427
Lambda(88, 5, 0.05) = 3.322
2.4427 < 3.322 -- No outliers detected for i = 4

Iteration i = 3
Mean of 85 measurements = 0.676432
Std Dev = 0.458511
x(i+1) = 1.78 from measurement 2/16/2016 from location MW-3
Rosner Statistic R = |1.78 - 0.676432|/0.458511 = 2.40685
Lambda(88, 4, 0.05) = 3.33
2.40685 < 3.33 -- No outliers detected for i = 3

Iteration i = 2
Mean of 86 measurements = 0.691241
Std Dev = 0.476046
x(i+1) = 1.95 from measurement 11/19/2015 from location MW-3
Rosner Statistic R = |1.95 - 0.691241|/0.476046 = 2.6442
Lambda(88, 3, 0.05) = 3.332
2.6442 < 3.332 -- No outliers detected for i = 2

Iteration i = 1
Mean of 87 measurements = 0.706629
Std Dev = 0.494555
x(i+1) = 2.03 from measurement 8/12/2015 from location MW-3
Rosner Statistic R = |2.03 - 0.706629|/0.494555 = 2.67588
Lambda(88, 2, 0.05) = 3.332
2.67588 < 3.332 -- No outliers detected for i = 1

Iteration i = 0
Mean of 88 measurements = 0.724394
Std Dev = 0.51918
x(i+1) = 2.27 from measurement 7/19/2017 from location MW-3
Rosner Statistic R = |2.27 - 0.724394|/0.51918 = 2.97701
Lambda(88, 1, 0.05) = 3.342
2.97701 < 3.342 -- No outliers detected for i = 0

Shapiro-Wilks Test of Normality

Parameter: Radium-228

All Locations

Normality Test of Parameter Concentrations

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

K = 5 for 11 measurements

i	x(i)	x(n-i+1)	x(n-1+1)-x(i)	a(n-i+1)	b(i)
1	0.0108	1.29	1.2792	0.5601	0.71648
2	0.132	0.828	0.696	0.3315	0.230724
3	0.163	0.808	0.645	0.226	0.14577
4	0.256	0.723	0.467	0.1429	0.0667343
5	0.271	0.496	0.225	0.0695	0.0156375
6	0.442	0.442	0		
7	0.496	0.271	-0.225		
8	0.723	0.256	-0.467		
9	0.808	0.163	-0.645		
10	0.828	0.132	-0.696		
11	1.29	0.0108	-1.2792		

Sum of b values = 1.17535
Sample Standard Deviation = 0.384624
W Statistic = 0.933808

5% Critical value of 0.85 is less than 0.933808
Data is normally distributed at 95% level of significance

1% Critical value of 0.792 is less than 0.933808
Data is normally distributed at 99% level of significance

Parametric Prediction Interval Analysis

Inter-Well Comparison
Parameter: Radium-228
Original Data (Not Transformed)
Non-Detects Replaced with 1/2 DL

Inter-Well Unified Guid. Formula 95% One-Sided Comparison

Background Samples = 11
Background Mean = 0.470164
Background Std Dev = 0.391617

Number of comparisons = 7
Future Samples (k) = 7
Actual confidence level is 1.0 - (0.05/7) = 99.2857 %
t is Percentile of Student's T-Test (0.95/7) = 0.992857
Degrees of Freedom = 11 (background observations) - 1
t(0.992857, 11) = 2.99548

Well MW-1

Date	Samples	Mean	Interval	Significant
7/18/2017	1	0.508	[0, 1.69541]	FALSE

Well MW-2

Date	Samples	Mean	Interval	Significant
7/18/2017	1	1.54	[0, 1.69541]	FALSE

Well MW-3

Date	Samples	Mean	Interval	Significant
7/19/2017	**1**	**2.27**	**[0, 1.69541]**	**TRUE**

Well MW-4

Date	Samples	Mean	Interval	Significant
7/20/2017	1	0.819	[0, 1.69541]	FALSE

Well MW-5

Date	Samples	Mean	Interval	Significant
7/19/2017	1	0.369	[0, 1.69541]	FALSE

Well MW-6

Date	Samples	Mean	Interval	Significant
7/19/2017	1	0.68	[0, 1.69541]	FALSE

Well MW-8

Date	Samples	Mean	Interval	Significant
7/17/2017	1	0.594	[0, 1.69541]	FALSE

Sen's Slope Analysis

Parameter: Radium-228

Location: MW-3

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

90% Confidence Level

Xj	Xk	(Xj - Xk)/(j-k)	Q
1.34 (10/15/2015)	2.03 (8/12/2015)	(1.34 - 2.03)/(2 - 1)	-0.69
1.95 (11/19/2015)	2.03 (8/12/2015)	(1.95 - 2.03)/(3 - 1)	-0.04
0.209 (1/5/2016)	2.03 (8/12/2015)	(0.209 - 2.03)/(4 - 1)	-0.607
1.78 (2/16/2016)	2.03 (8/12/2015)	(1.78 - 2.03)/(5 - 1)	-0.0625
1.22 (4/7/2016)	2.03 (8/12/2015)	(1.22 - 2.03)/(6 - 1)	-0.162
1.75 (5/27/2016)	2.03 (8/12/2015)	(1.75 - 2.03)/(7 - 1)	-0.0466667
0.801 (7/11/2016)	2.03 (8/12/2015)	(0.801 - 2.03)/(8 - 1)	-0.175571
0.387 (1/24/2017)	2.03 (8/12/2015)	(0.387 - 2.03)/(9 - 1)	-0.205375
0.427 (4/5/2017)	2.03 (8/12/2015)	(0.427 - 2.03)/(10 - 1)	-0.178111
2.27 (7/19/2017)	2.03 (8/12/2015)	(2.27 - 2.03)/(11 - 1)	0.024
1.95 (11/19/2015)	1.34 (10/15/2015)	(1.95 - 1.34)/(3 - 2)	0.61
0.209 (1/5/2016)	1.34 (10/15/2015)	(0.209 - 1.34)/(4 - 2)	-0.5655
1.78 (2/16/2016)	1.34 (10/15/2015)	(1.78 - 1.34)/(5 - 2)	0.146667
1.22 (4/7/2016)	1.34 (10/15/2015)	(1.22 - 1.34)/(6 - 2)	-0.03
1.75 (5/27/2016)	1.34 (10/15/2015)	(1.75 - 1.34)/(7 - 2)	0.082
0.801 (7/11/2016)	1.34 (10/15/2015)	(0.801 - 1.34)/(8 - 2)	-0.0898333
0.387 (1/24/2017)	1.34 (10/15/2015)	(0.387 - 1.34)/(9 - 2)	-0.136143
0.427 (4/5/2017)	1.34 (10/15/2015)	(0.427 - 1.34)/(10 - 2)	-0.114125
2.27 (7/19/2017)	1.34 (10/15/2015)	(2.27 - 1.34)/(11 - 2)	0.103333
0.209 (1/5/2016)	1.95 (11/19/2015)	(0.209 - 1.95)/(4 - 3)	-1.741
1.78 (2/16/2016)	1.95 (11/19/2015)	(1.78 - 1.95)/(5 - 3)	-0.085
1.22 (4/7/2016)	1.95 (11/19/2015)	(1.22 - 1.95)/(6 - 3)	-0.243333
1.75 (5/27/2016)	1.95 (11/19/2015)	(1.75 - 1.95)/(7 - 3)	-0.05
0.801 (7/11/2016)	1.95 (11/19/2015)	(0.801 - 1.95)/(8 - 3)	-0.2298
0.387 (1/24/2017)	1.95 (11/19/2015)	(0.387 - 1.95)/(9 - 3)	-0.2605
0.427 (4/5/2017)	1.95 (11/19/2015)	(0.427 - 1.95)/(10 - 3)	-0.217571
2.27 (7/19/2017)	1.95 (11/19/2015)	(2.27 - 1.95)/(11 - 3)	0.04
1.78 (2/16/2016)	0.209 (1/5/2016)	(1.78 - 0.209)/(5 - 4)	1.571
1.22 (4/7/2016)	0.209 (1/5/2016)	(1.22 - 0.209)/(6 - 4)	0.5055
1.75 (5/27/2016)	0.209 (1/5/2016)	(1.75 - 0.209)/(7 - 4)	0.513667
0.801 (7/11/2016)	0.209 (1/5/2016)	(0.801 - 0.209)/(8 - 4)	0.148
0.387 (1/24/2017)	0.209 (1/5/2016)	(0.387 - 0.209)/(9 - 4)	0.0356
0.427 (4/5/2017)	0.209 (1/5/2016)	(0.427 - 0.209)/(10 - 4)	0.0363333
2.27 (7/19/2017)	0.209 (1/5/2016)	(2.27 - 0.209)/(11 - 4)	0.294429
1.22 (4/7/2016)	1.78 (2/16/2016)	(1.22 - 1.78)/(6 - 5)	-0.56
1.75 (5/27/2016)	1.78 (2/16/2016)	(1.75 - 1.78)/(7 - 5)	-0.015
0.801 (7/11/2016)	1.78 (2/16/2016)	(0.801 - 1.78)/(8 - 5)	-0.326333
0.387 (1/24/2017)	1.78 (2/16/2016)	(0.387 - 1.78)/(9 - 5)	-0.34825
0.427 (4/5/2017)	1.78 (2/16/2016)	(0.427 - 1.78)/(10 - 5)	-0.2706
2.27 (7/19/2017)	1.78 (2/16/2016)	(2.27 - 1.78)/(11 - 5)	0.0816667
1.75 (5/27/2016)	1.22 (4/7/2016)	(1.75 - 1.22)/(7 - 6)	0.53
0.801 (7/11/2016)	1.22 (4/7/2016)	(0.801 - 1.22)/(8 - 6)	-0.2095
0.387 (1/24/2017)	1.22 (4/7/2016)	(0.387 - 1.22)/(9 - 6)	-0.277667
0.427 (4/5/2017)	1.22 (4/7/2016)	(0.427 - 1.22)/(10 - 6)	-0.19825
2.27 (7/19/2017)	1.22 (4/7/2016)	(2.27 - 1.22)/(11 - 6)	0.21
0.801 (7/11/2016)	1.75 (5/27/2016)	(0.801 - 1.75)/(8 - 7)	-0.949
0.387 (1/24/2017)	1.75 (5/27/2016)	(0.387 - 1.75)/(9 - 7)	-0.6815
0.427 (4/5/2017)	1.75 (5/27/2016)	(0.427 - 1.75)/(10 - 7)	-0.441
2.27 (7/19/2017)	1.75 (5/27/2016)	(2.27 - 1.75)/(11 - 7)	0.13
0.387 (1/24/2017)	0.801 (7/11/2016)	(0.387 - 0.801)/(9 - 8)	-0.414
0.427 (4/5/2017)	0.801 (7/11/2016)	(0.427 - 0.801)/(10 - 8)	-0.187
2.27 (7/19/2017)	0.801 (7/11/2016)	(2.27 - 0.801)/(11 - 8)	0.489667
0.427 (4/5/2017)	0.387 (1/24/2017)	(0.427 - 0.387)/(10 - 9)	0.04
2.27 (7/19/2017)	0.387 (1/24/2017)	(2.27 - 0.387)/(11 - 9)	0.9415

2.27 (7/19/2017)	0.427 (4/5/2017)	(2.27 - 0.427)/(11 - 10)	1.843

Number of Q values = 55

Ordered Q Values

n	Q
1	-1.741
2	-0.949
3	-0.69
4	-0.6815
5	-0.607
6	-0.5655
7	-0.56
8	-0.441
9	-0.414
10	-0.34825
11	-0.326333
12	-0.277667
13	-0.2706
14	-0.2605
15	-0.243333
16	-0.2298
17	-0.217571
18	-0.2095
19	-0.205375
20	-0.19825
21	-0.187
22	-0.178111
23	-0.175571
24	-0.162
25	-0.136143
26	-0.114125
27	-0.0898333
28	-0.085
29	-0.0625
30	-0.05
31	-0.0466667
32	-0.04
33	-0.03
34	-0.015
35	0.024
36	0.0356
37	0.0363333
38	0.04
39	0.04
40	0.0816667
41	0.082
42	0.103333
43	0.13
44	0.146667
45	0.148
46	0.21
47	0.294429
48	0.489667
49	0.5055
50	0.513667
51	0.53
52	0.61
53	0.9415
54	1.571
55	1.843

Sen's Estimator (Median Q) is -0.085

Time Period	Observations
8/12/2015	1
10/15/2015	1
11/19/2015	1
1/5/2016	1
2/16/2016	1

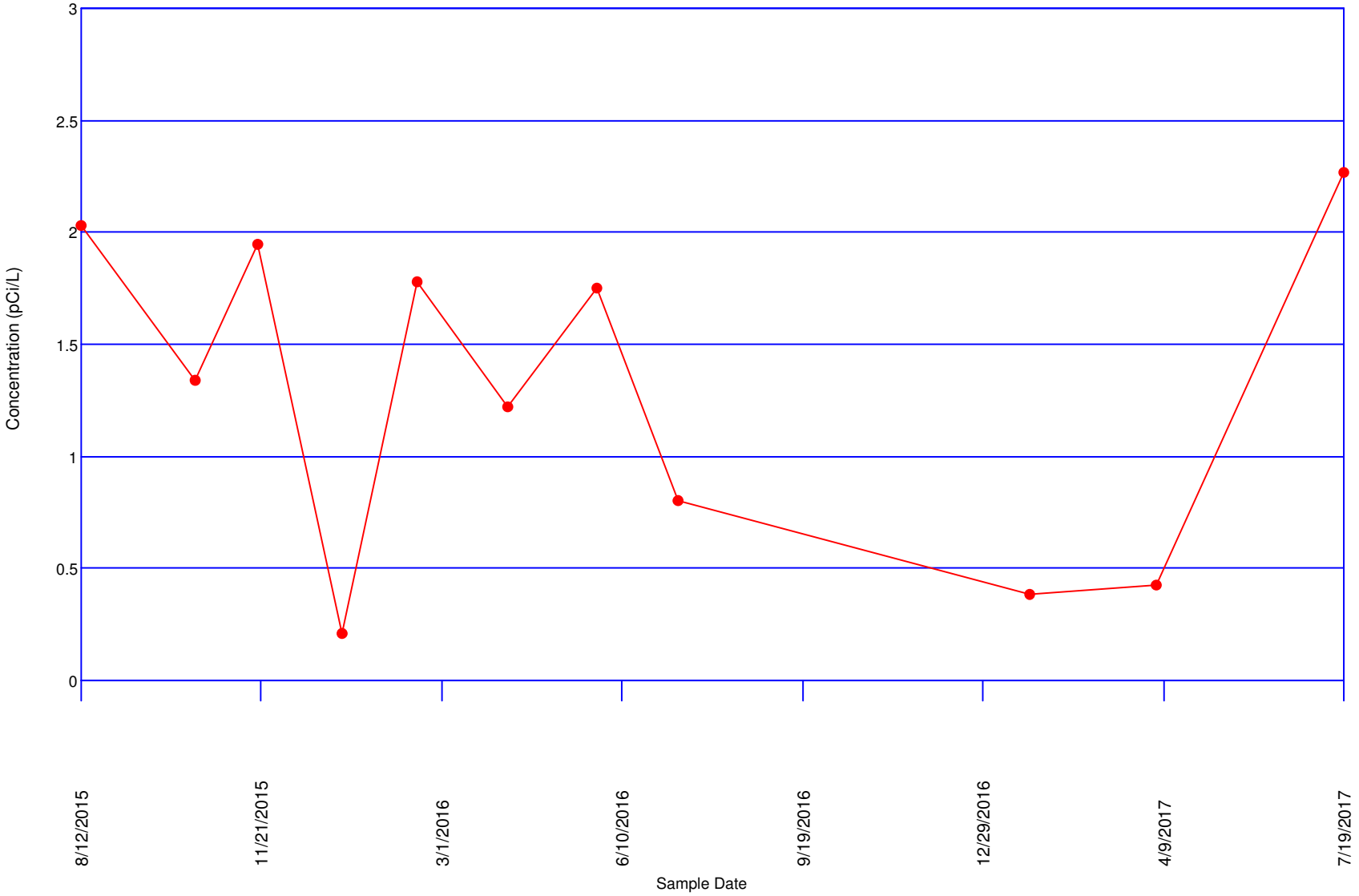
4/7/2016	1
5/27/2016	1
7/11/2016	1
1/24/2017	1
4/5/2017	1
7/19/2017	1

There are 0 time periods with multiple data

A = 0
B = 0
C = 0
D = 0
E = 0
F = 0
a = 2970
b = 8910
c = 220
Group Variance = 165
For 90% confidence interval (two-tailed), Z at (1-0.9)/2 = 1.64485
C = 21.1285
M1 = (55 - 21.1285)/2.0 = 16.9357
M2 = (55 + 21.1285)/2.0 + 1 = 39.0643
Lower limit is -0.217571 = Q(17)
Upper limit is 0.04 = Q(39)
-0.217571 < 0 < 0.04 indicating no trend in data.

Radium-228

Time-Series Graph of MW-3



Concentrations (mg/L)

Parameter: Sulfate

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

Total Measurements: 88
Total Non-Detect: 0
Percent Non-Detects: 0%
Total Background Measurements: 11
There is 1 background location

Loc.	Meas.	ND	Date	Conc.	Original
BG-1	11	0 (0%)	8/12/2015	23	23
			10/15/2015	15.1	15.1
			11/18/2015	17.5	17.5
			1/4/2016	19.5	19.5
			2/16/2016	18.6	18.6
			4/5/2016	19.6	19.6
			5/26/2016	19.3	19.3
			7/12/2016	18.2	18.2
			1/23/2017	20	20
			4/3/2017	18.5	18.5
			7/17/2017	17.8	17.8

There are 7 compliance locations

Loc.	Meas.	ND	Date	Conc.	Original
MW-1	11	0 (0%)	8/12/2015	23 J	23 J
			10/15/2015	13.1	13.1
			11/20/2015	9.8	9.8
			1/6/2016	11.2	11.2
			2/17/2016	8.7	8.7
			4/6/2016	10.5	10.5
			5/27/2016	10.9	10.9
			7/12/2016	9.4	9.4
			1/25/2017	7	7
			4/5/2017	7.5	7.5
			7/18/2017	9.3	9.3
MW-2	11	0 (0%)	8/12/2015	79	79
			10/15/2015	199	199
			11/19/2015	238	238
			1/6/2016	228	228
			2/17/2016	247	247
			4/6/2016	230	230
			5/27/2016	163	163
			7/12/2016	205	205
			1/26/2017	338	338
			4/5/2017	295	295
			7/18/2017	226	226
MW-3	11	0 (0%)	8/12/2015	24 J	24 J
			10/15/2015	14	14
			11/19/2015	12.3	12.3
			1/5/2016	10	10
			2/16/2016	9.1	9.1
			4/7/2016	12.9	12.9
			5/27/2016	16.8	16.8
			7/11/2016	125	125
			1/24/2017	174	174
			4/5/2017	167	167
			7/19/2017	125	125
MW-4	11	0 (0%)	8/12/2015	11	11
			10/15/2015	7	7
			11/19/2015	5.9	5.9
			1/4/2016	6.3	6.3
			2/16/2016	5.6	5.6
			4/7/2016	3.9	3.9
			5/25/2016	3.4	3.4

			7/13/2016	9.2	9.2
			1/25/2017	10	10
			4/5/2017	9.4	9.4
			7/20/2017	10.8	10.8
MW-5	11	0 (0%)	8/12/2015	4.1	4.1
			10/15/2015	3.7	3.7
			11/18/2015	3.1	3.1
			1/4/2016	4.1	4.1
			2/16/2016	3.6	3.6
			4/5/2016	3.1	3.1
			5/25/2016	3.4	3.4
			7/11/2016	2.6	2.6
			1/23/2017	3.7	3.7
			4/4/2017	4.1	4.1
			7/19/2017	5.6	5.6
MW-6	11	0 (0%)	8/12/2015	48	48
			10/19/2015	66.1	66.1
			11/20/2015	137	137
			1/5/2016	194	194
			2/17/2016	87.7	87.7
			4/5/2016	214	214
			5/26/2016	51.6	51.6
			7/11/2016	53.8	53.8
			1/24/2017	145	145
			4/4/2017	179	179
			7/19/2017	86.9	86.9
MW-8	11	0 (0%)	8/12/2015	6.3	6.3
			10/15/2015	6.1	6.1
			11/20/2015	4.4	4.4
			1/6/2016	5.5	5.5
			2/18/2016	5.6	5.6
			4/6/2016	5.7	5.7
			5/26/2016	6	6
			7/12/2016	5.9	5.9
			1/24/2017	6	6
			4/4/2017	6.5	6.5
			7/17/2017	6.3	6.3

There are 0 unused locations

Loc.	Meas.	ND	Date	Conc.	Original

Rosner's Test for Outliers

Parameter: Sulfate

All Locations

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

Data set mean = 55.8705

10 most extreme of 88 measurements

by order of magnitude difference from the mean

1	1/26/2017	MW-2	338	282.13
2	4/5/2017	MW-2	295	239.13
3	2/17/2016	MW-2	247	191.13
4	11/19/2015	MW-2	238	182.13
5	4/6/2016	MW-2	230	174.13
6	1/6/2016	MW-2	228	172.13
7	7/18/2017	MW-2	226	170.13
8	4/5/2016	MW-6	214	158.13
9	7/12/2016	MW-2	205	149.13
10	10/15/2015	MW-2	199	143.13

Iteration i = 9

Mean of 79 measurements = 34.1215
Std Dev = 52.5041
x(i+1) = 199 from measurement 10/15/2015 from location MW-2
Rosner Statistic R = |199 - 34.1215|/52.5041 = 3.1403
Lambda(88, 10, 0.05) = 3.3
3.1403 < 3.3 -- No outliers detected for i = 9

Iteration i = 8

Mean of 80 measurements = 36.2575
Std Dev = 55.5588
x(i+1) = 205 from measurement 7/12/2016 from location MW-2
Rosner Statistic R = |205 - 36.2575|/55.5588 = 3.03719
Lambda(88, 9, 0.05) = 3.3044
3.03719 < 3.3044 -- No outliers detected for i = 8

Iteration i = 7

Mean of 81 measurements = 38.4519
Std Dev = 58.6364
x(i+1) = 214 from measurement 4/5/2016 from location MW-6
Rosner Statistic R = |214 - 38.4519|/58.6364 = 2.99384
Lambda(88, 8, 0.05) = 3.3088
2.99384 < 3.3088 -- No outliers detected for i = 7

Iteration i = 6

Mean of 82 measurements = 40.739
Std Dev = 61.8444
x(i+1) = 226 from measurement 7/18/2017 from location MW-2
Rosner Statistic R = |226 - 40.739|/61.8444 = 2.9956
Lambda(88, 7, 0.05) = 3.3132
2.9956 < 3.3132 -- No outliers detected for i = 6

Iteration i = 5

Mean of 83 measurements = 42.9952
Std Dev = 64.8119
x(i+1) = 228 from measurement 1/6/2016 from location MW-2
Rosner Statistic R = |228 - 42.9952|/64.8119 = 2.85449
Lambda(88, 6, 0.05) = 3.3176
2.85449 < 3.3176 -- No outliers detected for i = 5

Iteration i = 4

Mean of 84 measurements = 45.2214
Std Dev = 67.5743
x(i+1) = 230 from measurement 4/6/2016 from location MW-2

Rosner Statistic R = |230 - 45.2214|/67.5743 = 2.73445
Lambda(88, 5, 0.05) = 3.322
2.73445 < 3.322 -- No outliers detected for i = 4

Iteration i = 3
Mean of 85 measurements = 47.4894
Std Dev = 70.3502
x(i+1) = 238 from measurement 11/19/2015 from location MW-2
Rosner Statistic R = |238 - 47.4894|/70.3502 = 2.70803
Lambda(88, 4, 0.05) = 3.33
2.70803 < 3.33 -- No outliers detected for i = 3

Iteration i = 2
Mean of 86 measurements = 49.8093
Std Dev = 73.1694
x(i+1) = 247 from measurement 2/17/2016 from location MW-2
Rosner Statistic R = |247 - 49.8093|/73.1694 = 2.69499
Lambda(88, 3, 0.05) = 3.332
2.69499 < 3.332 -- No outliers detected for i = 2

Iteration i = 1
Mean of 87 measurements = 52.6276
Std Dev = 77.3468
x(i+1) = 295 from measurement 4/5/2017 from location MW-2
Rosner Statistic R = |295 - 52.6276|/77.3468 = 3.13358
Lambda(88, 2, 0.05) = 3.332
3.13358 < 3.332 -- No outliers detected for i = 1

Iteration i = 0
Mean of 88 measurements = 55.8705
Std Dev = 82.6994
x(i+1) = 338 from measurement 1/26/2017 from location MW-2
Rosner Statistic R = |338 - 55.8705|/82.6994 = 3.41151
Lambda(88, 1, 0.05) = 3.342
3.41151 > 3.342 -- Measurement 1/26/2017 for location MW-2 is an outlier

Shapiro-Wilks Test of Normality

Parameter: Sulfate
All Locations
Normality Test of Parameter Concentrations
Original Data (Not Transformed)
Non-Detects Replaced with Detection Limit
K = 5 for 11 measurements

i	x(i)	x(n-i+1)	x(n-1+1)-x(i)	a(n-i+1)	b(i)
1	15.1	23	7.9	0.5601	4.42479
2	17.5	20	2.5	0.3315	0.82875
3	17.8	19.6	1.8	0.226	0.4068
4	18.2	19.5	1.3	0.1429	0.18577
5	18.5	19.3	0.8	0.0695	0.0556
6	18.6	18.6	0		
7	19.3	18.5	-0.8		
8	19.5	18.2	-1.3		
9	19.6	17.8	-1.8		
10	20	17.5	-2.5		
11	23	15.1	-7.9		

Sum of b values = 5.90171
Sample Standard Deviation = 1.93189
W Statistic = 0.933239

5% Critical value of 0.85 is less than 0.933239
Data is normally distributed at 95% level of significance

1% Critical value of 0.792 is less than 0.933239
Data is normally distributed at 99% level of significance

Parametric Prediction Interval Analysis

Inter-Well Comparison

Parameter: Sulfate

Original Data (Not Transformed)

Non-Detects Replaced with 1/2 DL

Inter-Well Unified Guid. Formula 95% One-Sided Comparison

Background Samples = 11
Background Mean = 18.8273
Background Std Dev = 1.93189

Number of comparisons = 7
Future Samples (k) = 7
Actual confidence level is 1.0 - (0.05/7) = 99.2857 %
t is Percentile of Student's T-Test (0.95/7) = 0.992857
Degrees of Freedom = 11 (background observations) - 1
t(0.992857, 11) = 2.99548

Well MW-1

Date	Samples	Mean	Interval	Significant
7/18/2017	1	9.3	[0, 24.8715]	FALSE

Well MW-2

Date	Samples	Mean	Interval	Significant
7/18/2017	**1**	**226**	**[0, 24.8715]**	**TRUE**

Well MW-3

Date	Samples	Mean	Interval	Significant
7/19/2017	**1**	**125**	**[0, 24.8715]**	**TRUE**

Well MW-4

Date	Samples	Mean	Interval	Significant
7/20/2017	1	10.8	[0, 24.8715]	FALSE

Well MW-5

Date	Samples	Mean	Interval	Significant
7/19/2017	1	5.6	[0, 24.8715]	FALSE

Well MW-6

Date	Samples	Mean	Interval	Significant
7/19/2017	**1**	**86.9**	**[0, 24.8715]**	**TRUE**

Well MW-8

Date	Samples	Mean	Interval	Significant
7/17/2017	1	6.3	[0, 24.8715]	FALSE

Sen's Slope Analysis

Parameter: Sulfate
Location: MW-2
Original Data (Not Transformed)
Non-Detects Replaced with Detection Limit

90% Confidence Level

Xj	Xk	(Xj - Xk)/(j-k)	Q
199 (10/15/2015)	79 (8/12/2015)	(199 - 79)/(2 - 1)	120
238 (11/19/2015)	79 (8/12/2015)	(238 - 79)/(3 - 1)	79.5
228 (1/6/2016)	79 (8/12/2015)	(228 - 79)/(4 - 1)	49.6667
247 (2/17/2016)	79 (8/12/2015)	(247 - 79)/(5 - 1)	42
230 (4/6/2016)	79 (8/12/2015)	(230 - 79)/(6 - 1)	30.2
163 (5/27/2016)	79 (8/12/2015)	(163 - 79)/(7 - 1)	14
205 (7/12/2016)	79 (8/12/2015)	(205 - 79)/(8 - 1)	18
338 (1/26/2017)	79 (8/12/2015)	(338 - 79)/(9 - 1)	32.375
295 (4/5/2017)	79 (8/12/2015)	(295 - 79)/(10 - 1)	24
226 (7/18/2017)	79 (8/12/2015)	(226 - 79)/(11 - 1)	14.7
238 (11/19/2015)	199 (10/15/2015)	(238 - 199)/(3 - 2)	39
228 (1/6/2016)	199 (10/15/2015)	(228 - 199)/(4 - 2)	14.5
247 (2/17/2016)	199 (10/15/2015)	(247 - 199)/(5 - 2)	16
230 (4/6/2016)	199 (10/15/2015)	(230 - 199)/(6 - 2)	7.75
163 (5/27/2016)	199 (10/15/2015)	(163 - 199)/(7 - 2)	-7.2
205 (7/12/2016)	199 (10/15/2015)	(205 - 199)/(8 - 2)	1
338 (1/26/2017)	199 (10/15/2015)	(338 - 199)/(9 - 2)	19.8571
295 (4/5/2017)	199 (10/15/2015)	(295 - 199)/(10 - 2)	12
226 (7/18/2017)	199 (10/15/2015)	(226 - 199)/(11 - 2)	3
228 (1/6/2016)	238 (11/19/2015)	(228 - 238)/(4 - 3)	-10
247 (2/17/2016)	238 (11/19/2015)	(247 - 238)/(5 - 3)	4.5
230 (4/6/2016)	238 (11/19/2015)	(230 - 238)/(6 - 3)	-2.66667
163 (5/27/2016)	238 (11/19/2015)	(163 - 238)/(7 - 3)	-18.75
205 (7/12/2016)	238 (11/19/2015)	(205 - 238)/(8 - 3)	-6.6
338 (1/26/2017)	238 (11/19/2015)	(338 - 238)/(9 - 3)	16.6667
295 (4/5/2017)	238 (11/19/2015)	(295 - 238)/(10 - 3)	8.14286
226 (7/18/2017)	238 (11/19/2015)	(226 - 238)/(11 - 3)	-1.5
247 (2/17/2016)	228 (1/6/2016)	(247 - 228)/(5 - 4)	19
230 (4/6/2016)	228 (1/6/2016)	(230 - 228)/(6 - 4)	1
163 (5/27/2016)	228 (1/6/2016)	(163 - 228)/(7 - 4)	-21.6667
205 (7/12/2016)	228 (1/6/2016)	(205 - 228)/(8 - 4)	-5.75
338 (1/26/2017)	228 (1/6/2016)	(338 - 228)/(9 - 4)	22
295 (4/5/2017)	228 (1/6/2016)	(295 - 228)/(10 - 4)	11.1667
226 (7/18/2017)	228 (1/6/2016)	(226 - 228)/(11 - 4)	-0.285714
230 (4/6/2016)	247 (2/17/2016)	(230 - 247)/(6 - 5)	-17
163 (5/27/2016)	247 (2/17/2016)	(163 - 247)/(7 - 5)	-42
205 (7/12/2016)	247 (2/17/2016)	(205 - 247)/(8 - 5)	-14
338 (1/26/2017)	247 (2/17/2016)	(338 - 247)/(9 - 5)	22.75
295 (4/5/2017)	247 (2/17/2016)	(295 - 247)/(10 - 5)	9.6
226 (7/18/2017)	247 (2/17/2016)	(226 - 247)/(11 - 5)	-3.5
163 (5/27/2016)	230 (4/6/2016)	(163 - 230)/(7 - 6)	-67
205 (7/12/2016)	230 (4/6/2016)	(205 - 230)/(8 - 6)	-12.5
338 (1/26/2017)	230 (4/6/2016)	(338 - 230)/(9 - 6)	36
295 (4/5/2017)	230 (4/6/2016)	(295 - 230)/(10 - 6)	16.25
226 (7/18/2017)	230 (4/6/2016)	(226 - 230)/(11 - 6)	-0.8
205 (7/12/2016)	163 (5/27/2016)	(205 - 163)/(8 - 7)	42
338 (1/26/2017)	163 (5/27/2016)	(338 - 163)/(9 - 7)	87.5
295 (4/5/2017)	163 (5/27/2016)	(295 - 163)/(10 - 7)	44
226 (7/18/2017)	163 (5/27/2016)	(226 - 163)/(11 - 7)	15.75
338 (1/26/2017)	205 (7/12/2016)	(338 - 205)/(9 - 8)	133
295 (4/5/2017)	205 (7/12/2016)	(295 - 205)/(10 - 8)	45
226 (7/18/2017)	205 (7/12/2016)	(226 - 205)/(11 - 8)	7
295 (4/5/2017)	338 (1/26/2017)	(295 - 338)/(10 - 9)	-43
226 (7/18/2017)	338 (1/26/2017)	(226 - 338)/(11 - 9)	-56

Number of Q values = 55

Ordered Q Values

n	Q
1	-69
2	-67
3	-56
4	-43
5	-42
6	-21.6667
7	-18.75
8	-17
9	-14
10	-12.5
11	-10
12	-7.2
13	-6.6
14	-5.75
15	-3.5
16	-2.66667
17	-1.5
18	-0.8
19	-0.285714
20	1
21	1
22	3
23	4.5
24	7
25	7.75
26	8.14286
27	9.6
28	11.1667
29	12
30	14
31	14.5
32	14.7
33	15.75
34	16
35	16.25
36	16.6667
37	18
38	19
39	19.8571
40	22
41	22.75
42	24
43	30.2
44	32.375
45	36
46	39
47	42
48	42
49	44
50	45
51	49.6667
52	79.5
53	87.5
54	120
55	133

Sen's Estimator (Median Q) is 11.1667

Time Period	Observations
8/12/2015	1
10/15/2015	1
11/19/2015	1
1/6/2016	1
2/17/2016	1

4/6/2016	1
5/27/2016	1
7/12/2016	1
1/26/2017	1
4/5/2017	1
7/18/2017	1

There are 0 time periods with multiple data

A = 0
B = 0
C = 0
D = 0
E = 0
F = 0
a = 2970
b = 8910
c = 220
Group Variance = 165
For 90% confidence interval (two-tailed), Z at (1-0.9)/2 = 1.64485
C = 21.1285
M1 = (55 - 21.1285)/2.0 = 16.9357
M2 = (55 + 21.1285)/2.0 + 1 = 39.0643
Lower limit is -1.5 = Q(17)
Upper limit is 19.8571 = Q(39)
-1.5 < 0 < 19.8571 indicating no trend in data.

Sen's Slope Analysis

Parameter: Sulfate
Location: MW-3
Original Data (Not Transformed)
Non-Detects Replaced with Detection Limit

90% Confidence Level

Xj	Xk	(Xj - Xk)/(j-k)	Q
14 (10/15/2015)	24 J (8/12/2015)	(14 - 24)/(2 - 1)	-10
12.3 (11/19/2015)	24 J (8/12/2015)	(12.3 - 24)/(3 - 1)	-5.85
10 (1/5/2016)	24 J (8/12/2015)	(10 - 24)/(4 - 1)	-4.66667
9.1 (2/16/2016)	24 J (8/12/2015)	(9.1 - 24)/(5 - 1)	-3.725
12.9 (4/7/2016)	24 J (8/12/2015)	(12.9 - 24)/(6 - 1)	-2.22
16.8 (5/27/2016)	24 J (8/12/2015)	(16.8 - 24)/(7 - 1)	-1.2
125 (7/11/2016)	24 J (8/12/2015)	(125 - 24)/(8 - 1)	14.4286
174 (1/24/2017)	24 J (8/12/2015)	(174 - 24)/(9 - 1)	18.75
167 (4/5/2017)	24 J (8/12/2015)	(167 - 24)/(10 - 1)	15.8889
125 (7/19/2017)	24 J (8/12/2015)	(125 - 24)/(11 - 1)	10.1
12.3 (11/19/2015)	14 (10/15/2015)	(12.3 - 14)/(3 - 2)	-1.7
10 (1/5/2016)	14 (10/15/2015)	(10 - 14)/(4 - 2)	-2
9.1 (2/16/2016)	14 (10/15/2015)	(9.1 - 14)/(5 - 2)	-1.63333
12.9 (4/7/2016)	14 (10/15/2015)	(12.9 - 14)/(6 - 2)	-0.275
16.8 (5/27/2016)	14 (10/15/2015)	(16.8 - 14)/(7 - 2)	0.56
125 (7/11/2016)	14 (10/15/2015)	(125 - 14)/(8 - 2)	18.5
174 (1/24/2017)	14 (10/15/2015)	(174 - 14)/(9 - 2)	22.8571
167 (4/5/2017)	14 (10/15/2015)	(167 - 14)/(10 - 2)	19.125
125 (7/19/2017)	14 (10/15/2015)	(125 - 14)/(11 - 2)	12.3333
10 (1/5/2016)	12.3 (11/19/2015)	(10 - 12.3)/(4 - 3)	-2.3
9.1 (2/16/2016)	12.3 (11/19/2015)	(9.1 - 12.3)/(5 - 3)	-1.6
12.9 (4/7/2016)	12.3 (11/19/2015)	(12.9 - 12.3)/(6 - 3)	0.2
16.8 (5/27/2016)	12.3 (11/19/2015)	(16.8 - 12.3)/(7 - 3)	1.125
125 (7/11/2016)	12.3 (11/19/2015)	(125 - 12.3)/(8 - 3)	22.54
174 (1/24/2017)	12.3 (11/19/2015)	(174 - 12.3)/(9 - 3)	26.95
167 (4/5/2017)	12.3 (11/19/2015)	(167 - 12.3)/(10 - 3)	22.1
125 (7/19/2017)	12.3 (11/19/2015)	(125 - 12.3)/(11 - 3)	14.0875
9.1 (2/16/2016)	10 (1/5/2016)	(9.1 - 10)/(5 - 4)	-0.9
12.9 (4/7/2016)	10 (1/5/2016)	(12.9 - 10)/(6 - 4)	1.45
16.8 (5/27/2016)	10 (1/5/2016)	(16.8 - 10)/(7 - 4)	2.26667
125 (7/11/2016)	10 (1/5/2016)	(125 - 10)/(8 - 4)	28.75
174 (1/24/2017)	10 (1/5/2016)	(174 - 10)/(9 - 4)	32.8
167 (4/5/2017)	10 (1/5/2016)	(167 - 10)/(10 - 4)	26.1667
125 (7/19/2017)	10 (1/5/2016)	(125 - 10)/(11 - 4)	16.4286
12.9 (4/7/2016)	9.1 (2/16/2016)	(12.9 - 9.1)/(6 - 5)	3.8
16.8 (5/27/2016)	9.1 (2/16/2016)	(16.8 - 9.1)/(7 - 5)	3.85
125 (7/11/2016)	9.1 (2/16/2016)	(125 - 9.1)/(8 - 5)	38.6333
174 (1/24/2017)	9.1 (2/16/2016)	(174 - 9.1)/(9 - 5)	41.225
167 (4/5/2017)	9.1 (2/16/2016)	(167 - 9.1)/(10 - 5)	31.58
125 (7/19/2017)	9.1 (2/16/2016)	(125 - 9.1)/(11 - 5)	19.3167
16.8 (5/27/2016)	12.9 (4/7/2016)	(16.8 - 12.9)/(7 - 6)	3.9
125 (7/11/2016)	12.9 (4/7/2016)	(125 - 12.9)/(8 - 6)	56.05
174 (1/24/2017)	12.9 (4/7/2016)	(174 - 12.9)/(9 - 6)	53.7
167 (4/5/2017)	12.9 (4/7/2016)	(167 - 12.9)/(10 - 6)	38.525
125 (7/19/2017)	12.9 (4/7/2016)	(125 - 12.9)/(11 - 6)	22.42
125 (7/11/2016)	16.8 (5/27/2016)	(125 - 16.8)/(8 - 7)	108.2
174 (1/24/2017)	16.8 (5/27/2016)	(174 - 16.8)/(9 - 7)	78.6
167 (4/5/2017)	16.8 (5/27/2016)	(167 - 16.8)/(10 - 7)	50.0667
125 (7/19/2017)	16.8 (5/27/2016)	(125 - 16.8)/(11 - 7)	27.05
174 (1/24/2017)	125 (7/11/2016)	(174 - 125)/(9 - 8)	49
167 (4/5/2017)	125 (7/11/2016)	(167 - 125)/(10 - 8)	21
125 (7/19/2017)	125 (7/11/2016)	(125 - 125)/(11 - 8)	0
167 (4/5/2017)	174 (1/24/2017)	(167 - 174)/(10 - 9)	-7
125 (7/19/2017)	174 (1/24/2017)	(125 - 174)/(11 - 9)	-24.5

Number of Q values = 55

Ordered Q Values

n	Q
1	-42
2	-24.5
3	-10
4	-7
5	-5.85
6	-4.66667
7	-3.725
8	-2.3
9	-2.22
10	-2
11	-1.7
12	-1.63333
13	-1.6
14	-1.2
15	-0.9
16	-0.275
17	0
18	0.2
19	0.56
20	1.125
21	1.45
22	2.26667
23	3.8
24	3.85
25	3.9
26	10.1
27	12.3333
28	14.0875
29	14.4286
30	15.8889
31	16.4286
32	18.5
33	18.75
34	19.125
35	19.3167
36	21
37	22.1
38	22.42
39	22.54
40	22.8571
41	26.1667
42	26.95
43	27.05
44	28.75
45	31.58
46	32.8
47	38.525
48	38.6333
49	41.225
50	49
51	50.0667
52	53.7
53	56.05
54	78.6
55	108.2

Sen's Estimator (Median Q) is 14.0875

Tied Group	Value	Members
1	125	2

Time Period	Observations
8/12/2015	1
10/15/2015	1

11/19/2015	1
1/5/2016	1
2/16/2016	1
4/7/2016	1
5/27/2016	1
7/11/2016	1
1/24/2017	1
4/5/2017	1
7/19/2017	1

There are 0 time periods with multiple data

A = 18
B = 0
C = 0
D = 0
E = 2
F = 0
a = 2970
b = 8910
c = 220
Group Variance = 164
For 90% confidence interval (two-tailed), Z at (1-0.9)/2 = 1.64485
C = 21.0644
M1 = (55 - 21.0644)/2.0 = 16.9678
M2 = (55 + 21.0644)/2.0 + 1 = 39.0322
Lower limit is 0 = Q(17)
Upper limit is 22.54 = Q(39)
0 < 0 < 22.54 indicating no trend in data.

Sen's Slope Analysis

Parameter: Sulfate

Location: MW-6

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

90% Confidence Level

Xj	Xk	(Xj - Xk)/(j-k)	Q
66.1 (10/19/2015)	48 (8/12/2015)	(66.1 - 48)/(2 - 1)	18.1
137 (11/20/2015)	48 (8/12/2015)	(137 - 48)/(3 - 1)	44.5
194 (1/5/2016)	48 (8/12/2015)	(194 - 48)/(4 - 1)	48.6667
87.7 (2/17/2016)	48 (8/12/2015)	(87.7 - 48)/(5 - 1)	9.925
214 (4/5/2016)	48 (8/12/2015)	(214 - 48)/(6 - 1)	33.2
51.6 (5/26/2016)	48 (8/12/2015)	(51.6 - 48)/(7 - 1)	0.6
53.8 (7/11/2016)	48 (8/12/2015)	(53.8 - 48)/(8 - 1)	0.828571
145 (1/24/2017)	48 (8/12/2015)	(145 - 48)/(9 - 1)	12.125
179 (4/4/2017)	48 (8/12/2015)	(179 - 48)/(10 - 1)	14.5556
86.9 (7/19/2017)	48 (8/12/2015)	(86.9 - 48)/(11 - 1)	3.89
137 (11/20/2015)	66.1 (10/19/2015)	(137 - 66.1)/(3 - 2)	70.9
194 (1/5/2016)	66.1 (10/19/2015)	(194 - 66.1)/(4 - 2)	63.95
87.7 (2/17/2016)	66.1 (10/19/2015)	(87.7 - 66.1)/(5 - 2)	7.2
214 (4/5/2016)	66.1 (10/19/2015)	(214 - 66.1)/(6 - 2)	36.975
51.6 (5/26/2016)	66.1 (10/19/2015)	(51.6 - 66.1)/(7 - 2)	-2.9
53.8 (7/11/2016)	66.1 (10/19/2015)	(53.8 - 66.1)/(8 - 2)	-2.05
145 (1/24/2017)	66.1 (10/19/2015)	(145 - 66.1)/(9 - 2)	11.2714
179 (4/4/2017)	66.1 (10/19/2015)	(179 - 66.1)/(10 - 2)	14.1125
86.9 (7/19/2017)	66.1 (10/19/2015)	(86.9 - 66.1)/(11 - 2)	2.31111
194 (1/5/2016)	137 (11/20/2015)	(194 - 137)/(4 - 3)	57
87.7 (2/17/2016)	137 (11/20/2015)	(87.7 - 137)/(5 - 3)	-24.65
214 (4/5/2016)	137 (11/20/2015)	(214 - 137)/(6 - 3)	25.6667
51.6 (5/26/2016)	137 (11/20/2015)	(51.6 - 137)/(7 - 3)	-21.35
53.8 (7/11/2016)	137 (11/20/2015)	(53.8 - 137)/(8 - 3)	-16.64
145 (1/24/2017)	137 (11/20/2015)	(145 - 137)/(9 - 3)	1.33333
179 (4/4/2017)	137 (11/20/2015)	(179 - 137)/(10 - 3)	6
86.9 (7/19/2017)	137 (11/20/2015)	(86.9 - 137)/(11 - 3)	-6.2625
87.7 (2/17/2016)	194 (1/5/2016)	(87.7 - 194)/(5 - 4)	-106.3
214 (4/5/2016)	194 (1/5/2016)	(214 - 194)/(6 - 4)	10
51.6 (5/26/2016)	194 (1/5/2016)	(51.6 - 194)/(7 - 4)	-47.4667
53.8 (7/11/2016)	194 (1/5/2016)	(53.8 - 194)/(8 - 4)	-35.05
145 (1/24/2017)	194 (1/5/2016)	(145 - 194)/(9 - 4)	-9.8
179 (4/4/2017)	194 (1/5/2016)	(179 - 194)/(10 - 4)	-2.5
86.9 (7/19/2017)	194 (1/5/2016)	(86.9 - 194)/(11 - 4)	-15.3
214 (4/5/2016)	87.7 (2/17/2016)	(214 - 87.7)/(6 - 5)	126.3
51.6 (5/26/2016)	87.7 (2/17/2016)	(51.6 - 87.7)/(7 - 5)	-18.05
53.8 (7/11/2016)	87.7 (2/17/2016)	(53.8 - 87.7)/(8 - 5)	-11.3
145 (1/24/2017)	87.7 (2/17/2016)	(145 - 87.7)/(9 - 5)	14.325
179 (4/4/2017)	87.7 (2/17/2016)	(179 - 87.7)/(10 - 5)	18.26
86.9 (7/19/2017)	87.7 (2/17/2016)	(86.9 - 87.7)/(11 - 5)	-0.133333
51.6 (5/26/2016)	214 (4/5/2016)	(51.6 - 214)/(7 - 6)	-162.4
53.8 (7/11/2016)	214 (4/5/2016)	(53.8 - 214)/(8 - 6)	-80.1
145 (1/24/2017)	214 (4/5/2016)	(145 - 214)/(9 - 6)	-23
179 (4/4/2017)	214 (4/5/2016)	(179 - 214)/(10 - 6)	-8.75
86.9 (7/19/2017)	214 (4/5/2016)	(86.9 - 214)/(11 - 6)	-25.42
53.8 (7/11/2016)	51.6 (5/26/2016)	(53.8 - 51.6)/(8 - 7)	2.2
145 (1/24/2017)	51.6 (5/26/2016)	(145 - 51.6)/(9 - 7)	46.7
179 (4/4/2017)	51.6 (5/26/2016)	(179 - 51.6)/(10 - 7)	42.4667
86.9 (7/19/2017)	51.6 (5/26/2016)	(86.9 - 51.6)/(11 - 7)	8.825
145 (1/24/2017)	53.8 (7/11/2016)	(145 - 53.8)/(9 - 8)	91.2
179 (4/4/2017)	53.8 (7/11/2016)	(179 - 53.8)/(10 - 8)	62.6
86.9 (7/19/2017)	53.8 (7/11/2016)	(86.9 - 53.8)/(11 - 8)	11.0333
179 (4/4/2017)	145 (1/24/2017)	(179 - 145)/(10 - 9)	34
86.9 (7/19/2017)	145 (1/24/2017)	(86.9 - 145)/(11 - 9)	-29.05

86.9 (7/19/2017)	179 (4/4/2017)	(86.9 - 179)/(11 - 10)	-92.1

Number of Q values = 55

Ordered Q Values

n	Q
1	-162.4
2	-106.3
3	-92.1
4	-80.1
5	-47.4667
6	-35.05
7	-29.05
8	-25.42
9	-24.65
10	-23
11	-21.35
12	-18.05
13	-16.64
14	-15.3
15	-11.3
16	-9.8
17	-8.75
18	-6.2625
19	-2.9
20	-2.5
21	-2.05
22	-0.133333
23	0.6
24	0.828571
25	1.33333
26	2.2
27	2.31111
28	3.89
29	6
30	7.2
31	8.825
32	9.925
33	10
34	11.0333
35	11.2714
36	12.125
37	14.1125
38	14.325
39	14.5556
40	18.1
41	18.26
42	25.6667
43	33.2
44	34
45	36.975
46	42.4667
47	44.5
48	46.7
49	48.6667
50	57
51	62.6
52	63.95
53	70.9
54	91.2
55	126.3

Sen's Estimator (Median Q) is 3.89

Time Period	Observations
8/12/2015	1
10/19/2015	1
11/20/2015	1
1/5/2016	1
2/17/2016	1

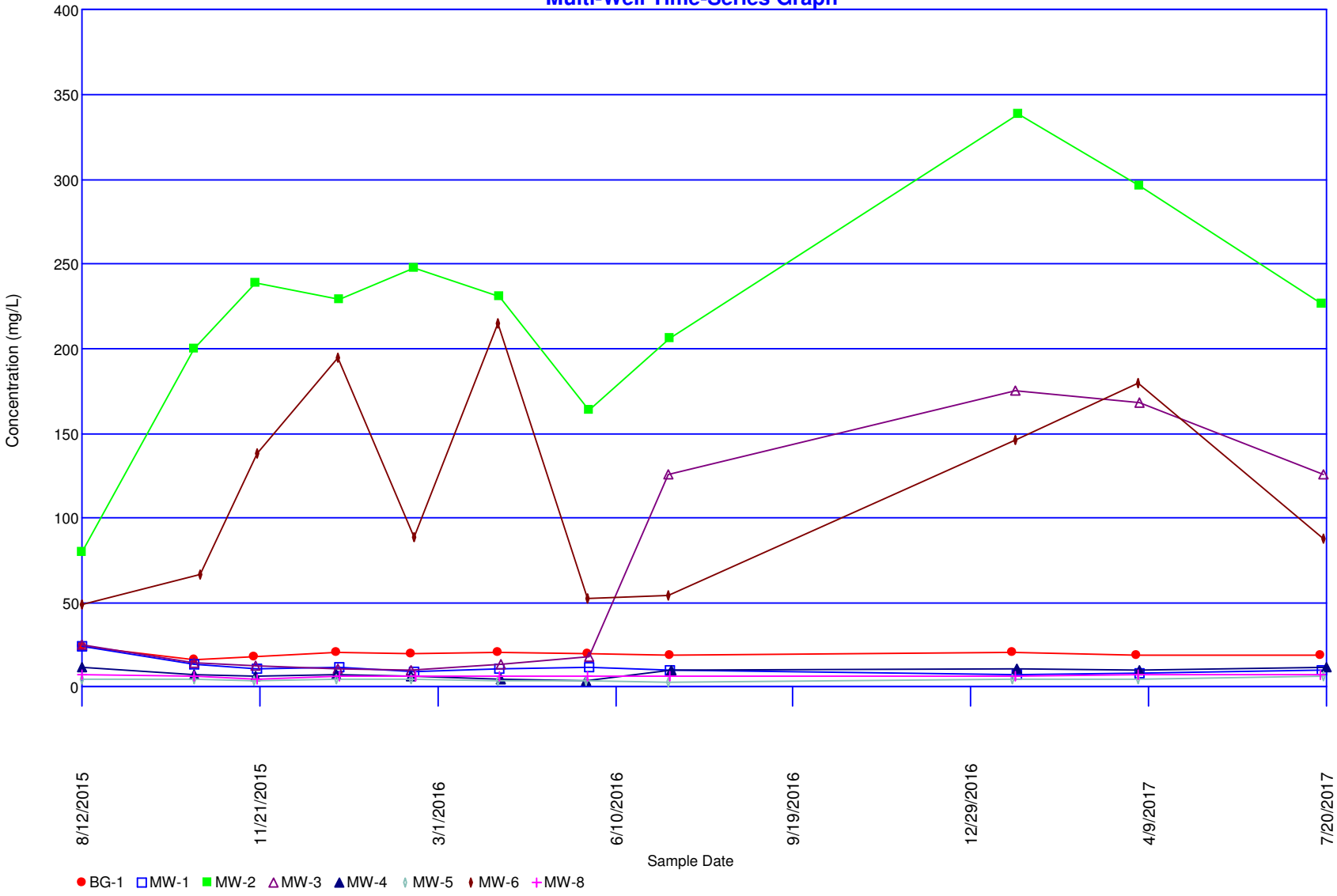
4/5/2016	1
5/26/2016	1
7/11/2016	1
1/24/2017	1
4/4/2017	1
7/19/2017	1

There are 0 time periods with multiple data

A = 0
B = 0
C = 0
D = 0
E = 0
F = 0
a = 2970
b = 8910
c = 220
Group Variance = 165
For 90% confidence interval (two-tailed), Z at (1-0.9)/2 = 1.64485
C = 21.1285
M1 = (55 - 21.1285)/2.0 = 16.9357
M2 = (55 + 21.1285)/2.0 + 1 = 39.0643
Lower limit is -8.75 = Q(17)
Upper limit is 14.5556 = Q(39)
-8.75 < 0 < 14.5556 indicating no trend in data.

Sulfate

Multi-Well Time-Series Graph



Concentrations (mg/L)

Parameter: Total Dissolved Solids

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

Total Measurements: 88
Total Non-Detect: 0
Percent Non-Detects: 0%
Total Background Measurements: 11
There is 1 background location

Loc.	Meas.	ND	Date	Conc.	Original
BG-1	11	0 (0%)	8/12/2015	690 B	690 B
			10/15/2015	654	654
			11/18/2015	652	652
			1/4/2016	643	643
			2/16/2016	650	650
			4/5/2016	628	628
			5/26/2016	633	633
			7/12/2016	668	668
			1/23/2017	623	623
			4/3/2017	2630	2630
			7/17/2017	606	606

There are 7 compliance locations

Loc.	Meas.	ND	Date	Conc.	Original
MW-1	11	0 (0%)	8/12/2015	1500	1500
			10/15/2015	370	370
			11/20/2015	569	569
			1/6/2016	700	700
			2/17/2016	593	593
			4/6/2016	770	770
			5/27/2016	920	920
			7/12/2016	1410	1410
			1/25/2017	931	931
			4/5/2017	1180	1180
			7/18/2017	1060	1060
MW-2	11	0 (0%)	8/12/2015	1700	1700
			10/15/2015	2120	2120
			11/19/2015	257	257
			1/6/2016	2480	2480
			2/17/2016	2470	2470
			4/6/2016	2700	2700
			5/27/2016	2870	2870
			7/12/2016	3290	3290
			1/26/2017	2780	2780
			4/5/2017	2060	2060
			7/18/2017	2670	2670
MW-3	11	0 (0%)	8/12/2015	2100	2100
			10/15/2015	2770	2770
			11/19/2015	256	256
			1/5/2016	2490	2490
			2/16/2016	2270	2270
			4/7/2016	2530	2530
			5/27/2016	3180	3180
			7/11/2016	2440	2440
			1/24/2017	303	303
			4/5/2017	1800	1800
			7/19/2017	1870	1870
MW-4	11	0 (0%)	8/12/2015	820	820
			10/15/2015	1110	1110
			11/19/2015	395	395
			1/4/2016	806	806
			2/16/2016	800	800
			4/7/2016	513	513
			5/25/2016	486	486

			7/13/2016	1040	1040
			1/25/2017	1150	1150
			4/5/2017	1030	1030
			7/20/2017	1150	1150
MW-5	11	0 (0%)	8/12/2015	230	230
			10/15/2015	296	296
			11/18/2015	235	235
			1/4/2016	259	259
			2/16/2016	263	263
			4/5/2016	194	194
			5/25/2016	229	229
			7/11/2016	221	221
			1/23/2017	220	220
			4/4/2017	195	195
			7/19/2017	228	228
MW-6	11	0 (0%)	8/12/2015	680 B	680 B
			10/19/2015	620	620
			11/20/2015	429	429
			1/5/2016	946	946
			2/17/2016	783	783
			4/5/2016	689	689
			5/26/2016	659	659
			7/11/2016	660	660
			1/24/2017	776	776
			4/4/2017	688	688
			7/19/2017	692	692
MW-8	11	0 (0%)	8/12/2015	1300 B	1300 B
			10/15/2015	1560	1560
			11/20/2015	224	224
			1/6/2016	1410	1410
			2/18/2016	1050	1050
			4/6/2016	1130	1130
			5/26/2016	1530	1530
			7/12/2016	1340	1340
			1/24/2017	1270	1270
			4/4/2017	772	772
			7/17/2017	934	934

There are 0 unused locations

Loc.	Meas.	ND	Date	Conc.	Original

Rosner's Test for Outliers

Parameter: Total Dissolved Solids

All Locations

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

Data set mean = 1119.3

10 most extreme of 88 measurements

by order of magnitude difference from the mean

1	7/12/2016	MW-2	3290	2170.7
2	5/27/2016	MW-3	3180	2060.7
3	5/27/2016	MW-2	2870	1750.7
4	1/26/2017	MW-2	2780	1660.7
5	10/15/2015	MW-3	2770	1650.7
6	4/6/2016	MW-2	2700	1580.7
7	7/18/2017	MW-2	2670	1550.7
8	4/3/2017	BG-1	2630	1510.7
9	4/7/2016	MW-3	2530	1410.7
10	1/5/2016	MW-3	2490	1370.7

Iteration i = 9

Mean of 79 measurements = 925.038
Std Dev = 619.382
x(i+1) = 2490 from measurement 1/5/2016 from location MW-3
Rosner Statistic R = |2490 - 925.038|/619.382 = 2.52665
Lambda(88, 10, 0.05) = 3.3
2.52665 < 3.3 -- No outliers detected for i = 9

Iteration i = 8

Mean of 80 measurements = 945.1
Std Dev = 641.075
x(i+1) = 2530 from measurement 4/7/2016 from location MW-3
Rosner Statistic R = |2530 - 945.1|/641.075 = 2.47225
Lambda(88, 9, 0.05) = 3.3044
2.47225 < 3.3044 -- No outliers detected for i = 8

Iteration i = 7

Mean of 81 measurements = 965.901
Std Dev = 663.994
x(i+1) = 2630 from measurement 4/3/2017 from location BG-1
Rosner Statistic R = |2630 - 965.901|/663.994 = 2.5062
Lambda(88, 8, 0.05) = 3.3088
2.5062 < 3.3088 -- No outliers detected for i = 7

Iteration i = 6

Mean of 82 measurements = 986.683
Std Dev = 686.191
x(i+1) = 2670 from measurement 7/18/2017 from location MW-2
Rosner Statistic R = |2670 - 986.683|/686.191 = 2.45313
Lambda(88, 7, 0.05) = 3.3132
2.45313 < 3.3132 -- No outliers detected for i = 6

Iteration i = 5

Mean of 83 measurements = 1007.33
Std Dev = 707.448
x(i+1) = 2700 from measurement 4/6/2016 from location MW-2
Rosner Statistic R = |2700 - 1007.33|/707.448 = 2.39265
Lambda(88, 6, 0.05) = 3.3176
2.39265 < 3.3176 -- No outliers detected for i = 5

Iteration i = 4

Mean of 84 measurements = 1028.31
Std Dev = 729.001
x(i+1) = 2770 from measurement 10/15/2015 from location MW-3

Rosner Statistic R = |2770 - 1028.31|/729.001 = 2.38915
Lambda(88, 5, 0.05) = 3.322
2.38915 < 3.322 -- No outliers detected for i = 4

Iteration i = 3
Mean of 85 measurements = 1048.92
Std Dev = 749.142
x(i+1) = 2780 from measurement 1/26/2017 from location MW-2
Rosner Statistic R = |2780 - 1048.92|/749.142 = 2.31075
Lambda(88, 4, 0.05) = 3.33
2.31075 < 3.33 -- No outliers detected for i = 3

Iteration i = 2
Mean of 86 measurements = 1070.09
Std Dev = 770.178
x(i+1) = 2870 from measurement 5/27/2016 from location MW-2
Rosner Statistic R = |2870 - 1070.09|/770.178 = 2.337
Lambda(88, 3, 0.05) = 3.332
2.337 < 3.332 -- No outliers detected for i = 2

Iteration i = 1
Mean of 87 measurements = 1094.34
Std Dev = 798.402
x(i+1) = 3180 from measurement 5/27/2016 from location MW-3
Rosner Statistic R = |3180 - 1094.34|/798.402 = 2.61229
Lambda(88, 2, 0.05) = 3.332
2.61229 < 3.332 -- No outliers detected for i = 1

Iteration i = 0
Mean of 88 measurements = 1119.3
Std Dev = 827.588
x(i+1) = 3290 from measurement 7/12/2016 from location MW-2
Rosner Statistic R = |3290 - 1119.3|/827.588 = 2.62293
Lambda(88, 1, 0.05) = 3.342
2.62293 < 3.342 -- No outliers detected for i = 0

Shapiro-Wilks Test of Normality

Parameter: Total Dissolved Solids
All Locations
Normality Test of Parameter Concentrations
Natural Logarithm Transformation
Non-Detects Replaced with Detection Limit
K = 5 for 11 measurements

i	x(i)	x(n-i+1)	x(n-1+1)-x(i)	a(n-i+1)	b(i)
1	6.40688	7.87474	1.46786	0.5601	0.822148
2	6.43455	6.53669	0.102145	0.3315	0.0338611
3	6.44254	6.50429	0.061748	0.226	0.013955
4	6.45047	6.48311	0.0326369	0.1429	0.00466382
5	6.46614	6.48004	0.0138998	0.0695	0.000966039
6	6.47697	6.47697	0		
7	6.48004	6.46614	-0.0138998		
8	6.48311	6.45047	-0.0326369		
9	6.50429	6.44254	-0.061748		
10	6.53669	6.43455	-0.102145		
11	7.87474	6.40688	-1.46786		

Sum of b values = 0.875594
Sample Standard Deviation = 0.425545
W Statistic = 0.423365

5% Critical value of 0.85 exceeds 0.423365
Evidence of non-normality at 95% level of significance

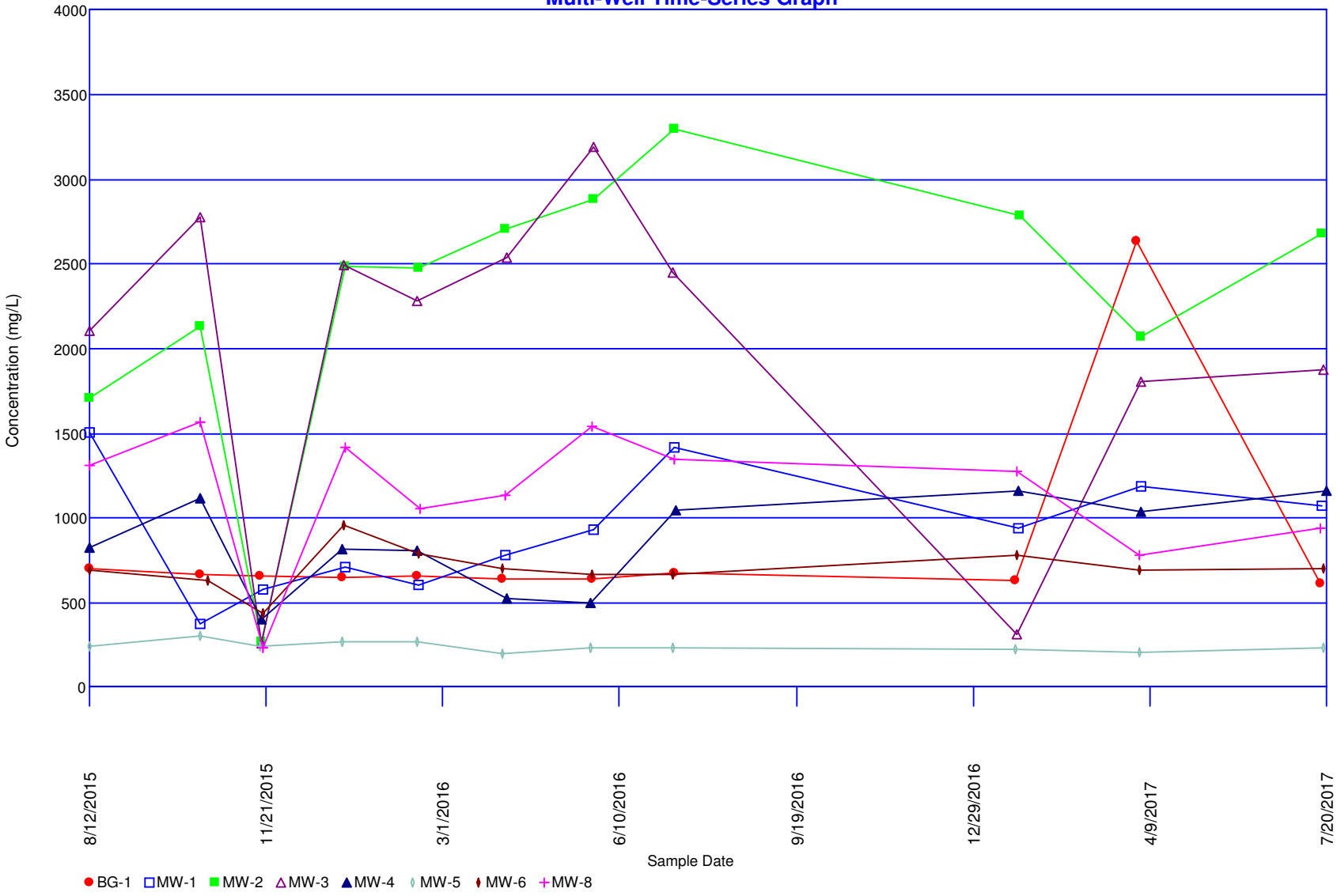
1% Critical value of 0.792 exceeds 0.423365
Evidence of non-normality at 99% level of significance

1				**Background Statistics for Data Sets with Non-Detects**								
2	**User Selected Options**											
3	Date/Time of Computation			9/18/2017 3:05:55 PM								
4	From File			UPL-Input-July-2017.xls								
5	Full Precision			OFF								
6	Confidence Coefficient			95%								
7	Coverage			95%								
8	Different or Future K Observations			1								
9	Number of Bootstrap Operations			2000								
10												
11	**TDS**											
12												
13	**General Statistics**											
14	Total Number of Observations			11			Number of Distinct Observations					11
15	Minimum			606			First Quartile					630.5
16	Second Largest			690			Median					650
17	Maximum			2630			Third Quartile					661
18	Mean			825.2			SD					599
19	Coefficient of Variation			0.726			Skewness					3.308
20	Mean of logged Data			6.596			SD of logged Data					0.426
21												
22	**Critical Values for Background Threshold Values (BTVs)**											
23	Tolerance Factor K (For UTL)			2.815			d2max (for USL)					2.234
24												
25	**Normal GOF Test**											
26	Shapiro Wilk Test Statistic			0.381			**Shapiro Wilk GOF Test**					
27	5% Shapiro Wilk Critical Value			0.85			Data Not Normal at 5% Significance Level					
28	Lilliefors Test Statistic			0.498			**Lilliefors GOF Test**					
29	5% Lilliefors Critical Value			0.267			Data Not Normal at 5% Significance Level					
30	**Data Not Normal at 5% Significance Level**											
31												
32	**Background Statistics Assuming Normal Distribution**											
33	95% UTL with 95% Coverage			2511			90% Percentile (z)					1593
34	95% UPL (t)			1959			95% Percentile (z)					1810
35	95% USL			2163			99% Percentile (z)					2219
36												
37	**Gamma GOF Test**											
38	A-D Test Statistic			3.195			**Anderson-Darling Gamma GOF Test**					
39	5% A-D Critical Value			0.732			Data Not Gamma Distributed at 5% Significance Level					
40	K-S Test Statistic			0.488			**Kolmogrov-Smirnoff Gamma GOF Test**					
41	5% K-S Critical Value			0.256			Data Not Gamma Distributed at 5% Significance Level					
42	**Data Not Gamma Distributed at 5% Significance Level**											
43												
44	**Gamma Statistics**											
45	k hat (MLE)			4.342			k star (bias corrected MLE)					3.218
46	Theta hat (MLE)			190.1			Theta star (bias corrected MLE)					256.4
47	nu hat (MLE)			95.51			nu star (bias corrected)					70.8
48	MLE Mean (bias corrected)			825.2			MLE Sd (bias corrected)					460
49												
50	**Background Statistics Assuming Gamma Distribution**											
51	95% Wilson Hilferty (WH) Approx. Gamma UPL			1755			90% Percentile					1442
52	95% Hawkins Wixley (HW) Approx. Gamma UPL			1726			95% Percentile					1698
53	95% WH Approx. Gamma UTL with 95% Coverage			2461			99% Percentile					2249
54	95% HW Approx. Gamma UTL with 95% Coverage			2453								
55	95% WH USL			1997			95% HW USL					1973

	A	B	C	D	E	F	G	H	I	J	K	L
56												
57	**Lognormal GOF Test**											
58					Shapiro Wilk Test Statistic	0.423	**Shapiro Wilk Lognormal GOF Test**					
59					5% Shapiro Wilk Critical Value	0.85	Data Not Lognormal at 5% Significance Level					
60					Lilliefors Test Statistic	0.465	**Lilliefors Lognormal GOF Test**					
61					5% Lilliefors Critical Value	0.267	Data Not Lognormal at 5% Significance Level					
62	**Data Not Lognormal at 5% Significance Level**											
63												
64	**Background Statistics assuming Lognormal Distribution**											
65					95% UTL with 95% Coverage	2426			90% Percentile (z)	1263		
66					95% UPL (t)	1639			95% Percentile (z)	1474		
67					95% USL	1894			99% Percentile (z)	1970		
68												
69	**Nonparametric Distribution Free Background Statistics**											
70	**Data do not follow a Discernible Distribution (0.05)**											
71												
72	**Nonparametric Upper Limits for Background Threshold Values**											
73					Order of Statistic, r	11			95% UTL with 95% Coverage	2630		
74					Approximate f	0.579			Confidence Coefficient (CC) achieved by UTL	0.431		
75					95% Percentile Bootstrap UTL with 95% Coverage	2630			95% BCA Bootstrap UTL with 95% Coverage	2630		
76					95% UPL	2630			90% Percentile	690		
77					90% Chebyshev UPL	2702			95% Percentile	1660		
78					95% Chebyshev UPL	3552			99% Percentile	2436		
79					95% USL	2630						
80												
81	Note: The use of USL to estimate a BTV is recommended only when the data set represents a background											
82	data set free of outliers and consists of observations collected from clean unimpacted locations.											
83	The use of USL tends to provide a balance between false positives and false negatives provided the data											
84	represents a background data set and when many onsite observations need to be compared with the BTV.											
85												

Total Dissolved Solids

Multi-Well Time-Series Graph



Concentrations (ug/L)

Parameter: Zinc

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

Total Measurements: 88
Total Non-Detect: 49
Percent Non-Detects: 55.6818%
Total Background Measurements: 11
There is 1 background location

Loc.	Meas.	ND	Date	Conc.	Original
BG-1	11	9 (81.8182%)	8/12/2015	8.3 J	8.3 J
			10/15/2015	10	10
			11/18/2015	ND<10 U	ND<10 U
			1/4/2016	ND<10 U	ND<10 U
			2/16/2016	ND<10 U	ND<10 U
			4/5/2016	ND<10 U	ND<10 U
			5/26/2016	ND<10 U	ND<10 U
			7/12/2016	ND<10 U	ND<10 U
			1/23/2017	ND<10 U	ND<10 U
			4/3/2017	ND<10 U	ND<10 U
			7/17/2017	ND<5 U	ND<5 U

There are 7 compliance locations

Loc.	Meas.	ND	Date	Conc.	Original
MW-1	11	5 (45.4545%)	8/12/2015	7 J	7 J
			10/15/2015	12.4	12.4
			11/20/2015	ND<10 U	ND<10 U
			1/6/2016	13.3	13.3
			2/17/2016	ND<10 U	ND<10 U
			4/6/2016	10.2	10.2
			5/27/2016	ND<10 U	ND<10 U
			7/12/2016	13.2	13.2
			1/25/2017	ND<10 U	ND<10 U
			4/5/2017	ND<10 U	ND<10 U
			7/18/2017	28	28
MW-2	11	3 (27.2727%)	8/12/2015	13	13
			10/15/2015	26.8	26.8
			11/19/2015	50.7	50.7
			1/6/2016	ND<10 U	ND<10 U
			2/17/2016	27.2	27.2
			4/6/2016	113	113
			5/27/2016	ND<10 U	ND<10 U
			7/12/2016	37.9	37.9
			1/26/2017	15.8	15.8
			4/5/2017	ND<10 U	ND<10 U
			7/18/2017	10.7	10.7
MW-3	11	8 (72.7273%)	8/12/2015	5.2 J	5.2 J
			10/15/2015	41.8	41.8
			11/19/2015	ND<10 U	ND<10 U
			1/5/2016	ND<10 U	ND<10 U
			2/16/2016	ND<10 U	ND<10 U
			4/7/2016	12.5	12.5
			5/27/2016	ND<10 U	ND<10 U
			7/11/2016	ND<10 U	ND<10 U
			1/24/2017	ND<10 U	ND<10 U
			4/5/2017	ND<10 U	ND<10 U
			7/19/2017	ND<5 U	ND<5 U
MW-4	11	10 (90.9091%)	8/12/2015	31	31
			10/15/2015	ND<10 U	ND<10 U
			11/19/2015	ND<10 U	ND<10 U
			1/4/2016	ND<10 U	ND<10 U
			2/16/2016	ND<10 U	ND<10 U
			4/7/2016	ND<10 U	ND<10 U
			5/25/2016	ND<10 U	ND<10 U

			7/13/2016	ND<10 U	ND<10 U
			1/25/2017	ND<10 U	ND<10 U
			4/5/2017	ND<10 U	ND<10 U
			7/20/2017	ND<5 U	ND<5 U
MW-5	11	5 (45.4545%)	8/12/2015	16	16
			10/15/2015	106	106
			11/18/2015	ND<10 U	ND<10 U
			1/4/2016	ND<10 U	ND<10 U
			2/16/2016	ND<10 U	ND<10 U
			4/5/2016	36.1	36.1
			5/25/2016	ND<10 U	ND<10 U
			7/11/2016	21.2	21.2
			1/23/2017	ND<10 U	ND<10 U
			4/4/2017	13.5	13.5
			7/19/2017	16.6	16.6
MW-6	11	7 (63.6364%)	8/12/2015	6 J	6 J
			10/19/2015	11.5	11.5
			11/20/2015	ND<10 U	ND<10 U
			1/5/2016	11.3	11.3
			2/17/2016	ND<10 U	ND<10 U
			4/5/2016	ND<10 U	ND<10 U
			5/26/2016	ND<10 U	ND<10 U
			7/11/2016	11.8	11.8
			1/24/2017	ND<10 U	ND<10 U
			4/4/2017	ND<10 U	ND<10 U
			7/19/2017	ND<5 U	ND<5 U
MW-8	11	2 (18.1818%)	8/12/2015	5.1 J	5.1 J
			10/15/2015	12	12
			11/20/2015	22.1	22.1
			1/6/2016	18.7	18.7
			2/18/2016	14.6	14.6
			4/6/2016	47.7	47.7
			5/26/2016	ND<10 U	ND<10 U
			7/12/2016	17.8	17.8
			1/24/2017	29.2	29.2
			4/4/2017	ND<10 U	ND<10 U
			7/17/2017	50.7	50.7

There are 0 unused locations

Loc.	Meas.	ND	Date	Conc.	Original

Rosner's Test for Outliers

Parameter: Zinc

All Locations

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

Data set mean = 16.2034

10 most extreme of 88 measurements

by order of magnitude difference from the mean

1	4/6/2016	MW-2	113	96.7966
2	10/15/2015	MW-5	106	89.7966
3	11/19/2015	MW-2	50.7	34.4966
4	7/17/2017	MW-8	50.7	34.4966
5	4/6/2016	MW-8	47.7	31.4966
6	10/15/2015	MW-3	41.8	25.5966
7	7/12/2016	MW-2	37.9	21.6966
8	4/5/2016	MW-5	36.1	19.8966
9	8/12/2015	MW-4	31	14.7966
10	1/24/2017	MW-8	29.2	12.9966

Iteration i = 9

Mean of 79 measurements = 11.5316
Std Dev = 4.89528
x(i+1) = 29.2 from measurement 1/24/2017 from location MW-8
Rosner Statistic R = |29.2 - 11.5316|/4.89528 = 3.60927
Lambda(88, 10, 0.05) = 3.3
3.60927 > 3.3 -- Measurement 1/24/2017 for location MW-8 is an outlier

---

Iteration i = 8

Mean of 80 measurements = 11.775
Std Dev = 5.32899
x(i+1) = 31 from measurement 8/12/2015 from location MW-4
Rosner Statistic R = |31 - 11.775|/5.32899 = 3.60763
Lambda(88, 9, 0.05) = 3.3044
Measurement 8/12/2015 for location MW-4 is an outlier

Iteration i = 7

Mean of 81 measurements = 12.0753
Std Dev = 5.94543
x(i+1) = 36.1 from measurement 4/5/2016 from location MW-5
Rosner Statistic R = |36.1 - 12.0753|/5.94543 = 4.04087
Lambda(88, 8, 0.05) = 3.3088
Measurement 4/5/2016 for location MW-5 is an outlier

Iteration i = 6

Mean of 82 measurements = 12.3902
Std Dev = 6.56086
x(i+1) = 37.9 from measurement 7/12/2016 from location MW-2
Rosner Statistic R = |37.9 - 12.3902|/6.56086 = 3.88817
Lambda(88, 7, 0.05) = 3.3132
Measurement 7/12/2016 for location MW-2 is an outlier

Iteration i = 5

Mean of 83 measurements = 12.7446
Std Dev = 7.27604
x(i+1) = 41.8 from measurement 10/15/2015 from location MW-3
Rosner Statistic R = |41.8 - 12.7446|/7.27604 = 3.9933
Lambda(88, 6, 0.05) = 3.3176
Measurement 10/15/2015 for location MW-3 is an outlier

Iteration i = 4

Mean of 84 measurements = 13.1607
Std Dev = 8.17613
x(i+1) = 47.7 from measurement 4/6/2016 from location MW-8

Rosner Statistic R = |47.7 - 13.1607|/8.17613 = 4.2244
Lambda(88, 5, 0.05) = 3.322
Measurement 4/6/2016 for location MW-8 is an outlier

Iteration i = 3
Mean of 85 measurements = 13.6024
Std Dev = 9.09022
x(i+1) = 50.7 from measurement 7/17/2017 from location MW-8
Rosner Statistic R = |50.7 - 13.6024|/9.09022 = 4.08105
Lambda(88, 4, 0.05) = 3.33
Measurement 7/17/2017 for location MW-8 is an outlier

Iteration i = 2
Mean of 86 measurements = 14.0337
Std Dev = 9.88245
x(i+1) = 50.7 from measurement 11/19/2015 from location MW-2
Rosner Statistic R = |50.7 - 14.0337|/9.88245 = 3.71024
Lambda(88, 3, 0.05) = 3.332
Measurement 11/19/2015 for location MW-2 is an outlier

Iteration i = 1
Mean of 87 measurements = 15.0908
Std Dev = 13.9192
x(i+1) = 106 from measurement 10/15/2015 from location MW-5
Rosner Statistic R = |106 - 15.0908|/13.9192 = 6.53122
Lambda(88, 2, 0.05) = 3.332
Measurement 10/15/2015 for location MW-5 is an outlier

Iteration i = 0
Mean of 88 measurements = 16.2034
Std Dev = 17.3335
x(i+1) = 113 from measurement 4/6/2016 from location MW-2
Rosner Statistic R = |113 - 16.2034|/17.3335 = 5.58436
Lambda(88, 1, 0.05) = 3.342
Measurement 4/6/2016 for location MW-2 is an outlier

Shapiro-Wilks Test of Normality

Parameter: Zinc
All Locations
Normality Test of Parameter Concentrations
Natural Logarithm Transformation
Non-Detects Replaced with Detection Limit
K = 5 for 11 measurements

i	x(i)	x(n-i+1)	x(n-1+1)-x(i)	a(n-i+1)	b(i)
1	1.60944	2.30259	0.693147	0.5601	0.388232
2	2.11626	2.30259	0.18633	0.3315	0.0617683
3	2.30259	2.30259	0	0.226	0
4	2.30259	2.30259	0	0.1429	0
5	2.30259	2.30259	0	0.0695	0
6	2.30259	2.30259	0		
7	2.30259	2.30259	0		
8	2.30259	2.30259	0		
9	2.30259	2.30259	0		
10	2.30259	2.11626	-0.18633		
11	2.30259	1.60944	-0.693147		

Sum of b values = 0.45
Sample Standard Deviation = 0.210916
W Statistic = 0.455204

5% Critical value of 0.85 exceeds 0.455204
Evidence of non-normality at 95% level of significance

1% Critical value of 0.792 exceeds 0.455204
Evidence of non-normality at 99% level of significance

1				**Background Statistics for Data Sets with Non-Detects**								
2	**User Selected Options**											
3	Date/Time of Computation			9/18/2017 3:08:52 PM								
4	From File			UPL-Input-July-2017.xls								
5	Full Precision			OFF								
6	Confidence Coefficient			95%								
7	Coverage			95%								
8	Different or Future K Observations			1								
9	Number of Bootstrap Operations			2000								
10												
11	**Zinc**											
12												
13	**General Statistics**											
14	Total Number of Observations			11			Number of Missing Observations			0		
15	Number of Distinct Observations			3								
16	Number of Detects			2			Number of Non-Detects			9		
17	Number of Distinct Detects			2			Number of Distinct Non-Detects			2		
18	Minimum Detect			8.3			Minimum Non-Detect			5		
19	Maximum Detect			10			Maximum Non-Detect			10		
20	Variance Detected			1.445			Percent Non-Detects			81.82%		
21	Mean Detected			9.15			SD Detected			1.202		
22	Mean of Detected Logged Data			2.209			SD of Detected Logged Data			0.132		
23												
24	**Warning: Data set has only 2 Detected Values.**											
25	**This is not enough to compute meaningful or reliable statistics and estimates.**											
26												
27												
28	**Critical Values for Background Threshold Values (BTVs)**											
29	Tolerance Factor K (For UTL)			2.815			d2max (for USL)			2.234		
30												
31	**Normal GOF Test on Detects Only**											
32	**Not Enough Data to Perform GOF Test**											
33												
34	**Kaplan Meier (KM) Background Statistics Assuming Normal Distribution**											
35	Mean			6.955			SD			1.845		
36	95% UTL95% Coverage			12.15			95% KM UPL (t)			10.45		
37	90% KM Percentile (z)			9.318			95% KM Percentile (z)			9.989		
38	99% KM Percentile (z)			11.25			95% KM USL			11.08		
39												
40	**DL/2 Substitution Background Statistics Assuming Normal Distribution**											
41	Mean			5.527			SD			1.977		
42	95% UTL95% Coverage			11.09			95% UPL (t)			9.27		
43	90% Percentile (z)			8.061			95% Percentile (z)			8.779		
44	99% Percentile (z)			10.13			95% USL			9.944		
45	**DL/2 is not a recommended method. DL/2 provided for comparisons and historical reasons**											
46												
47	**Gamma GOF Tests on Detected Observations Only**											
48	**Not Enough Data to Perform GOF Test**											
49												
50	**Gamma Statistics on Detected Data Only**											
51	k hat (MLE)			115.5			k star (bias corrected MLE)			N/A		
52	Theta hat (MLE)			0.0792			Theta star (bias corrected MLE)			N/A		
53	nu hat (MLE)			462.2			nu star (bias corrected)			N/A		
54	MLE Mean (bias corrected)			N/A								
55	MLE Sd (bias corrected)			N/A			95% Percentile of Chisquare (2k)			N/A		

	A	B	C	D	E	F	G	H	I	J	K	L
56												
57	**The following statistics are computed using gamma distribution and KM estimates**											
58	**Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods**											
59					k hat (KM)	14.21				nu hat (KM)		312.7
60					WH	HW					WH	HW
61				95% Approx. Gamma UTL with 95% Coverage	13.4	13.63			95% Approx. Gamma UPL		10.91	10.98
62				95% Gamma USL	11.79	11.91						
63												
64	**Lognormal GOF Test on Detected Observations Only**											
65	**Not Enough Data to Perform GOF Test**											
66												
67	**Background Lognormal ROS Statistics Assuming Lognormal Distribution Using Imputed Non-Detects**											
68				Mean in Original Scale	7.809			Mean in Log Scale	2.047			
69				SD in Original Scale	1.052			SD in Log Scale	0.132			
70				95% UTL95% Coverage	11.22			95% BCA UTL95% Coverage	10			
71				95% Bootstrap (%) UTL95% Coverage	10			95% UPL (t)	9.941			
72				90% Percentile (z)	9.172			95% Percentile (z)	9.621			
73				99% Percentile (z)	10.53			95% USL	10.4			
74												
75	**Background DL/2 Statistics Assuming Lognormal Distribution**											
76				Mean in Original Scale	5.527			Mean in Log Scale	1.656			
77				SD in Original Scale	1.977			SD in Log Scale	0.346			
78				95% UTL95% Coverage	13.85			95% UPL (t)	10.07			
79				90% Percentile (z)	8.153			95% Percentile (z)	9.244			
80				99% Percentile (z)	11.7			95% USL	11.33			
81	**DL/2 is not a Recommended Method. DL/2 provided for comparisons and historical reasons.**											
82												
83	**Nonparametric Distribution Free Background Statistics**											
84	**Data do not follow a Discernible Distribution (0.05)**											
85												
86	**Nonparametric Upper Limits for BTVs(no distinction made between detects and nondetects)**											
87				Order of Statistic, r	11			95% UTL with95% Coverage	10			
88				Approximate f	0.579			Confidence Coefficient (CC) achieved by UTL	0.431			
89				95% UPL	10			95% USL	10			
90				95% KM Chebyshev UPL	15.35							
91												
92	Note: The use of USL to estimate a BTV is recommended only when the data set represents a background											
93	data set free of outliers and consists of observations collected from clean unimpacted locations.											
94	The use of USL tends to provide a balance between false positives and false negatives provided the data											
95	represents a background data set and when many onsite observations need to be compared with the BTV.											

Sen's Slope Analysis

Parameter: Zinc
Location: MW-1
Original Data (Not Transformed)
Non-Detects Replaced with Detection Limit

90% Confidence Level

Xj	Xk	(Xj - Xk)/(j-k)	Q
12.4 (10/15/2015)	7 J (8/12/2015)	(12.4 - 7)/(2 - 1)	5.4
ND<10 U (11/20/2015)	7 J (8/12/2015)	(10 - 7)/(3 - 1)	1.5
13.3 (1/6/2016)	7 J (8/12/2015)	(13.3 - 7)/(4 - 1)	2.1
ND<10 U (2/17/2016)	7 J (8/12/2015)	(10 - 7)/(5 - 1)	0.75
10.2 (4/6/2016)	7 J (8/12/2015)	(10.2 - 7)/(6 - 1)	0.64
ND<10 U (5/27/2016)	7 J (8/12/2015)	(10 - 7)/(7 - 1)	0.5
13.2 (7/12/2016)	7 J (8/12/2015)	(13.2 - 7)/(8 - 1)	0.885714
ND<10 U (1/25/2017)	7 J (8/12/2015)	(10 - 7)/(9 - 1)	0.375
ND<10 U (4/5/2017)	7 J (8/12/2015)	(10 - 7)/(10 - 1)	0.333333
28 (7/18/2017)	7 J (8/12/2015)	(28 - 7)/(11 - 1)	2.1
ND<10 U (11/20/2015)	12.4 (10/15/2015)	(10 - 12.4)/(3 - 2)	-2.4
13.3 (1/6/2016)	12.4 (10/15/2015)	(13.3 - 12.4)/(4 - 2)	0.45
ND<10 U (2/17/2016)	12.4 (10/15/2015)	(10 - 12.4)/(5 - 2)	-0.8
10.2 (4/6/2016)	12.4 (10/15/2015)	(10.2 - 12.4)/(6 - 2)	-0.55
ND<10 U (5/27/2016)	12.4 (10/15/2015)	(10 - 12.4)/(7 - 2)	-0.48
13.2 (7/12/2016)	12.4 (10/15/2015)	(13.2 - 12.4)/(8 - 2)	0.133333
ND<10 U (1/25/2017)	12.4 (10/15/2015)	(10 - 12.4)/(9 - 2)	-0.342857
ND<10 U (4/5/2017)	12.4 (10/15/2015)	(10 - 12.4)/(10 - 2)	-0.3
28 (7/18/2017)	12.4 (10/15/2015)	(28 - 12.4)/(11 - 2)	1.73333
13.3 (1/6/2016)	ND<10 U (11/20/2015)	(13.3 - 10)/(4 - 3)	3.3
ND<10 U (2/17/2016)	ND<10 U (11/20/2015)	(10 - 10)/(5 - 3)	0
10.2 (4/6/2016)	ND<10 U (11/20/2015)	(10.2 - 10)/(6 - 3)	0.0666667
ND<10 U (5/27/2016)	ND<10 U (11/20/2015)	(10 - 10)/(7 - 3)	0
13.2 (7/12/2016)	ND<10 U (11/20/2015)	(13.2 - 10)/(8 - 3)	0.64
ND<10 U (1/25/2017)	ND<10 U (11/20/2015)	(10 - 10)/(9 - 3)	0
ND<10 U (4/5/2017)	ND<10 U (11/20/2015)	(10 - 10)/(10 - 3)	0
28 (7/18/2017)	ND<10 U (11/20/2015)	(28 - 10)/(11 - 3)	2.25
ND<10 U (2/17/2016)	13.3 (1/6/2016)	(10 - 13.3)/(5 - 4)	-3.3
10.2 (4/6/2016)	13.3 (1/6/2016)	(10.2 - 13.3)/(6 - 4)	-1.55
ND<10 U (5/27/2016)	13.3 (1/6/2016)	(10 - 13.3)/(7 - 4)	-1.1
13.2 (7/12/2016)	13.3 (1/6/2016)	(13.2 - 13.3)/(8 - 4)	-0.025
ND<10 U (1/25/2017)	13.3 (1/6/2016)	(10 - 13.3)/(9 - 4)	-0.66
ND<10 U (4/5/2017)	13.3 (1/6/2016)	(10 - 13.3)/(10 - 4)	-0.55
28 (7/18/2017)	13.3 (1/6/2016)	(28 - 13.3)/(11 - 4)	2.1
10.2 (4/6/2016)	ND<10 U (2/17/2016)	(10.2 - 10)/(6 - 5)	0.2
ND<10 U (5/27/2016)	ND<10 U (2/17/2016)	(10 - 10)/(7 - 5)	0
13.2 (7/12/2016)	ND<10 U (2/17/2016)	(13.2 - 10)/(8 - 5)	1.06667
ND<10 U (1/25/2017)	ND<10 U (2/17/2016)	(10 - 10)/(9 - 5)	0
ND<10 U (4/5/2017)	ND<10 U (2/17/2016)	(10 - 10)/(10 - 5)	0
28 (7/18/2017)	ND<10 U (2/17/2016)	(28 - 10)/(11 - 5)	3
ND<10 U (5/27/2016)	10.2 (4/6/2016)	(10 - 10.2)/(7 - 6)	-0.2
13.2 (7/12/2016)	10.2 (4/6/2016)	(13.2 - 10.2)/(8 - 6)	1.5
ND<10 U (1/25/2017)	10.2 (4/6/2016)	(10 - 10.2)/(9 - 6)	-0.0666667
ND<10 U (4/5/2017)	10.2 (4/6/2016)	(10 - 10.2)/(10 - 6)	-0.05
28 (7/18/2017)	10.2 (4/6/2016)	(28 - 10.2)/(11 - 6)	3.56
13.2 (7/12/2016)	ND<10 U (5/27/2016)	(13.2 - 10)/(8 - 7)	3.2
ND<10 U (1/25/2017)	ND<10 U (5/27/2016)	(10 - 10)/(9 - 7)	0
ND<10 U (4/5/2017)	ND<10 U (5/27/2016)	(10 - 10)/(10 - 7)	0
28 (7/18/2017)	ND<10 U (5/27/2016)	(28 - 10)/(11 - 7)	4.5
ND<10 U (1/25/2017)	13.2 (7/12/2016)	(10 - 13.2)/(9 - 8)	-3.2
ND<10 U (4/5/2017)	13.2 (7/12/2016)	(10 - 13.2)/(10 - 8)	-1.6
28 (7/18/2017)	13.2 (7/12/2016)	(28 - 13.2)/(11 - 8)	4.93333
ND<10 U (4/5/2017)	ND<10 U (1/25/2017)	(10 - 10)/(10 - 9)	0
28 (7/18/2017)	ND<10 U (1/25/2017)	(28 - 10)/(11 - 9)	9

Number of Q values = 55

Ordered Q Values

n	Q
1	-3.3
2	-3.2
3	-2.4
4	-1.6
5	-1.55
6	-1.1
7	-0.8
8	-0.66
9	-0.55
10	-0.55
11	-0.48
12	-0.342857
13	-0.3
14	-0.2
15	-0.0666667
16	-0.05
17	-0.025
18	0
19	0
20	0
21	0
22	0
23	0
24	0
25	0
26	0
27	0
28	0.0666667
29	0.133333
30	0.2
31	0.333333
32	0.375
33	0.45
34	0.5
35	0.64
36	0.64
37	0.75
38	0.885714
39	1.06667
40	1.5
41	1.5
42	1.73333
43	2.1
44	2.1
45	2.1
46	2.25
47	3
48	3.2
49	3.3
50	3.56
51	4.5
52	4.93333
53	5.4
54	9
55	18

Sen's Estimator (Median Q) is 0.0666667

Tied Group	Value	Members
1	10	5

Time Period	Observations
8/12/2015	1
10/15/2015	1

11/20/2015	1
1/6/2016	1
2/17/2016	1
4/6/2016	1
5/27/2016	1
7/12/2016	1
1/25/2017	1
4/5/2017	1
7/18/2017	1

There are 0 time periods with multiple data

A = 300
B = 0
C = 60
D = 0
E = 20
F = 0
a = 2970
b = 8910
c = 220
Group Variance = 148.333
For 90% confidence interval (two-tailed), Z at (1-0.9)/2 = 1.64485
C = 20.033
M1 = (55 - 20.033)/2.0 = 17.4835
M2 = (55 + 20.033)/2.0 + 1 = 38.5165
Lower limit is -0.025 = Q(17)
Upper limit is 1.06667 = Q(39)
-0.025 < 0 < 1.06667 indicating no trend in data.

Sen's Slope Analysis

Parameter: Zinc
Location: MW-5
Original Data (Not Transformed)
Non-Detects Replaced with Detection Limit

90% Confidence Level

Xj	Xk	(Xj - Xk)/(j-k)	Q
106 (10/15/2015)	16 (8/12/2015)	(106 - 16)/(2 - 1)	90
ND<10 U (11/18/2015)	16 (8/12/2015)	(10 - 16)/(3 - 1)	-3
ND<10 U (1/4/2016)	16 (8/12/2015)	(10 - 16)/(4 - 1)	-2
ND<10 U (2/16/2016)	16 (8/12/2015)	(10 - 16)/(5 - 1)	-1.5
36.1 (4/5/2016)	16 (8/12/2015)	(36.1 - 16)/(6 - 1)	4.02
ND<10 U (5/25/2016)	16 (8/12/2015)	(10 - 16)/(7 - 1)	-1
21.2 (7/11/2016)	16 (8/12/2015)	(21.2 - 16)/(8 - 1)	0.742857
ND<10 U (1/23/2017)	16 (8/12/2015)	(10 - 16)/(9 - 1)	-0.75
13.5 (4/4/2017)	16 (8/12/2015)	(13.5 - 16)/(10 - 1)	-0.277778
16.6 (7/19/2017)	16 (8/12/2015)	(16.6 - 16)/(11 - 1)	0.06
ND<10 U (11/18/2015)	106 (10/15/2015)	(10 - 106)/(3 - 2)	-96
ND<10 U (1/4/2016)	106 (10/15/2015)	(10 - 106)/(4 - 2)	-48
ND<10 U (2/16/2016)	106 (10/15/2015)	(10 - 106)/(5 - 2)	-32
36.1 (4/5/2016)	106 (10/15/2015)	(36.1 - 106)/(6 - 2)	-17.475
ND<10 U (5/25/2016)	106 (10/15/2015)	(10 - 106)/(7 - 2)	-19.2
21.2 (7/11/2016)	106 (10/15/2015)	(21.2 - 106)/(8 - 2)	-14.1333
ND<10 U (1/23/2017)	106 (10/15/2015)	(10 - 106)/(9 - 2)	-13.7143
13.5 (4/4/2017)	106 (10/15/2015)	(13.5 - 106)/(10 - 2)	-11.5625
16.6 (7/19/2017)	106 (10/15/2015)	(16.6 - 106)/(11 - 2)	-9.93333
ND<10 U (1/4/2016)	ND<10 U (11/18/2015)	(10 - 10)/(4 - 3)	0
ND<10 U (2/16/2016)	ND<10 U (11/18/2015)	(10 - 10)/(5 - 3)	0
36.1 (4/5/2016)	ND<10 U (11/18/2015)	(36.1 - 10)/(6 - 3)	8.7
ND<10 U (5/25/2016)	ND<10 U (11/18/2015)	(10 - 10)/(7 - 3)	0
21.2 (7/11/2016)	ND<10 U (11/18/2015)	(21.2 - 10)/(8 - 3)	2.24
ND<10 U (1/23/2017)	ND<10 U (11/18/2015)	(10 - 10)/(9 - 3)	0
13.5 (4/4/2017)	ND<10 U (11/18/2015)	(13.5 - 10)/(10 - 3)	0.5
16.6 (7/19/2017)	ND<10 U (11/18/2015)	(16.6 - 10)/(11 - 3)	0.825
ND<10 U (2/16/2016)	ND<10 U (1/4/2016)	(10 - 10)/(5 - 4)	0
36.1 (4/5/2016)	ND<10 U (1/4/2016)	(36.1 - 10)/(6 - 4)	13.05
ND<10 U (5/25/2016)	ND<10 U (1/4/2016)	(10 - 10)/(7 - 4)	0
21.2 (7/11/2016)	ND<10 U (1/4/2016)	(21.2 - 10)/(8 - 4)	2.8
ND<10 U (1/23/2017)	ND<10 U (1/4/2016)	(10 - 10)/(9 - 4)	0
13.5 (4/4/2017)	ND<10 U (1/4/2016)	(13.5 - 10)/(10 - 4)	0.583333
16.6 (7/19/2017)	ND<10 U (1/4/2016)	(16.6 - 10)/(11 - 4)	0.942857
36.1 (4/5/2016)	ND<10 U (2/16/2016)	(36.1 - 10)/(6 - 5)	26.1
ND<10 U (5/25/2016)	ND<10 U (2/16/2016)	(10 - 10)/(7 - 5)	0
21.2 (7/11/2016)	ND<10 U (2/16/2016)	(21.2 - 10)/(8 - 5)	3.73333
ND<10 U (1/23/2017)	ND<10 U (2/16/2016)	(10 - 10)/(9 - 5)	0
13.5 (4/4/2017)	ND<10 U (2/16/2016)	(13.5 - 10)/(10 - 5)	0.7
16.6 (7/19/2017)	ND<10 U (2/16/2016)	(16.6 - 10)/(11 - 5)	1.1
ND<10 U (5/25/2016)	36.1 (4/5/2016)	(10 - 36.1)/(7 - 6)	-26.1
21.2 (7/11/2016)	36.1 (4/5/2016)	(21.2 - 36.1)/(8 - 6)	-7.45
ND<10 U (1/23/2017)	36.1 (4/5/2016)	(10 - 36.1)/(9 - 6)	-8.7
13.5 (4/4/2017)	36.1 (4/5/2016)	(13.5 - 36.1)/(10 - 6)	-5.65
16.6 (7/19/2017)	36.1 (4/5/2016)	(16.6 - 36.1)/(11 - 6)	-3.9
21.2 (7/11/2016)	ND<10 U (5/25/2016)	(21.2 - 10)/(8 - 7)	11.2
ND<10 U (1/23/2017)	ND<10 U (5/25/2016)	(10 - 10)/(9 - 7)	0
13.5 (4/4/2017)	ND<10 U (5/25/2016)	(13.5 - 10)/(10 - 7)	1.16667
16.6 (7/19/2017)	ND<10 U (5/25/2016)	(16.6 - 10)/(11 - 7)	1.65
ND<10 U (1/23/2017)	21.2 (7/11/2016)	(10 - 21.2)/(9 - 8)	-11.2
13.5 (4/4/2017)	21.2 (7/11/2016)	(13.5 - 21.2)/(10 - 8)	-3.85
16.6 (7/19/2017)	21.2 (7/11/2016)	(16.6 - 21.2)/(11 - 8)	-1.53333
13.5 (4/4/2017)	ND<10 U (1/23/2017)	(13.5 - 10)/(10 - 9)	3.5
16.6 (7/19/2017)	ND<10 U (1/23/2017)	(16.6 - 10)/(11 - 9)	3.3

Number of Q values = 55

Ordered Q Values

n	Q
1	-96
2	-48
3	-32
4	-26.1
5	-19.2
6	-17.475
7	-14.1333
8	-13.7143
9	-11.5625
10	-11.2
11	-9.93333
12	-8.7
13	-7.45
14	-5.65
15	-3.9
16	-3.85
17	-3
18	-2
19	-1.53333
20	-1.5
21	-1
22	-0.75
23	-0.277778
24	0
25	0
26	0
27	0
28	0
29	0
30	0
31	0
32	0
33	0
34	0.06
35	0.5
36	0.583333
37	0.7
38	0.742857
39	0.825
40	0.942857
41	1.1
42	1.16667
43	1.65
44	2.24
45	2.8
46	3.1
47	3.3
48	3.5
49	3.73333
50	4.02
51	8.7
52	11.2
53	13.05
54	26.1
55	90

Sen's Estimator (Median Q) is 0

Tied Group	Value	Members
1	10	5

Time Period	Observations
8/12/2015	1
10/15/2015	1

11/18/2015	1
1/4/2016	1
2/16/2016	1
4/5/2016	1
5/25/2016	1
7/11/2016	1
1/23/2017	1
4/4/2017	1
7/19/2017	1

There are 0 time periods with multiple data

A = 300
B = 0
C = 60
D = 0
E = 20
F = 0
a = 2970
b = 8910
c = 220
Group Variance = 148.333
For 90% confidence interval (two-tailed), Z at (1-0.9)/2 = 1.64485
C = 20.033
M1 = (55 - 20.033)/2.0 = 17.4835
M2 = (55 + 20.033)/2.0 + 1 = 38.5165
Lower limit is -3 = Q(17)
Upper limit is 0.825 = Q(39)
-3 < 0 < 0.825 indicating no trend in data.

Sen's Slope Analysis

Parameter: Zinc
Location: MW-8
Original Data (Not Transformed)
Non-Detects Replaced with Detection Limit

90% Confidence Level

Xj	Xk	(Xj - Xk)/(j-k)	Q
12 (10/15/2015)	5.1 J (8/12/2015)	(12 - 5.1)/(2 - 1)	6.9
22.1 (11/20/2015)	5.1 J (8/12/2015)	(22.1 - 5.1)/(3 - 1)	8.5
18.7 (1/6/2016)	5.1 J (8/12/2015)	(18.7 - 5.1)/(4 - 1)	4.53333
14.6 (2/18/2016)	5.1 J (8/12/2015)	(14.6 - 5.1)/(5 - 1)	2.375
47.7 (4/6/2016)	5.1 J (8/12/2015)	(47.7 - 5.1)/(6 - 1)	8.52
ND<10 U (5/26/2016)	5.1 J (8/12/2015)	(10 - 5.1)/(7 - 1)	0.816667
17.8 (7/12/2016)	5.1 J (8/12/2015)	(17.8 - 5.1)/(8 - 1)	1.81429
29.2 (1/24/2017)	5.1 J (8/12/2015)	(29.2 - 5.1)/(9 - 1)	3.0125
ND<10 U (4/4/2017)	5.1 J (8/12/2015)	(10 - 5.1)/(10 - 1)	0.544444
50.7 (7/17/2017)	5.1 J (8/12/2015)	(50.7 - 5.1)/(11 - 1)	4.56
22.1 (11/20/2015)	12 (10/15/2015)	(22.1 - 12)/(3 - 2)	10.1
18.7 (1/6/2016)	12 (10/15/2015)	(18.7 - 12)/(4 - 2)	3.35
14.6 (2/18/2016)	12 (10/15/2015)	(14.6 - 12)/(5 - 2)	0.866667
47.7 (4/6/2016)	12 (10/15/2015)	(47.7 - 12)/(6 - 2)	8.925
ND<10 U (5/26/2016)	12 (10/15/2015)	(10 - 12)/(7 - 2)	-0.4
17.8 (7/12/2016)	12 (10/15/2015)	(17.8 - 12)/(8 - 2)	0.966667
29.2 (1/24/2017)	12 (10/15/2015)	(29.2 - 12)/(9 - 2)	2.45714
ND<10 U (4/4/2017)	12 (10/15/2015)	(10 - 12)/(10 - 2)	-0.25
50.7 (7/17/2017)	12 (10/15/2015)	(50.7 - 12)/(11 - 2)	4.3
18.7 (1/6/2016)	22.1 (11/20/2015)	(18.7 - 22.1)/(4 - 3)	-3.4
14.6 (2/18/2016)	22.1 (11/20/2015)	(14.6 - 22.1)/(5 - 3)	-3.75
47.7 (4/6/2016)	22.1 (11/20/2015)	(47.7 - 22.1)/(6 - 3)	8.53333
ND<10 U (5/26/2016)	22.1 (11/20/2015)	(10 - 22.1)/(7 - 3)	-3.025
17.8 (7/12/2016)	22.1 (11/20/2015)	(17.8 - 22.1)/(8 - 3)	-0.86
29.2 (1/24/2017)	22.1 (11/20/2015)	(29.2 - 22.1)/(9 - 3)	1.18333
ND<10 U (4/4/2017)	22.1 (11/20/2015)	(10 - 22.1)/(10 - 3)	-1.72857
50.7 (7/17/2017)	22.1 (11/20/2015)	(50.7 - 22.1)/(11 - 3)	3.575
14.6 (2/18/2016)	18.7 (1/6/2016)	(14.6 - 18.7)/(5 - 4)	-4.1
47.7 (4/6/2016)	18.7 (1/6/2016)	(47.7 - 18.7)/(6 - 4)	14.5
ND<10 U (5/26/2016)	18.7 (1/6/2016)	(10 - 18.7)/(7 - 4)	-2.9
17.8 (7/12/2016)	18.7 (1/6/2016)	(17.8 - 18.7)/(8 - 4)	-0.225
29.2 (1/24/2017)	18.7 (1/6/2016)	(29.2 - 18.7)/(9 - 4)	2.1
ND<10 U (4/4/2017)	18.7 (1/6/2016)	(10 - 18.7)/(10 - 4)	-1.45
50.7 (7/17/2017)	18.7 (1/6/2016)	(50.7 - 18.7)/(11 - 4)	4.57143
47.7 (4/6/2016)	14.6 (2/18/2016)	(47.7 - 14.6)/(6 - 5)	33.1
ND<10 U (5/26/2016)	14.6 (2/18/2016)	(10 - 14.6)/(7 - 5)	-2.3
17.8 (7/12/2016)	14.6 (2/18/2016)	(17.8 - 14.6)/(8 - 5)	1.06667
29.2 (1/24/2017)	14.6 (2/18/2016)	(29.2 - 14.6)/(9 - 5)	3.65
ND<10 U (4/4/2017)	14.6 (2/18/2016)	(10 - 14.6)/(10 - 5)	-0.92
50.7 (7/17/2017)	14.6 (2/18/2016)	(50.7 - 14.6)/(11 - 5)	6.01667
ND<10 U (5/26/2016)	47.7 (4/6/2016)	(10 - 47.7)/(7 - 6)	-37.7
17.8 (7/12/2016)	47.7 (4/6/2016)	(17.8 - 47.7)/(8 - 6)	-14.95
29.2 (1/24/2017)	47.7 (4/6/2016)	(29.2 - 47.7)/(9 - 6)	-6.16667
ND<10 U (4/4/2017)	47.7 (4/6/2016)	(10 - 47.7)/(10 - 6)	-9.425
50.7 (7/17/2017)	47.7 (4/6/2016)	(50.7 - 47.7)/(11 - 6)	0.6
17.8 (7/12/2016)	ND<10 U (5/26/2016)	(17.8 - 10)/(8 - 7)	7.8
29.2 (1/24/2017)	ND<10 U (5/26/2016)	(29.2 - 10)/(9 - 7)	9.6
ND<10 U (4/4/2017)	ND<10 U (5/26/2016)	(10 - 10)/(10 - 7)	0
50.7 (7/17/2017)	ND<10 U (5/26/2016)	(50.7 - 10)/(11 - 7)	10.175
29.2 (1/24/2017)	17.8 (7/12/2016)	(29.2 - 17.8)/(9 - 8)	11.4
ND<10 U (4/4/2017)	17.8 (7/12/2016)	(10 - 17.8)/(10 - 8)	-3.9
50.7 (7/17/2017)	17.8 (7/12/2016)	(50.7 - 17.8)/(11 - 8)	10.9667
ND<10 U (4/4/2017)	29.2 (1/24/2017)	(10 - 29.2)/(10 - 9)	-19.2
50.7 (7/17/2017)	29.2 (1/24/2017)	(50.7 - 29.2)/(11 - 9)	10.75

50.7 (7/17/2017) ND<10 U (4/4/2017) (50.7 - 10)/(11 - 10) 40.7

Number of Q values = 55

Ordered Q Values

n	Q
1	-37.7
2	-19.2
3	-14.95
4	-9.425
5	-6.16667
6	-4.1
7	-3.9
8	-3.75
9	-3.4
10	-3.025
11	-2.9
12	-2.3
13	-1.72857
14	-1.45
15	-0.92
16	-0.86
17	-0.4
18	-0.25
19	-0.225
20	0
21	0.544444
22	0.6
23	0.816667
24	0.866667
25	0.966667
26	1.06667
27	1.18333
28	1.81429
29	2.1
30	2.375
31	2.45714
32	3.0125
33	3.35
34	3.575
35	3.65
36	4.3
37	4.53333
38	4.56
39	4.57143
40	6.01667
41	6.9
42	7.8
43	8.5
44	8.52
45	8.53333
46	8.925
47	9.6
48	10.1
49	10.175
50	10.75
51	10.9667
52	11.4
53	14.5
54	33.1
55	40.7

Sen's Estimator (Median Q) is 1.81429

Tied Group	Value	Members
1	10	2

Time Period	Observations
8/12/2015	1
10/15/2015	1

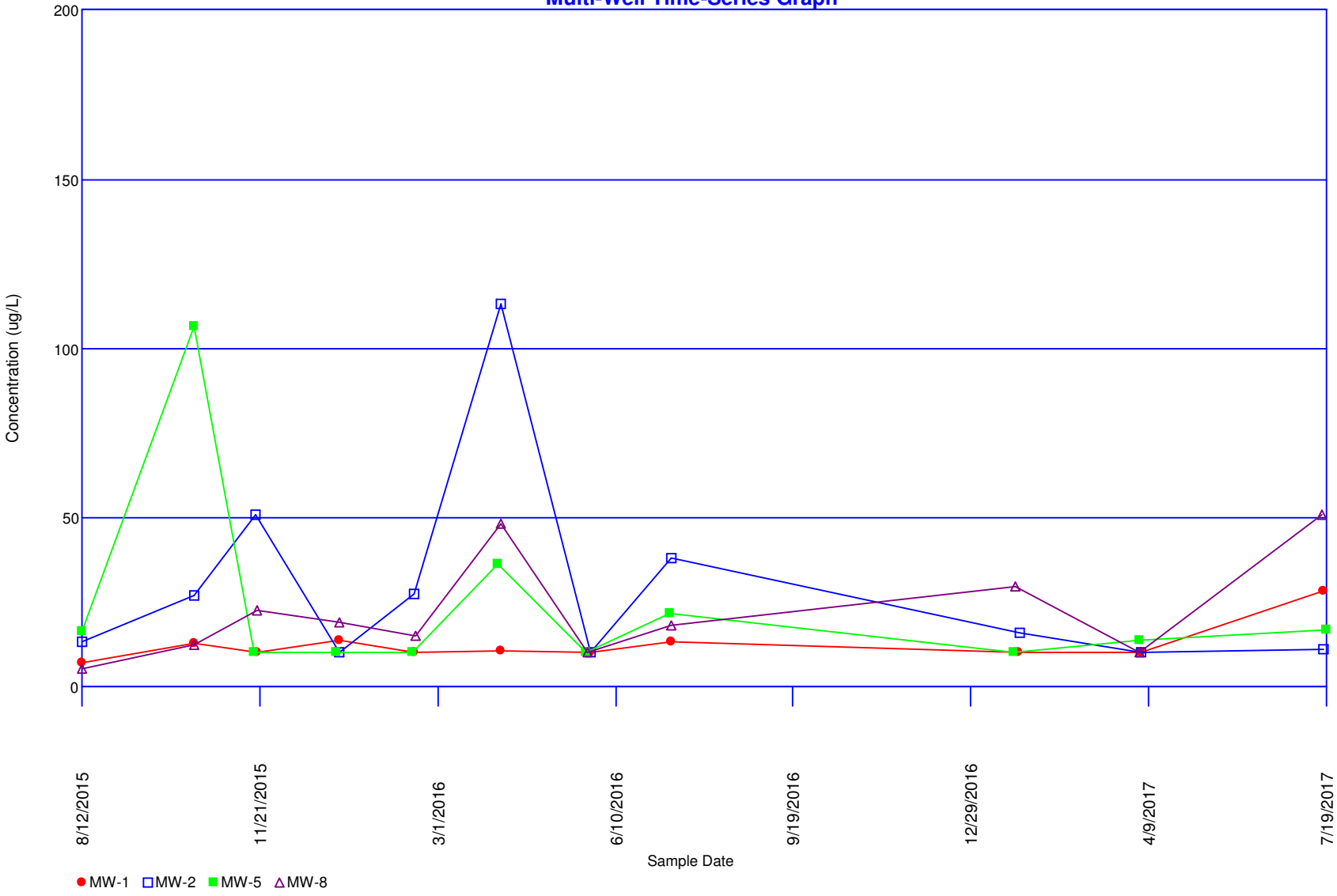
11/20/2015	1
1/6/2016	1
2/18/2016	1
4/6/2016	1
5/26/2016	1
7/12/2016	1
1/24/2017	1
4/4/2017	1
7/17/2017	1

There are 0 time periods with multiple data

A = 18
B = 0
C = 0
D = 0
E = 2
F = 0
a = 2970
b = 8910
c = 220
Group Variance = 164
For 90% confidence interval (two-tailed), Z at (1-0.9)/2 = 1.64485
C = 21.0644
M1 = (55 - 21.0644)/2.0 = 16.9678
M2 = (55 + 21.0644)/2.0 + 1 = 39.0322
Lower limit is -0.4 = Q(17)
Upper limit is 4.57143 = Q(39)
-0.4 < 0 < 4.57143 indicating no trend in data.

Zinc

Multi-Well Time-Series Graph





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